

Expansion

"No matter how distracted we may be by the number of problems now facing us, one issue remains fundamental: Overpopulation. The crowding of our cities, our nations, underlies all other problems." Paul Ehrlich

We began as a small number of humans, making very little impact on our environment. We were governed by our surroundings for millions of years, using the materials at hand to live in a manner which created little impact on our immediate physical environment--much less the ecological systems which supported our long-term existence. We emerged from the cradle of civilization, unaware of the existence of most of the rest of the planet. As soon as we became civilized, we began to raise armies to conquer the "known world." The bounty was consistently distributed to those who had the greater power, which at that time was a larger or more sophisticated armed force. A small population was in danger as a larger population would naturally have the advantage of numbers, the excess of which could be sacrificed in the glorious cause of conquering the smaller population. Behind the ideological claims of spreading one's chosen philosophy to the barbarians, it was obvious that conquerors usurped control of the resources held by the conquered. Perhaps this was only an afterthought, but it seems to hold true that conflicts are, and always have been, basically a determination of who will control the resources.

Our history is a chronicle of the conflicts that resulted from our expansion even as they were fed by it. Groups began as nomads with a ranging territory that allowed for avoidance of conflict, but as populations grew and agriculture replaced hunting and gathering, the concept of held territory became more important. Undiscovered lands did not enter into the equation, of course, and so conflicts were inevitable once the available choice real estate had been divided and subdivided. As more lands were discovered, colonial empires were built by subduing the native inhabitants and, if possible, using their labor to return wealth to the colonizing nation. As the population in the colonizing nation expanded, greater exploitation was required.

Population excess in Europe was one important motivation which influenced people to come to what was considered the "New World," where there was an abundance of land and resources waiting to be exploited. The spoils in Europe had already been divided up and distributed, but the area across the ocean was ripe for exploitation. The claims of the people who were native to the area were easily disregarded when usurpers from across the sea showed up with superior weaponry and an insatiable lust for the property and other resources of the new domain. The former occupants proved to be pesky in refusing to turn over the property, but in both North and South America, the natives fell like wheat before the reaper when introduced to previously unknown diseases, modern weaponry and new concepts of ownership. In a holocaust rivaling any before or since, they fell to allow the new "owners" to move in.

It is easier to understand history when the effects of increasing population are considered. The previous example is one which has been repeated time and time again throughout the recorded history of human endeavor. In studying history, we are informed of the decisions which were made due to population expansion, but that is the extent of the analysis. No one (until Thomas Malthus) ever seems to have seriously considered the idea that perhaps some of the genocide and continuous conflict might have been avoided if fewer people were sharing the resources. Population growth has been viewed as so inevitable and so necessary that it has seldom been questioned in any analysis of

history. The population just grew and made it necessary to usurp areas which were occupied by people who had poorer defensive capabilities. And, of course, we must have a disclaimer here acknowledging that there was aggression before there was a large human population. It is interesting to note, however, that people consistently left areas of conflict to go to less populated areas. Although we cannot say that population expansion is the cause of all conflict--world peace may break out at any moment--it seems unlikely that, as our world population grows, we will become more reasonable about equitably distributing the resources of the planet. As exploitation and environmental degradation reduce the share of the resource pie to be distributed on one hand, and population expansion demands more resource development on the other, the reverse seems more likely.

The expansion of our human numbers has played a part in the increasing conflict in our world, but it has also been an underlying factor in other regards. We humans have developed an exceedingly complex society in response to our ever-growing population. Everything we do must be done faster and more efficiently, and must continue to progress in that manner. We have computers that can do millions of calculations instantly and we need all that speed and more. We must keep track of the billions of transactions in our lives. We use billions of tons of paper to have copies of our important transactions. We must keep track of the billions of people. We have millions of miles of highways to transport goods between population centers. We drive our automobiles in congested traffic at a pace little faster than walking. We create new words to describe new experiences we are having due to our expansion. We are always very busy dealing with our problems, which can only be solved by experts as the problems are increasingly complex.

