The Winners of the Blue Planet Prize

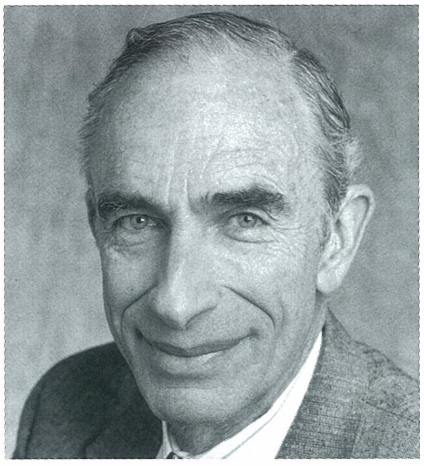
1999

1999

Blue Planet Prize

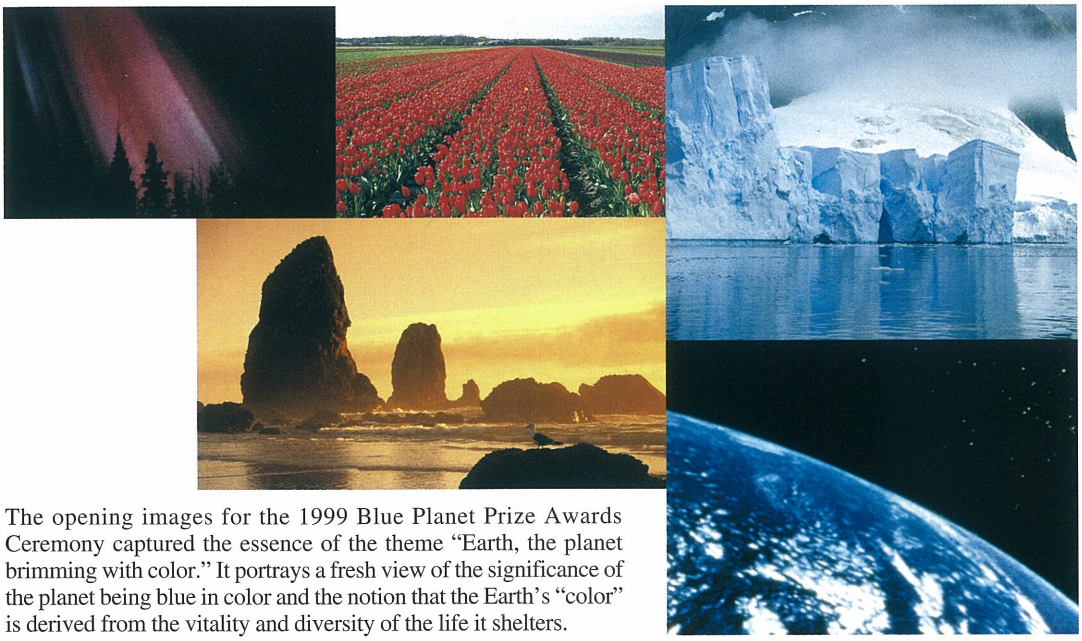
Dr. Paul R. Ehrlich (U.S.A.)

Director of the Center of Conservation Biology, Stanford University



Professor Qu Geping (P.R.C.)

Chairman of the Environmental Protection and Resources Conservation Committee of the National People's Congress of China



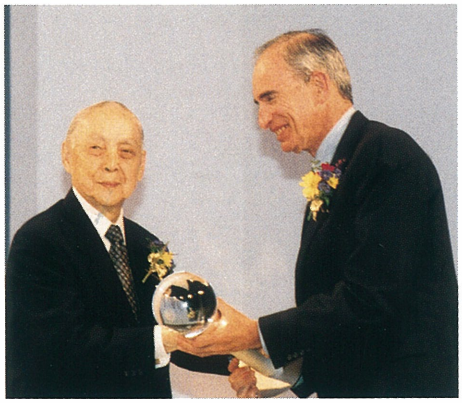
The opening images for the 1999 Blue Planet Prize Awards Ceremony captured the essence of the theme "Earth, the planet brimming with color." It portrays a fresh view of the significance of the planet being blue in color and the notion that the Earth's "color" is derived from the vitality and diversity of the life it shelters.

His Imperial Highness Prince Akishino congratulates the laureates.

Their Imperial Highnesses Prince and Princess Akishino toast the laureates at the Congratulatory Party.

Dr. Jiro Kondo, chairman of the Selection Committee, explains the rationale for the determination of the year's winners.

Thomas S. Foley, Ambassador of the United States to Japan (left), and Chen Jian, Ambassador of the People's Republic of China to Japan (right), congratulate the laureates.



Dr. Paul R. Ehrlich accepts the 1999 Blue Planet Prize from Foundation Chairman Jiro Furumoto.

Prof. Qu Geping accepting the 1999 Blue Planet Prize.