A new word in our lexicon relating to overpopulation is gridlock. It is the name for the near-standstill which we engender by our great number of automobiles. And it is not only with land vehicles that we experience this new phenomenon. The airports of the world are also approaching gridlock. Government and business experts estimate that delays in which loaded planes sometimes spend more time on the ground waiting than they do flying, cost the nation \$5 billion a year in wasted time and fuel. Federal Aviation Administration chief T. Allan McArtor said in 1988:

"We are getting very close, closer than anyone realizes, to commercial aviation gridlock. In a very few years we may very well see fully loaded planes in one city unable to leave because there is no room at their destination city, and others can't come into the first city because these planes haven't left. Then we will start rationing our limited capacity to fly people." (3)

We are running out of prison space, out of garbage space, out of living space. Technologically we have the highest "civilization" ever known and yet many people are alienated, even those who have the benefits of technology at their fingertips. We have legal entanglements that last for years trying to determine who is entitled to what. We are known by numbers: social security numbers, credit card numbers, bank account numbers, insurance policy numbers. We seek to simplify our lives, hoping to somehow rid ourselves of the strangling regulations and other constraints which have grown around us, seemingly without our knowledge or consent.

Our mechanized and regulated society is a source of frustration to many of us, but generally we feel it is part of the price we must pay for progress. The price we must pay, however, is getting steep, and, ironically, may nullify all of the progress we have made. In our attempt to improve upon our natural habitat, and in our constant need to accommodate a human population which is out of control, we have just begun to notice and pay some attention to evidence of global changes. These

global changes alter the planetary environment and pose a threat to all life. The complexity and magnitude of such global change due to our human busyness on the planet has never before had to be considered.

Damage to the protective stratospheric ozone layer and the warming of the earth by what have come to be called "greenhouse" gases are two of the most complex problems that confront us today. There is no simple and straightforward way to accurately calculate the effects of these phenomena and the timetables to establish when these effects will take place. Dr. Michael Oppenheimer, a former Harvard astrophysicist who is now senior atmospheric scientist with the Environmental Defense Fund has this to say about what is happening:

"We're flying blind into a highly uncertain future. These changes are going to affect every human being and every ecosystem on the face of the earth, and we only have a glimmer of what these changes will be. The atmosphere is supposed to do two things for us: maintain a constant chemical climate of oxygen, nitrogen and water vapor, and help maintain the radiation balance--for example, by keeping out excess UV. The unthinkable is that we're distorting this atmospheric balance. We're shifting the chemical balance so that we have more poisons in the atmosphere--ozone and acid rain on ground level--while we're also changing the thermal climate of the earth through the greenhouse effect and simultaneously causing destruction of our primary filter of ultraviolet light." (4)

(It should be noted here that in speaking of ozone Dr. Oppenheimer is talking about both ground level ozone, which is a dangerous pollutant, and upper atmospheric ozone, which screens out harmful ultraviolet radiation.)

The Rowland-Molina mechanism, a theory first developed in 1974 by Sherwood Rowland and Mario Molina, stated that chlorofluorocarbons (CFC compounds) are broken up by ultraviolet rays as they rise into the stratosphere, liberating chlorine which destroys ozone. Stratospheric ozone is important, because it keeps much of the dangerous component of sunlight (ultraviolet) from reaching Earth's surface. Because ultraviolet light is ionizing radiation, it can be very harmful to organisms. It has been confirmed by recent studies that CFC's are the major factor causing the annual decline in ozone over Antarctica and a 2.3 percent decline in ozone over mid-latitudes from 1969 to 1986. The decline in ozone over the mid-latitudes was announced by a panel of more than 100 scientists who worked under the National Aeronautics and Space Administration for 17 months in "the most thorough examination ever undertaken of ozone." (5)

We are unable to establish all the probable effects of this ozone depletion, but the most commonly communicated concern has been that skin cancer rates will rise. In a comment typical of the Reagan administration's environmental consciousness, Donald Hodel suggested that we could cope with the ozone loss by wearing sunglasses and hats. At the time of this proposal he was the Secretary of the Interior (1987). The Bush administration has done nothing to change this stance. Of greater concern is the possible widespread damage to crops and to the human immune system. Our politicians and bureaucrats seek to reassure us, painting a bright picture of the future, but most are too busy to educate themselves on these issues, and therefore are increasingly unaware of the ramifications of our expansion. "More important" matters take up their time.

The greenhouse effect is caused by the release of gases such as chlorofluorocarbons, methane and nitrous oxides and carbon dioxide, the principal greenhouse gas. Since 1958, concentrations of carbon dioxide in the atmosphere have increased 25 percent, mainly due to the burning of oil and

coal. As we destroy forests, which absorb about 100 tons of carbon dioxide per acre, the increments of carbon dioxide remain in the atmosphere. It is estimated that in the last 40 years as much as half the world's forests have been destroyed.(6) Methane is produced by burning wood, by raising rice and cattle, and from natural decomposition processes in swamps. We produce nitrous oxide through our chemical fertilizers and car emissions. The "greenhouse effect" is a theory which postulates that average global temperatures will rise, due to the "trapping" of radiant energy from the sun under the atmospheric envelope of greenhouse gases. In the absence of these gases, much of the sun's energy is reflected back into space. If the earth's average temperature rises (even by just a few degrees) polar ice caps will melt, oceans will rise and global weather patterns may change drastically. For years we have heard about the greenhouse effect and its possible ramifications. Disasters that may occur in the future do not, however, engender much concern.

It is disputable whether or not recent droughts are more concrete evidence, but they are close enough to home that more people are finally beginning to have some concern that the greenhouse effect will do more than increase the sunny days of the summer and create some new oceanfront property. Some people are less concerned, however. White House administration spokesman Marlin Fitzwater, when asked for details about the administration's plan to deal with drought said, "pray for rain." Not surprisingly, the Reagan administration's record on the environment is the worst of this century. His successor has stalled international progress on dealing with global warming, claiming that it needs more study, although this is an increasingly isolated position in the world community.

Some of our foremost scientists have independently arrived at one conclusion concerning our present policy in response to these global threats: it won't begin to do the job. They have recommended that we reduce production of CFC's by 95 percent worldwide within the next six to eight years, reduce dependence on fossil fuels, halt deforestation, establish a national institute devoted to basic environmental research and discontinue basic environmental research by or funded by EPA and the Department of Energy, due to political pressures on these agencies. (7) There are some indications that, finally, this environmental threat is being taken seriously.

Unfortunately, the seriousness of the threat is not always matched by rational proposals for dealing with it. Some scientists are already proposing fantastic schemes for thwarting global warming, like disbursing millions of tons of sulfur dioxide (a precursor to acid rain) into the stratosphere with a fleet of several hundred Boeing 747's. The hypothesis assumes that the sulfur dioxide will remain in the upper atmosphere and serve to block enough sunlight from reaching Earth. To counteract the greenhouse effect, other such speculative and megalomaniacal schemes have also been floated by the "salvation-through-science" technocrats. The "solution" to the problem of global pollution and environmental destruction is apparently a larger dose of the same untested, resource-depleting and massively expensive technology that got us into this mess in the first place. The simple, comprehensive, effective and inherently rational solution engendered by population reduction continues to escape some scientists and most bureaucrats. We need to stop ecological decline on all fronts to ensure a beneficial future, and this will require more than simply finding another technological fix.

We have seen the effect of "flying blind" in the nuclear power industry. The nuclear power picture is exceedingly complex and there is a reason why we haven't heard the "good news" about it---there isn't any (apart from the proclamations of nuclear industry advocates, who have yet to deal effectively with nuclear waste and spiraling costs). We now have nuclear plants which cost billions, rather than millions of dollars to construct. One reason for the overruns is that two thirds of the commercial reactors retired to date produced power for less than 15 years, rather than the estimated

30 years used in utility calculations. (8) None are delivering power at competitive cost in comparison to other energy alternatives, unless the costs of their decommissioning are disregarded, as they have been. No one knows exactly what the costs will be to dismantle these plants. Though estimates by independent analysts run into the billions, it is very difficult to estimate the costs because there are many assumptions that must be made on less than solid evidence. Similarly, no one can really say with any great degree of certainty what it will cost to cart away the radioactive wastes, some of which (nickel 59) have a half-life of 80,000 years. No one knows specifically where these wastes should go, except that it should be quite a distance from their particular area. Fortunately, most high-level wastes will be toxic for only 10,000 years, a period of time longer than recorded human history. As of this writing, the apparent lucky winner in the nuclear waste repository sweepstakes is Yucca Mountain, Nevada. It might be the site where some 48,000 metric tons of high-level nuclear wastes will be deposited between now and the year 2000. Of course, that is for the United States only. Other countries have not established repositories.