Profile

Dr. Paul R. Ehrlich

Director of the Center of Conservation Biology, Stanford University

Education and Academic and Professional Activities

1932	Born in May in the United States.
1953	B.A., University of Pennsylvania.
1955	M.Sc., University of Kansas.
1957	Ph.D., University of Kansas.
1957-1959	Research Associate, NIH Project–Genetics and Behavior of Parasitic Mites (Chicago Academy of Sciences and Department of Entomology, University of Kansas).
1959-1962	Assistant Professor, Biological Sciences, Stanford University.
1962-1966	Associate Professor, Biological Sciences, Stanford University.
1966—	Professor, Biological Sciences, Stanford University.
1966-1976	Director, Graduate Studies Biological Sciences, Stanford University.
1977—	Bing Professor of Population Studies, Stanford University.
1982	Fellow, American Academy of Arts and Sciences.
1984—	Director, Center for Conservation Biology, Stanford University.
1985	Member, National Academy of Sciences.
1987	Gold Medal, WWF International.
1989	UNEP Global 500 Roll of Honour.
1989-1990	President, American Institute of Biological Sciences.
1990	Crafoord Prize, Royal Swedish Academy of Sciences.
1991	MacArthur Prize Fellowship.
1992	Member, European Academy of Sciences and Arts.
1995	Sasakawa Prize (with Anne Ehrlich), United Nations Environment Programme.
1998	Tyler Prize for Environmental Achievement (with Anne Ehrlich).

Dr. Paul R. Ehrlich closely observed populations of butterflies over a 35-year period and analyzed the relationship of environmental factors to boom and bust cycles in the populations. This study led him to co-found the new field of conservation biology. He also co-authored the theory of co-evolution, which attempts to explain the mutual effects of multiple species on survival and breeding. He came to understand that since humankind was just one of many interdependent species evolved in a process of co-evolution, maintenance of the current ecology, which sustained a great diversity of species, was essential to the continued survival of the human race.

He concluded that the current and ongoing explosion of growth in the human popula-

tion was a major cause of habitat destruction and published his belief in his 1968 book, *The Population Bomb*. Well in advance of the Club of Rome's pronouncement of the "Limits to Growth," he pointed out that there were limits to human resource consumption. More than 3-million copies of this book sold around the world, which helped to spur the first intergovernmental conference on population. In recent years, he has advocated that women's education and emancipation is one of the most important strategies for controlling population.

In his 1981 book, *Extinction*, he raised the general public's awareness of the dangers of the disappearance of species. He also played an important role in 1983 in warning about the environmental dangers of nuclear war and predicting the destructive impact on the ecosystem.

With his colleagues and wife, Anne, who is also a biologist and a constant companion, Dr. Ehrlich is active in advocating policies and advancing research that promote the global conservation of biodiversity.

Essay

Our Environmental Future

Dr. Paul R. Ehrlich

July 2001

The biggest question about our future—the one to which present and future generations must pay much more attention—is the same one I outlined when I received the Blue Planet Prize several years ago. It is a question of especial importance to today's young people, who will be living with the environmental consequences of human activities today. The question is whether *Homo sapiens* can successfully find a way to change from exhausting its natural capital, while fighting over what remains, to establishing a sustainable society. Such a society would be one living peacefully on the income stream from its capital while taking effective measures to increase equity within and between groups and nations, to suppress war and other forms of violence, and to avoid public health disasters. That means humanity must find a way of successfully dealing with the "human predicament." That is, learning both how to live within the constraints set by Earth's life-support systems, and how to live with each other in unprecedentedly large and technically sophisticated societies. We must especially strive to avoid great losses of biodiversity, the most important part of our natural capital—the living parts of the ecosystems that support our lives. Biodiversity loss and/or rapid climate change could lead to a disastrous ecological collapse and social breakdown. And if current trends continue, that is precisely where society is headed. Sadly, in the short time that has elapsed since I was honored, the leadership in my nation has moved in exactly the wrong direction.

Three major factors are multiplying together to produce the crucial ecological dimension of the predicament; the destruction of natural ecosystems. The first is vast overpopulation. Earth now has more than 6 billion human beings—on the order of three times the number that might be considered "optimal" given current patterns of consumption and behavior. Those patterns are involved in the second factor, runaway consumption among the rich. It is not just the numbers of people that cause environmental degradation, but also how those people behave. And the rich, with their addiction to such things as commuting to work by automobile, large air-conditioned homes filled with electric appliances, and large-scale consumption of meat and seafood, are putting enormous stress on ecosystems. Additionally, the poor are trying to "catch up" and adopt the patterns of overconsumption now in place in Japan and the West.

The third factor is the use of faulty technologies and unfortunate socio-economic and political arrangements to service that consumption. Today's reckless dependence on fossil fuels is a case of the use of faulty technologies. That dependence is leading society into a cul-de-sac since it will take many decades for large-scale deployment of alternative, more environmentally benign technologies. A prime example is employing gas-guzzling sport utility

vehicles to commute. A better solution to getting to and from work would be using the small, energy efficient gas-electric hybrid vehicles that have been pioneered by Japanese firms. Still better would be installing comprehensive and safe mass transit systems in every large city. And best of all would be redesigning cities to minimize the need to commute, allowing many people to work "electronically" from home and most of the rest to get to offices and factories by walking or bicycling. But here again the poor are striving to emulate the behavior of the rich and going through their own version of the Victorian industrial revolution, including taking up the developed world's addiction to automobiles, rather than advancing to more sensible and efficient ways of meeting human needs.