No one knows exactly how to decommission nuclear plants safely, and the problem is further complicated by the multiplicity of designs of nuclear reactors. We will have to find out soon, however, because the Nuclear Regulatory Commission estimates that 67 large commercial reactors will no longer be in operation by the year 2010. Add to that the " 20 which are already shut down worldwide, the 63 that are likely to retire by the turn of the century and another 162 between 2000 and 2010." (9) Reassurance is hard to come by when discussing the details of nuclear power and its various complications, but the energy industries are undaunted, assuming according to one advertising flyer that we have "a bright energy future due to our coal and nuclear power resources." The only way to make that assumption is to ignore the environmental damage that would ensue from burning coal in large amounts, and to ignore the fact that we don't know how to handle nuclear wastes.

But what connection do problems such as the greenhouse effect, ozone depletion and nuclear waste accumulation have with overpopulation? Aren't these obviously problems involved with the development of technology rather than overpopulation? To answer this question we must carefully scrutinize the population factor to look beyond what seems "obvious." Two scientists from the American Museum of Natural History in New York found that the rate of increase of atmospheric carbon dioxide almost exactly matches the growth of the world's population for at least the past 25 years. "This nearly perfect (statistical) correlation can hardly be fortuitous," write the two researchers. (10) The cutting and burning of forests in the Amazon region--one factor in the Greenhouse Effect--is done by an expanding number of individual families wanting farmland for subsistence, and by corporate ranchers who desire grazing land for cattle so that the large population which eats hamburgers can have them. The burning of fossil fuels, which is rapidly removing those fuels as an energy source, supports the driving habits of an ever-growing number of people, as well as the factories which produce goods for increasing numbers of people.

The connection between nuclear power and overpopulation is less obvious, but it is found in the time lag between the planning for population expansion and the implementation of mechanisms to deal with such expansion. While the need for development of energy sources may come and go, we are still left with the results of hasty development to accommodate the needs of the larger population which is expected. That is precisely what has happened with nuclear power. Though conservation to save power would have been more sensible than building nuclear plants, we lacked that good sense and so instead were compelled to supply nuclear power to supplement hydroelectric power to fulfill the energy needs of the continuously expanding population.

Other population factors which contribute to the greenhouse effect are accumulations of methane gas due to the increase in livestock and rice raised around the world. Both of these factors are directly caused by an expanding population which requires more and more food. It seems relatively simple, but we don't seem to recognize this relationship between our exploding numbers and these environmental threats. An important consideration about the warming of the earth and the decline in ozone is that, as with most of our other problems, an expanding population will not be helpful in stopping it. This is not to say that a population decrease would instantly stop the damage, or that we are not taking any damage control steps whatsoever. In 1987 thirty-one nations signed a treaty in Montreal which called for a 50 percent reduction in CFC production by 1988. In March of 1988 Du Pont corporation announced that they planned to eventually end production of CFCs and would encourage other manufacturers of CFCs to join them in this effort. Steps such as these are important because we are finally coming closer to a global recognition that we are not immune from the consequences of environmental change. Hopefully this recognition will include the absolute necessity of reducing the population.

If it does not, then perhaps our water problems will bring us to our senses. When we live with population densities as high as 650,000 people per square mile, as people do in Hong Kong, we cannot expect that there will be no effects. A major repercussion is the threat to public health that has always been present in areas of high population density. Contamination of water supplies has historically increased the incidence of disease in areas of high population density, or areas where people were not aware of the connection between water quality and disease. Attempting to maintain public health is no small feat even in areas with population densities much lower than the quoted figure. Though we are aware of the connection between a pure water supply and good health, we do not make the connection that reports of tainted wells, threatened aquifers and overloaded septic systems have anything to do with increasing population. We focus on finding technological solutions to accommodate the increase.

As the population grows another conflict appears. Development requires maximum concentration of people for reasonable marketing ratios, but maximum concentration of people poses a threat to such shared community resources as water. Once again, people are placed in a no-win position. Development means jobs and prosperity for the community, but the price of this prosperity is continued deterioration of shared community resources. Obviously we have been making this trade-off for over a century of industrialization and for centuries before that, as people have formed communities since the beginning of recorded history. Today, however, the increments of pollutants to the water systems throughout the United States and the world make it difficult to maintain a reasonably pure supply of water. One of the enticements to induce industry to move to a particular area is the state of the water supply. The development in the area then increases the amount of pollutants to the water and the asset of a pure water supply is threatened. It is common knowledge that industrialization requires large amounts of energy. It is less common knowledge that industrialization requires a great deal of water which often is not recycled or recyclable. We all want "clean" industry in our backyards as opposed to "heavy" industry, which produces obvious pollution, but all of our economic activity produces waste of some kind.