And, of course, all this behavior is encouraged by political systems that are incapable of taking the long view. Economic systems that promote consumption, and gross inequities that give huge numbers of people little or no say in the kinds of lives they lead. Today, some two-billion people live in awful poverty. That's more people than existed a century ago. Is it progress?

These three factors are combining to destroy Earth's ecosystems—communities of plants, animals and microorganisms interacting with each other and their physical environments. Society depends on those ecosystems for an array of indispensable services and goods. The services include amelioration of climate, provision of freshwater, flood control, creation and maintenance of the fertile soil that is essential to agriculture and forestry, recycling of nutrients and pollination of crops. The serious deterioration of one service alone—the control of potential pests of crops—could bring about the collapse of civilization. Ecosystem goods include fish from the sea and bodies of freshwater (which supply a crucial protein supplement to the diets of many poor people), timber and a large portion of the medicines used by all societies.

In addition to the degradation of ecosystems, another key element to the human predicament is the decay of the human epidemiological environment. Overpopulation, poverty and misallocation of public health efforts are increasing our vulnerability to lethal epidemics. Many diseases cannot persist in small populations. For example, measles requires societies of hundreds of thousands of people to maintain itself. Humanity is now pushing large groups of people into close contact with the animal reservoirs of infectious disease, and many of those people are malnourished and thus immune-compromised. This creates near-ideal conditions for novel diseases to transfer into the human population and cause vast epidemics. AIDS is likely to be only the first such transfer in recent times. A similar problem is created by patterns of agriculture, such as the Chinese pig-duck system in which swine, fowl and people are brought into close contact, making the emergence of killer flu strains all the more likely. The deterioration of the epidemiological environment is also a result of insanely stupid patterns of antibiotic overuse, which has guaranteed the huge problems now being created by antibiotic resistance in bacteria. In addition, rapid transport systems now make it possible for epidemics and "super-bacteria" to be disseminated worldwide very rapidly.

Solving humanity's interrelated dilemmas of ecological collapse—a degraded epidemiological environment, gross economic inequity, violence, including a substantial but little-recognized residual threat of large-scale nuclear war, and cultural homogenization among

the rich accompanied by ethnic fragmentation among the poor—will be very difficult. That is due to the failure of cultural evolution in social organization and ethics to keep pace with cultural evolution in technological development. The situation has not been helped by most people's lack of understanding that the economy is a wholly-owned subsidiary of the environment. We will need economic strength and ever more clever technologies to help us make a transition to a sustainable society. But they alone can't accomplish the task. Reducing human numbers humanely and curbing consumption among the rich while increasing it among the poor, among other things, will also be necessary. And in order to do that, people must find ways to speed and direct human cultural evolution without a concomitant loss of human freedom.

That job is made all the more difficult because the seriousness of the human predicament is still unknown to the vast majority of the general public and decision-makers worldwide. Although environmental scientists understand the general directions in which humanity should be moving to solve it's environmental problems, the policy response of society remains pathetic. As a result, real progress in solving environmental problems requires not just greater efforts from the ecological and physical sciences, but a major commitment from the behavioral sciences, which have the potential to help develop ways to improve that response.

The behavioral sciences can give humanity a much better understanding of the ways in which culture—humanity's vast store of non-genetic information—evolves. Culture determines most interesting human behavior. And a crucial aspect of that behavior is humanity's treatment of its life-support systems. With the discovery that there are only some 26,000–38,000 genes in the human genome, it has become even more obvious that gene shortage has put the final nail in the coffin of "evolutionary psychology." That discipline has been long on psychology, but based on a distorted view of evolutionary theory. But beyond the weak evolutionary underpinnings of evolutionary psychology, gene shortage shows that we cannot look to our genes to either explain or modify most of our behavior. The unitary, unchanging "human nature," once thought to be invented by gods and later assumed to be a product of genetic evolution, is non-existent. Comprehending how cultural evolution produces the vast diversity of "human natures" may help us to discover how to reconfigure social, political and economic incentives and cut through barriers of ignorance and denial to allow society to turn onto a path to sustainability. It may show us how to change the course of cultural evolution in beneficial ways.

Some of the most important products of human cultural evolution are ethical concerns, including concerns for non-human organisms and the environment in general. Fortunately, cultures already have been evolving in the direction of broader environmental ethics. Social scientists need to look carefully at that evolution, both within the scientific community and in society as a whole. They must pay special attention to the extinction crisis, the related erosion of natural capital and the flows of services that capital provides. Ways must be found to accelerate the evolution of environmental ethics, as well of course, as the ethics that govern how human beings treat one another.

The problem of generating concern and appropriate actions will involve a much heavier participation in public debate than most scientists are accustomed to, but which has been shown to be possible by the success of the "nuclear winter" efforts of the early 1980s. The cur-

rent activities of the Intergovernmental Panel on Climate Change (IPCC) could serve as a partial model of a basic mechanism to expose society to the full range of population-environment-resource issues and their ethical implications. The IPCC involves hundreds of scientists from diverse disciplines in a continuing evaluation of the global warming situation. The goal is to reach consensus on the technical issues related to that contentious topic and give society and decision-makers advice on how to ameliorate its probable worst negative effects.

A start toward creating a broadly focused mechanism for mitigating impacts on ecosystems has been made by a group of environmental scientists attempting to organize an Intergovernmental Panel on Ecosystem Change (IPEC). Like the IPCC, it would be a process that is transparent to all participants as well as to the general public and decision-makers. IPEC will also strive to involve very broad participation from non-scientists, ranging from ethicists to representatives of the public, even more than was done in the nuclear winter and IPCC examples. We certainly now have tools—satellite TV, the Internet, fax machines, conference calls—that would make wide communication, debate and consensus building feasible.

Many of the necessary ideas have already been generated, the tools for spreading new ideas now abound, and environmental leadership is increasingly appearing inside and outside the scientific community. The needed changes in ethics are under way, and with focused effort, scientists may learn how to accelerate them. But the political will has not been generated, and the fate of humanity still rests too much in the hands of politicians and other decision-makers who are utterly ignorant of how the world works. Our challenge, and that of young people today, is to educate them or remove them from positions of power. The task is daunting, but the benefits of success would be immense. As I have often pointed out, it is highly unlikely that human beings will ever create a utopia, but collectively we could create a much better future than the one to which we're headed toward today.

Lecture

Keeping the Blue Planet Habitable: A Multidisciplinary Challenge

Dr. Paul R. Ehrlich

Humanity now faces the most daunting challenge of the few hundred thousand years since our species first appeared. *Homo sapiens* has become a global force and is altering Earth's biosphere at an accelerating pace, creating what has become known as the "human predicament." The scale of the human enterprise, as measured by energy use, has increased some twenty-three-fold since 1850.[1] Ironically, humanity's very successes, as demonstrated by a sixfold increase in population size during those 150 years, dazzling technological achievements, and an explosively expanding appropriation of resources, are undermining the sustainability of civilization. Most of the planet's land areas have been altered almost beyond recognition to fulfill human needs; not even the ocean depths and polar extremes remain untouched. Most, if not all, of society's observed and measurable impacts on its life support systems are now negative, indicating an overshoot of Earth's human carrying capacity. The enormous challenge now facing us is to harness that brilliant technology and all the wisdom we can summon to reverse the negative trends and create a sustainable future.

Driving Forces

The factors that are driving the environmental impact (I) of the scale of human activities can be viewed in terms of the I = PAT identity, where "P" is the size of the population, "A" is affluence (measured as consumption per capita), and "T" measures the environmental impacts of technologies and the economic, social and political arrangements involved in servicing that consumption.[2] Because the "A" and "T" factors are very difficult to sort out from available statistics, it is customary to substitute per-capita energy use for "A x T" in the identity.

The good news is that population growth has substantially slowed, especially in the last decade. Growth is now estimated to be about 1.35 percent per year, having fallen from over 2 percent in the 1960s. Nevertheless, the momentum of past growth ensures further growth for several generations, expanding the population from 6 billion today to 8 to 10 billion before growth can end and be reversed. Putting this in context, estimates by environmental scientists of a human population size that can be supported in the *long term*, given relatively generous assumptions about living standards, technologies and equity (A x T), are in the vicinity of 2 billion.[3]

Although the recent slowdown in population growth is cheering, consumption in most nations continues to grow rapidly, much of it in developed nations reasonably classed as overconsumption compared to the material goods available to the vast majority of human beings. The most serious environmental impacts are generated in the United States, the world's third

most populous nation. The U.S. population is growing by about 1 percent per year and has an extremely high level of consumption per person: roughly ten to thirty times that of people in developing nations.[4] Japan's per-capita consumption is about two-thirds that of the U.S. Thus, each person added to the American or Japanese population is a far greater threat to world sustainability than a birth in Kenya or Bangladesh.

Most developing nations have recognized the problems of rapid population growth and are dealing with them. But in the rich sectors of otherwise poor economies, consumption patterns are converging on those of the developed nations.[5] Indeed, the pressures generated by rapidly rising consumption levels in China alone could soon exceed those of the West and Japan. The spread of Western-style consumerism is a global threat, and the prospect of ever greater disparities in living standards between or within nations bodes ill for the environment, which in most circumstances benefits from increased equity.[6]

With developing societies following the industrial world's consumptive model, humanity is using Earth's finite inventory of accessible nonrenewable resources with remarkable profligacy.[7] Yet production of petroleum, on which modern industrial societies so much depend, is nearing its maximum and soon will begin declining. Larger reserves of coal, and less well-known but limited quantities of natural gas, may prolong fossil-fuel dependence, but at a high cost.

Fossil-fuel use is an example of an environmentally malign technology, which is compounded by inefficient use: designing cities to be dependent on automobile transport, for instance, rather than on walking, bicycling, or efficient, convenient mass transport. Burning fossil fuels causes serious (and familiar) pollution problems, but even more serious is their emissions' dominant contribution to global warming. That humanity will soon have to find more benign substitutes for fossil fuels is clear; the transition will be forced either by the environmental consequences of their use, or by the rising costs and diminishing returns of extracting and refining them, or some combination of the two.