Not only do we threaten the purity of the water but we have created scarcity in water supplies by diverting water to areas which were previously desert. Though the West and particularly the Southwest of the United States receive only one-third of the nation's annual rainfall, they now account for more than two-thirds of the nation's delivered water consumption. We are pumping out more water from subterranean aquifers than is replenished, which means that the depth at which

wells reach water has increased. The extent of that increase is shocking: 400 feet in 50 years near Phoenix, more than 100 feet since 1950 along parts of the California coast, up to 10 feet per year under large areas of the Columbian plateau in the state of Washington. Most of the available water supplies are dedicated--the dams have been built, use is set. However, **we are using more water than nature replaces**. Peak use regulations and other conservation measures are becoming the norm for these areas, but their populations are still growing. A 45% increase in the population of the western United States is expected by the year 2000. (11) The majority of this population increase is expected to occur in the arid Southwest. These people will require water, but it is unlikely that the water will be there. This example of excessive water usage in the southwestern United States is not an exceptional case. Water problems are a source of concern throughout the world. The demands never lessen; they just shift from one area to another.

In examining our habits of resource usage, it seems that we believe we can continue to adjust the natural ecological balance to suit our aims without fear of the consequences. But this is not so. Such areas as Phoenix, Dallas and other metropolitan developments in naturally arid ecological systems cannot be maintained for any long period of time. The number of people which can be supported in arid climates has been exceeded in these areas, and though our technology can give the illusion of increased carrying capacity, we will reach the limits of expansion. Communities in the southwestern United States and other parts of the country are beginning to see that exceedingly strict measures will be necessary to conserve their water supplies. Such measures seem onerous to users inconvenienced by what appears to be a temporary lack of water, but they are just seeing the tip of the iceberg. The seriousness of our water problems is illustrated by Department of Agriculture estimates that one-fourth of groundwater withdrawals in the United States are not recharged. (12) Our excessive use of water worldwide will have major repercussions in the future in development, in agriculture and in all our planning. It is difficult to envision such repercussions because we take our water supplies for granted, as we do other renewable resources. These water supplies have served us for thousands of years and most of us cannot conceive of "running out" of water. It is only our proliferation in the last few hundred years that has brought us to this impasse.

Other inconveniences engendered by population expansion are beginning to command our attention. The "Progressives" scream in anguish that their plans for building and development will grind to a halt in the face of any stringent regulation, and we are left once again with a conflict between a healthy economy and a healthy environment. Overdevelopment of desirable areas in the United States has resulted in the implementation of expensive and complex sewage treatment. In industrialized nations, dealing with the massive amounts of garbage that we daily burn or haul to landfills to bury is becoming more and more difficult. Current estimates indicate that we are exceeding the capacity of most of our landfills. Twenty-five percent of the superfund hazardous waste sites slated for cleanup are landfills. We export our garbage when we can, but fewer areas are available for this "export." It remains on barges, the "garbage without a country." In attempting to apply technological solutions to the problem, we burn the garbage in euphemistically named "waste to energy" plants. We try to ignore the fact that these plants add to the amount of pollutants in the air. The ash from burned garbage will probably be considered hazardous waste. If it is termed such by the EPA, which is likely, disposal costs will rise astronomically. Disposal fees have already risen in some places from \$30 per ton to \$250 per ton, an increase of over 700 percent. As the bills come due for our reckless environmental policies of the past, we scramble to find new, safe technologies to heal the wounds. Recycling and composting will reduce the severity of some of these problems, but not all of the waste can or will be recycled. In addition, the best possible recycling measures

cannot recapture anything approximating the original energy potential.

Radioactive waste is a problem which continues to baffle us. Some advocate burying it in sealed containers, assuring that it will be safe within reasonable limits. Opponents of this method disagree on the reasonable limits of safety. No one wants the burial ground to be in their backyard, but, as the economy tightens, people become more willing to trade short-term economic advantages for possible long-term health threats. **Annually**, according to an EPA report of 1989, **we produce 22 billion tons of toxic waste** to maintain our modern lifestyles in the United States. That works out to over 60 million tons a day. Other sources rate the amount of toxic waste produced even higher--one metric ton per person per day. (13) The accumulation of this toxic waste has created a problem of monumental proportions. We are only beginning to examine the technology to handle such problems as radioactive and toxic waste. Granted, a change in lifestyles would make it possible to have less waste and a reasonable ecological balance, but population growth has a constant effect on economic and ecological gains: It absorbs them. In addition, advocates of economic growth and advocates of the environment often are adversaries, making lifestyle changes unlikely.

Although there are many examples of environmental deterioration from Western nations, the Western nations are not alone. Indeed, China, the USSR and Eastern Europe are doing no better, and sometimes worse, in dealing with environmental degradation. Population growth, industrial development and expanded irrigation have stretched the Beijing region's meager supplies to their limit. A number of rivers have dried up. Groundwater use in some areas now exceeds replenishment, and water tables are dropping up to three feet a year. Overpumping in Beijing's eastern suburbs is causing the land itself to subside as much as four inches annually. So much water is now siphoned from the region's rivers that the amount reaching the sea has fallen 93 percent since the 1950s. The resulting rise in the salinity of coastal estuaries has damaged commercial fisheries. (14) China's reliance on its large reserves of coal is producing the same effects that are found in other coal burning regions: acid rain, air pollutants, smog.

The U.S.S.R. and Eastern Europe face environmental crises that are already worse than those of the West. Here are just a few examples:

** Lake Baikal, repository of 20 percent of the earth's fresh water is succumbing to industrial waste.

** Fyodor Morgun, head of the new national Environmental Committee in the USSR reported to the Communist Party conference in Moscow in June 1988 that industrial pollution is 10 times greater than safe-health norms in 102 Soviet cities, affecting about 50 million people, nearly a fifth of the population.

** The Dnieper river has mercury levels 140 times greater than permitted by the government.

** According to Jeff Trimble, environmental reporter for the U.S. News and World Report, "Research by the Soviet government has revealed that some parts of the stricken Soviet environment may be beyond saving. Lake Ladoga near Leningrad is thought to be terminally polluted. The Aral Sea in Central Asia, once the fourth-largest lake on earth, has shrunk by two thirds in the last 28 years, its water depleted for irrigation of new farmlands. Most fish life has disappeared and local harvests are falling because of lack of water and the toxic salts that blow across croplands from the drying lake bed. Some scientists predict the lake, once an oasis in the most arid section of the USSR, will be a lifeless swamp by the end of the century." (15)

** Hilary French, reporting for World Watch magazine, said that in Molbis, East Germany "the air pollution is so thick that drivers often have to turn on their headlights in the middle of the day. The Polish government has recently declared five villages in the industrial region of Silesia unfit to live in because of high levels of heavy metals in the soil. It has bought out most of the villagers, enabling them to relocate. In Czechoslovakia, residents aren't waiting for a formal decree: they're leaving heavily polluted northern Bohemia at such a rate that the government is offering them financial incentives to stay." (16) In Poland, chemical contamination has rendered one fourth of the soil unfit for food production and left only 1 percent of the water safe for drinking.(17)

When the problem is not contamination, it is the voracious appetite of the huge worldwide population. This appetite is fueled by the greedy use of resources which is typical of the billion or more people of the developed countries and the lesser use of resources by the 3 billion or more people of the less developed countries. As the demand for wood products rises with the growing population, forests are declining. Worldwide, millions of acres of forests disappear every year, as forests are cleared for farms and cities, and demand for wood products exceeds the sustainable yield of remaining forests. **Ninety-five percent of our original forests in the United States have been cleared**, and timber interests are eyeing the last 5 percent, stating that "we must have the timber." (18) We are concerned about saving these last few original forests, but our population growth worldwide and our global markets are sure to deny conservation goals. We must also keep in mind that cost efficiency is lessened when the timber is taken from more and more isolated sources. Therefore we can expect that prices of timber products will rise.