Another example of malign technology is the overuse or careless disposal of toxic substances, such as pesticides and countless industrial chemicals that have been released to the environment. Economic and institutional systems have evolved to disregard negative environmental externalities—social costs not captured in the market prices of environmentally damaging products—so precautions and prevention of damage have too seldom been undertaken. But cleaning up afterward is not only much more costly, it sometimes is impossible.

Carrying Capacity

The number of people Earth can support *in the long term* without degrading the environment, given existing socioeconomic systems, consumption patterns, and technological capabilities, is called the *human carrying capacity* of the planet at that time.[8] Carrying capacity can be exceeded without causing immediate effects that are obvious to the untutored observer. Many local or regional overshoots[9] and subsequent crashes of human populations have occurred in the past, but today history is being repeated on a global scale. Humanity has already overshot Earth's carrying capacity by a simple measure: no nation is supporting its present population on *income*: the sustainable flow of renewable resources. Instead, key renewable resources, the

natural capital of humanity, are being used so rapidly that they have effectively become non-renewable.[10] *Homo sapiens* collectively acts like a person who cheerfully writes ever larger checks without considering the impact on the account's balance.[11]

Warning signs that the human enterprise is nearing the end of rapid growth in population and consumption include declines in the amount or availability of productive land,[12] soil,[13] fresh water,[14] and biodiversity,[15] all of which are crucial elements of natural capital essential for sustaining civilization and especially agricultural production.[16]

Impacts on the Biosphere

The most critical aspect of the human predicament is the degree to which human activities are modifying the biosphere and increasingly disrupting the functioning of ecosystems.[17] The result is a progressive loss of crucial ecosystem services that sustain civilization. The loss of populations and species of other organisms that are involved in supplying these services has been accelerating as human activities alter or demolish more and more natural habitats and overharvest living resources. Tropical forest destruction continues throughout much of the developing world.[18] The annihilation of oceanic fisheries has come to public attention as stock after stock has been overfished[19] and much of the physical/biological infrastructure that supports the fisheries is destroyed. People are now using over half of the reasonably accessible freshwater runoff,[20] and some 43 percent of Earth's vegetated land surface has lost some portion of its capacity to supply humanity with benefits—causing overall about a 10-percent reduction in potential productivity.[21]

Human activities are even interfering significantly with the global cycles of physical elements. They have approximately doubled the natural rate by which nitrogen is added to the terrestrial nitrogen cycle, potentially impairing soil fertility, accelerating losses of biodiversity, contributing to acid deposition, and enhancing the greenhouse effect.[22] A fundamental but indirect indicator of humanity's impacts is that it is already consuming, coopting or has destroyed more than 40 percent of terrestrial net primary production—the food supply of all animals, not just people.[23] Most disturbing, ecosystem services that are essential for maintaining agricultural production, such as replenishing soil fertility, pollination and natural pest control,[24] are faltering in many areas.

Lagging food production is probably the most significant symptom of ecosystem deterioration. Following a spectacular rise in production before 1980, the global grain harvest has failed since 1984 to keep pace with population growth. The green revolution, along with opening of some new land, a dramatic expansion of irrigation and other favorable factors, boosted grain production by more than 73 percent from 1960 to 1980, while the population expanded by 46 percent. But from 1980 to 1998, grain production increases barely equaled the population's growth of 32 percent. In 1984, grain production reached its per-capita peak, and since then has fluctuated below that level.

Cereal grains comprise the human feeding base and, by weight, amount to roughly half of all foodstuffs produced by agriculture. Grain harvests thus are the best indicator of food supplies and availability, although economic factors and changes in eating habits are also significant. Since about 40 percent of the world grain harvest is used for feeding livestock, shortages

can be partly offset by reducing the use of cereals as feed. Similarly, reduced demand for animal products can lower pressures on grain stocks. Although such shifts have occurred in recent years, averting serious shortages and price rises, the overall trend in food production has been increasingly problematic.

The reasons are many and vary from area to area, but among those of rising importance is land degradation. Rich agricultural soils, normally formed at rates of centimeters per century, are being eroded away in many areas at rates of tens of centimeters per decade.[25] Faulty irrigation has often led to serious degradation as soils accumulate salts or become waterlogged. Little suitable land remains to open for farming, while increasing amounts are taken out of production because of productivity losses and urban sprawl.

The rising dependence on irrigation coincides with diminishing new sources of water. Chronic or episodic shortages of water supplies exist in many areas of the world, including the Middle East, northern China and India, and such shortages seem bound to become more acute as populations expand. In many regions, "fossil" freshwater deposits, accumulated underground over thousands of years during glacial periods, are being "mined." Aquifers are being drained at rates many times higher than they can be recharged, often compromising their freshwater holding capacity in the process. Becoming dependent on such largely irreplaceable sources of water, especially for such nonessential purposes as irrigating low-value forage crops in arid regions, is both shortsighted and risky.[26]

Fisheries yields tell an even more dismal story. Some two-thirds of the world's major fisheries are being maximally harvested today or are in decline.[27] While overall yields have continued to increase slightly, on a per-capita basis the fisheries harvest reached a peak in 1988 and has remained below that level since then. The chief cause of the declines in major fish stocks is overharvesting, although more systemic environmental damage has played a role through pollution and modification of estuaries and coral reefs as well as destruction of mangrove fringes and coastal wetlands. Anadromous fish such as salmon have suffered from dammed rivers and oversilting from bank erosion. Aquaculture (fish farming) harvests have largely offset declines in traditional fisheries, but at the cost of displacing natural fish populations and causing serious environmental problems. Fish farming also increasingly depends on feed grains and other agricultural products to support production, thus competing, along with livestock, with food production for human beings.