We can also expect that prices of food products will rise. As with our forests, our croplands are declining. In the United States, 4.5 million acres of cropland were lost annually between 1967 and 1977 to urban expansion and other development, and this trend has increased since. (19) Other factors may compound this loss in the future. Producing ethanol for gasahol production will inevitably clash with our need for increased food production, since both are agricultural products. The solution of the vaunted Green Revolution to our future food needs depended upon increasing per acre yields, but this strategy is fading when confronted by soil erosion, water and energy constraints, diminishing returns from fertilizer use and a slowing in the benefits of technological advances. It is estimated that our petroleum-based fertilizers have increased yields fourfold, but these increases are expensive, being 100 times as demanding of resources and energy as agriculture which is not augmented by synthetic fertilizers. (20)

Many people find it hard to believe that we are running out of agricultural plenty, however. One of the frustrating questions one continually hears when posing the idea that overpopulation is a problem in the United States, as opposed to being a problem only of Third World countries is this: "Why do we have to cut back? I have seen a lot of land which is not being used." It is typical of our view of land use that we only assign value to land which is, or can be, commercially exploited. We give it no value if it is being used by species other than humans. This view of land stems from our traditions that consider humans as separate from nature rather than entirely dependent on it. That land which is "not being used" is often part of our unconsidered rangelands. It provides:

** Habitat for wildlife: deer, antelope, bison, rabbits, pheasants and numerous other species occupying a critical position in the prairie ecology.

** Forage for cattle and sheep.

As we have increased our use of synthetic fibers the population of sheep has declined, making more rangeland available, but even with this additional land, overgrazing is still prevalent enough to indicate that we are exceeding the carrying capacity of our rangelands. As with other resources, the rangelands are not used in a singular manner, but have many competing uses--mining, grazing, recreation and development. Other competitors for rangeland are the many thousands of species whose habitat is the rangelands. When we compete for this land which is "not being used" these species do not have a voice, and therefore are disenfranchised as they are not considered in the multiple use strategy. As far as most humans are concerned, they have no part to play. As population increases, all this competition increases---a simple factor in a complex equation.

We must address the underlying problem. Too many people trying to utilize the same space will consistently have the same result--friction and damaged health. Solutions that attempt to avoid this obvious factor are bound to fail. We cannot have numbers of people greater than the carrying capacity of an area and expect anything other than a breakdown of the ecological systems that operate successfully when not overloaded. We should not be surprised at the inevitable consequences of natural law--starvation, disease, environmental deterioration and conflict over territorial needs. When we are annually losing 24 billion tons of topsoil worldwide and trying to feed 88 million more people, it is not difficult to envision the inevitable result. Population is not the only element involved in these calamities, of course, but the undeniable and pervasive part that it plays and the urgent need for action to reduce the population have been completely overlooked by most people.

The consequences of population expansion and encroachment that we do see are regulations. People make the change to wood stoves for heating because of the cost benefits of burning wood, but particulate matter in the air increases. Eventually, as more people convert to wood heat, air quality becomes a problem and regulations are put into effect that do not allow use of the wood stove on days when air quality is threatened. More efficient wood stoves are touted as the answer to the problem. Similarly, too many people have automobiles, and the waste products of the internal combustion engine affect the quality of the air we breathe and the atmospheric balance. More efficient engines for automobiles are considered the answer to the problem. Although automobiles are made to run more efficiently, the insult to the environment persists because the number of people using automobiles increases. A recent study by Worldwatch Institute estimated that the number of passenger cars worldwide grew from **53 million** in 1950 to **386 million** in 1986. Mind you, that is just passenger cars, and does not include vehicles for industrial use.

The average person does not see his use of a wood stove or an automobile as part of the problem, because the increments of pollution are not large individually. We have had wood burning devices and automobiles for many years now and are quite attached to them economically, sentimentally and socially. But unlimited procreation means that your rights stop at the point which violates the community welfare. Though Western tradition holds that the individual's rights are of great import, we cannot hold out individually against the tide of expansion that we have achieved. We limit our own freedom as we strangle ourselves with our indiscriminate reproduction. In doing so we consistently diminish our individual rights. We cannot have all of the things we wish to have: a clean environment, jobs for all, automobiles, wood stoves, and as many children as we desire.

We often attempt to examine a single resource in a singular manner. The results of such an examination make it possible to say that oil, for example, will be available to us until the middle of

the 21st century, if use is maintained at present levels, or that we have enough coal to last for several more centuries, or that we are sufficiently managing our renewable resources. It seems reassuring to believe that we have enough of a resource to last into our children's lives, and that our ingenuity will be our salvation once a non-renewable resource is gone forever, but looking at resources and the complexity of their interrelationships makes such a resource census childishly inadequate. It should be obvious that we cannot examine these systems in a singular fashion. The effects of the use of one system (croplands, for instance) affect other systems (rangelands, forests, fisheries) and vice versa. For example, constant year round supplies of water for the Panama Canal are provided by the rain forests of Panama which are being cut and burned. Stands of mahogany go to provide luxury for those who can "afford" it, but the cost of such conspicuous consumption is that one economic resource of Panama, the canal, is being threatened by the ravaging of another resource, timber. Though we do not easily recognize these connections, the cutting and burning of rain forests affects us all eventually. And this is not an isolated example of the unseen effects of our actions. We know that if we eat a great deal of fish we will deplete the ability of fisheries to be replenished, but it is less obvious that our use of fish meal in chicken feed means that as we eat more chicken, we are also depleting fisheries.

We are not aware of these interrelationships so we do not consider them in our decisions, but exceeding the carrying capacity of any of these systems will have serious repercussions. Diminishing the viability of ecosystems by polluting them is bound to affect our economic health--and, of course, our physical health. We cannot shore up any one of these systems in an exclusive fashion. We cannot ensure their continuous ability to sustain themselves without accounting for the effect of our demands upon them, and their interrelationships with each other. Though we consult different experts to determine whether or not we have enough oil or coal or timber to last for a specified number of years, we still have to consider the fact that oil or coal or timber will not sustain us by themselves. We live by the grace of an ecosystem that is the totality of all its interactions, and if we create imbalances in that ecosystem, the whole system suffers. As John Holdren pointed out in 1973:

"Still more threatening, in all probability, is civilization's interference in the smooth functioning of biological processes that provide us with services we do not know how to replace. Most potential crop pests are controlled by their natural enemies or by other environmental conditions, not by technology. Similarly, many agents of human disease are controlled not principally by medical technology but by environmental conditions, and some carriers of such agents are controlled by a combination of environmental conditions and natural enemies. The cycling of essential plant nutrients such as nitrogen, phosphorus and sulfur is contingent at various stages on biological processes, and these same cycles play an important role in the disposal of civilization's wastes. The environmental concentrations of ammonia, carbon dioxide, and hydrogen sulfide--all poisonous--are biologically controlled. These "public service" functions of the biological environment cannot be replaced by technology now or in the next century. This is so not so much for lack of scientific knowledge or technical skill (although such limitations are important in many cases), but rather, for the most part, because the sheer size of the tasks simply dwarfs civilization's capacity to produce and deploy new technology." (21)

Any single factor that indicates deterioration in our fishing grounds, agricultural lands, prairies, or woodlands should be enough to prompt an immediate examination of population growth. Any

single estimate of the total depletion of a non-renewable resource, such as oil, should awaken us to the consequences of our behavior. Any single factor indicating that we are doing damage to the systems that sustain our atmospheric protection should be immediately addressed, and the effects of population expansion should be included in the examination. The combination of these factors and others in the state of our ecological decline make our ignorance of population expansion as suicidal as an ignorance of the nuclear threat. Population expansion affects our politics, our economics---every aspect of our lives.

Resources are the basis of our existence. Control of resources has been the definition of power throughout history. It is undeniable that expansion plays a part in increasing conflict. More people competing for a fixed amount of resources will produce conflict, because we are talking about limited resources. The argument to contradict this idea is that resources are manipulated in an unfair fashion. It is true that we can manipulate fixed resources in any fashion we choose. Some people may use much more than they should, as is obvious at present with the United States, and, to a lesser extent, the other industrialized nations. The distribution of resources might, by some miracle of good sense, be divided more equally between the humans of the earth and other species. But even if this were done, there would still be a need to reduce the human population because there would still be a rapid depletion of fixed resources, and conflict would inevitably result when people competed for the same limited resources. Other species also are competing for resources, and we humans have over the centuries become the arbiter of the competition. Our vested interests take precedence over those who have no means to participate in our economic system--all other species. If we require the resources that support them, they lose. But in this superficial winning and losing, there is a "domino effect" which operates similarly to the parable of the horseshoe nail. For those who are not familiar with the parable, it goes roughly like this:

For the want of the nail the shoe was lost.

For the want of the shoe the horse was lost.

For the want of the horse the rider was lost.

For the want of the rider the battle was lost.

For the want of the battle the kingdom was lost.

All for the want of a horseshoe nail.

Any comprehensive observation of an ecological system indicates that each species is equally important to the function of the entire system. If we wish to be one of the species which "thrives" in the future we should look to our place in the whole scheme of things. Or we can just continue expanding.