Perhaps the most serious environmental problem is depletion of biological capital. Microorganisms, plants, and other animals are being exterminated at a rate unprecedented in 65-million years—roughly 10,000 times faster than the stock can be replaced.[28] Much of Earth's natural habitat has disappeared under cities, towns, highways, railways, crop fields, pastures and tree plantations. Habitat alteration—which, along with overexploitation of economically valuable species, is the engine driving the current surge of extinctions—can take place in subtle, easily overlooked ways, much less obvious than paving over or plowing under natural ecosystems. Logging, grazing, introducing exotic species, using pesticides and exterminating particular species each can have profound effects on an ecosystem, even though it may superficially appear unchanged.

Those vanishing organisms are working parts of our life-support systems. If we destroy

them, the price will be a catastrophic decline in the carrying capacity of Earth for human beings. Natural ecosystems provide vital life-support functions of cleansing, recycling and renewal, upon which the economy is utterly dependent. These essential ecosystem services include amelioration of climate and weather, generation and maintenance of soil structure and fertility, recycling of nutrients, moderation of the hydrological cycle that supplies rainfall and surface water, pollination of crops, disposal of wastes and toxins, control of more than 95 percent of potential crop pests, and maintaining a vast natural library of biodiversity. That library is the source of ecosystem goods[29] such as timber and food from the sea; the harvesting and trading of both are familiar and important components of the human economy. It also provides innumerable other potential and actual ecosystem goods ranging from medicines to the genetic material essential for developing crop varieties that are resistant to pests and diseases and able to cope with varying conditions, such as climate change and soil salinity.

In the past decade or so, perhaps the most dramatic evidence that humanity is disrupting the biosphere is anthropogenic climate change. The 1995 report of the scientific committee of the Intergovernmental Panel on Climate Change (IPCC) cautiously stated that the warming measured over the last century "is unlikely to be entirely natural in origin... the balance of evidence suggests that there is a discernable human influence on global climate."[30] Despite a determined campaign of denial by certain elements of industry and a handful of dissident scientists,[31] it has become increasingly clear that the IPCC was correct. Top atmospheric scientists wrote: "warming trends of both the surface and troposphere are now sufficiently clear that the issue should no longer be whether global warming is occurring, but what is the rate of warming."[32] Many suspicious signs of rapid change in the climate have emerged, from an increased frequency of extreme weather events in North America[33] and South Asia to a seeming meltdown in Alaska where glaciers are in rapid retreat. There, in addition, long-standing permafrost is dissolving and widespread forest death is occurring, caused by interacting stresses from permafrost soils being converted to swamps and newly abundant insect pests attacking already weakened trees.[34] Parallel changes have been seen in other northern polar regions and Antarctica.

Toxification of Earth

When global toxification (including releases of persistent organochlorine compounds such as DDT and long-lived radioactive fallout from nuclear weapons tests) is considered, every square inch of Earth's surface, land and sea, has been "significantly altered."[35] Toxic substances are generally viewed as threats to individuals, not to societies. They have not ordinarily been seen as posing the same sort of threat to the future as do essentially irreversible environmental impacts, such as land degradation, the loss of biodiversity and climate change. While cancer deaths and disabilities from toxic exposures surely are tragedies for individuals and families, collapses of agricultural and natural ecosystems could be tragic for entire societies. Nonetheless, globally distributed toxins (for instance, some chlorinated hydrocarbons such as DDT breakdown products, endosulfan and PCBs)[36] unquestionably can kill or injure many kinds of wildlife and seriously disrupt the functioning of natural ecosystems.[37]

Now evidence is mounting of serious effects on wildlife and human health from the

release of hormone-mimicking synthetic organic chemicals, although demonstrating the causal links is difficult.[38] Some synthetic chemicals have molecular structures similar to naturally occurring hormones, and in ways both subtle and insidious, may affect normal development in both animals and human beings.[39] These hormone-mimicking chemicals may pose a major threat to humanity, both directly and indirectly. Directly, they may be causing or exacerbating reproductive disorders, including infertility, and triggering behavioral changes in some people, potentially causing a variety of social problems. The indirect threats arise from the disruptive effects of these chemicals on wildlife and ecosystems.

Social Vulnerability

Any and all of the foregoing negative trends can induce social disruption or be exacerbated by it. For example, many changes associated with economic development and global change potentially could reduce health security. The human epidemiological environment is affected by population growth, increased mobility, settlement of new areas and nutritional status. Modernization and loss of indigenous medicinal knowledge, microbial evolution of antibiotic resistance, land conversion and biodiversity loss, agricultural intensification, stratospheric ozone depletion, and climate change are all trends that may enhance human vulnerability to major epidemics of infectious diseases. The potential for a serious pandemic to destabilize social and political arrangements should be obvious. A case in point is AIDS. Although its acute stages are delayed, its victims are usually people in their prime productive and reproductive years. The result can be a population dependent on aging adults struggling to support their orphaned grandchildren. Rapidly lethal diseases such as those caused by Marburg, Ebola or Hanta viruses could wreak havoc in vulnerable populations, especially those lacking good medical facilities. And the resurgence of dreaded diseases, such as tuberculosis and malaria as pathogens increasingly develop resistance to chemicals deployed against them, is a real cause for worry.

Land degradation itself, combined with poverty and inequity, can lead to social problems as large portions of rural populations are forced off the land, sometimes generating major migrations. Hunger and extreme poverty are well-known destabilizing factors. Deforestation and desertification increase people's vulnerability to extreme weather events, as witness the tragic consequences of hurricane Mitch. No one knows how much of Mitch's intensity can be ascribed to global warming, although it may well have been significant. But there is no doubt that previous deforestation and marginalization of much of the population had left them highly vulnerable to disaster.

Rapid population growth itself can significantly hinder the processes of modernization and economic development, just as poverty and illiteracy are known to hinder the adoption of family planning practices. And gross inequities, as well as resource scarcities, surely undermine social stability within and between societies, as witness the role of freshwater scarcity in generating tensions in the Middle East. Water management issues also are producing problems in China, as the Three Forks Dam construction forces millions of people to be relocated.

Seeking Answers

Given the enormous scale and continuing expansion of the human enterprise today, all three factors—population growth, consumption and technology (including socioeconomic and political arrangements)—must be altered if civilization is to become sustainable. The key issue in judging overpopulation is not how many people can fit in any given space, but whether the population's requirements for food, water, materials, energy and ecosystem services can be met on a sustainable basis. Most of the land perceived by urbanized individuals as "empty" either grows the food essential to peoples' well-being, or supplies forestry products, or, lacking water, good soil, and a suitable climate, cannot directly contribute much to the support of civilization. Thus, the Netherlands, Singapore, Japan and England *can be affluent and crowded with people only because the rest of the world is not.* The Netherlands, for example, imports large amounts of food[40] and extracts from other parts of the world much of the energy and virtually all of the materials it requires. It uses an estimated 17 times more land for food and energy than exists within its borders.[41]

Through ingenuity and invention, it is possible to enlarge Earth's human carrying capacity, as indeed has happened in the past—the agricultural and industrial revolutions were changes that led to quantum jumps in carrying capacity. Tomorrow, widespread behavioral changes, such as shifts to more vegetable-based diets, conservation of resources and restoration of natural ecosystems, could enlarge Earth's carrying capacity for human beings in a short time as well. Assuming full cooperation in the needed changes, it might be possible to support today's population of 6 billion in reasonable comfort for some time (that is, assuming no further population growth). But most people in today's rich nations are unlikely to embrace spontaneously a lifestyle of "voluntary simplicity" just to increase global carrying capacity. How many Japanese or Americans would choose to adjust their lifestyles radically to live, say, like today's Chinese, so that more Africans, South Asians or South Americans could be adequately supported? How many Chinese would give up their dreams of American-style affluence for the same reason? It certainly seems unlikely, since the current trend among those who can afford it is toward increased affluence and consumption, which tends to *decrease* carrying capacity and intensify the degree of overpopulation.

Finding Answers

Thirty years ago, finding ways to slow population growth was near the top of the environmental science community's agenda. It is now realized that finding ways to curb runaway consumption may be even more difficult. Economic, political and institutional constraints make it very difficult to establish desirable changes in the mix of technologies used to supply the consumption. Obviously, keeping global warming to tolerable levels, as well as reducing other problems arising from air pollution, will require a major shift away from dependence on fossil fuels as energy sources in modern economies. Yet this is strongly resisted by economically powerful corporations that supply the fuels and others whose products, such as automobiles, are designed to use them. Similarly, chemical and plastics manufacturers and users actively resist efforts to reduce human exposure to hormone-mimicking synthetic organic chemicals.[42]

Indeed, the only major global success in the technological arena in the last decade or so

has been implementation of the 1987 Montreal Ozone Protocol to phase out chlorofluorocarbons because of depletion of the stratospheric ozone shield. Achieving that was relatively simple since a "smoking gun" appeared in the form of the Antarctic ozone hole and the relatively few corporations involved could make even bigger profits manufacturing substitutes. Limiting the flux of greenhouse gases from energy consumption, deforestation and agriculture will be more difficult by orders of magnitude.

Still, one heartening change has been the rapidly growing cooperation of economists and ecologists in efforts to find policy instruments to help preserve humanity's natural capital.[43] While the trend can be traced back to early efforts by economist Herman Daly, the last decade has seen an explosion of activity. At Stanford University, regular seminars now bring together economists, ecologists, engineers, professors of law and business, and others to discuss the environmental dimensions of the human predicament. The Beijer Institute of Ecological Economics has conducted an active program of discussion and research in this area and produced a series of important publications bringing the two disciplines together.[44]

A result has been a growing realization among natural and social scientists that we cannot depend on working with governments alone to solve the growing environmental crisis. Instead, the emphasis is shifting to recruiting the business community into the struggle to achieve a sustainable society. Although the process has just begun, encouraging signs have appeared, such as the Natural Step program, begun by Dr. Karl-Henrick Robert in Sweden, and the writings of businessmen Paul Hawken and Stephan Schmidheiny.[45] Some businesses have already demonstrated that it is possible to make more money operating in a manner that is ecologically sound than by ignoring environmental impacts. One outstanding example is *Interface*, a company that (under the leadership of CEO Ray Anderson) supplies commercial carpeting on a rental basis. When the carpet is worn, *Interface* replaces it and completely recycles the old material rather than stuffing it into a landfill. The company is enormously successful, grossing more than $1 billion annually. Through such examples, other corporations may learn that they can do well while doing good.

Converting business to a powerful force for environmental quality is a huge task, but even that cannot solve our predicament as long as the scale of the human enterprise continues to grow. People must become involved in solving local and regional environmental problems and in encouraging their governments to cooperate more in seeking ways to reduce the size of the enterprise. Business leaders have both heavy responsibilities and great opportunities in these areas—and they have a great deal of expertise in putting theory into practice. They and their children and grandchildren are fully as dependent for their lives on the services provided by natural ecosystems as everyone else. And perhaps more than anyone else, they are experts in the critical area of consumption and able to find ways to curb the growth of society's energy use and material throughput.

Technological change, such as substituting electronic communication for travel and environmentally more benign energy sources for the dominant fossil-fuel technologies of today, can help. But changes in family sizes, infrastructural arrangements, lifestyle, and human aspirations and attitudes are also needed. The human predicament cannot be solved without the cooperation of a substantial portion of the human population. To gain that cooperation, more

equity is desperately needed; solving the problems of racism, sexism, religious prejudice and gross economic inequity are part and parcel of solving the predicament. The business community has the political power to lead the transition to a sustainable global society; one with a smaller population supplied with both necessities and some luxuries. I urge businessmen everywhere to learn about the current environmental situation and then accept the challenge. And scientists, politicians and ordinary citizens should do the same. Nothing less is at stake than the fate of human civilization.

The most important take-home messages of this talk are:

- The environmental crisis is increasingly severe, and there may not be much time left to prevent a disastrous end to it.
- Population growth must be reversed, overconsumption must be constrained, and more environmentally benign technologies must be deployed.
- Greater efforts must be made to improve the epidemiological environment.
- Much more attention must be paid to developing and deploying sustainable agriculture and restoring oceanic fisheries.
- To accomplish the needed tasks, more attention should be paid to issues that lie within the purview of the social sciences. Natural scientists already know in what directions society must go. But developing the critical social, political and institutional reforms to move society to sustainability will require innovation on the part of economists, political scientists, legal scholars and others.
- People must not only change their behaviour toward the environment in order to solve the human predicament, they must change their behaviour toward one another.

References

1 J.P. Holdren, 1991, Population and the Energy Problem. *Population and Environment* 12:231-235, and personal communication (1998).

2 J. Holdren and P. Ehrlich, 1974, Human Population and the Global Environment, *American Scientist* 62:282-292; P. Ehrlich and A. Ehrlich, 1990, *The Population Explosion*, Simon and Schuster, New York.

3 G.C. Daily, A.H. Ehrlich, and P.R. Ehrlich, 1994, Optimum Human Population Size. *Population and Environment* 15: 469-475.

4 P.R. Ehrlich, et al., 1997, No Middle Way on the Environment. *The Atlantic Monthly* 280 (6): 98-104.

5 World Resources Institute, 1998, *World Resources* 1998-99, Oxford University Press, Oxford.

6 G. Daily and P. Ehrlich, 1996. Socioeconomic Equity, Sustainability, and Earth's Carrying Capacity. *Ecological Applications* 6(4): 991-1001.

7 Holdren, 1991.

8 G. Daily and P. Ehrlich, 1992. Population, Sustainability, and Earth's Carrying Capacity. *BioScience* 42: 761-771.

9 W. Catton, 1980, *Overshoot: The Ecological Basis of Revolutionary Change*, University of Illinois Press, Urbana IL.

10 Ehrlich and Ehrlich, 1990. See Chapter 2 and the references in it.

11 For a fine overview of some of the critical trends, see R. Naylor, 1996. Energy and Resource Constraints on Intensive Agricultural Production, *Annual Review of Energy*; and N. Myers, 1995, *Ultimate Security: The Environmental Basis of Political Stability*, W.W. Norton, New York.

12 See, e.g., H. Colby, F. Crook, and S.-E. Webb, 1992, Agricultural Statistics of the People's Republic of China, 1949-1990, *Statistical Bulletin* no. 844, U.S. Department of Agriculture, Washington D.C.; M. Imhoff et al., 1986. Monsoon Flood Boundary Delineation and Damage Assessment Using Space-Borne Imaging Radar and Landsat Data, *Photogrammatic Engineering and Remote Sensing* 53:405-413. See also pp. 171-180 of Ehrlich, Ehrlich, and Daily, 1995.

13 For an overview, see chapter 6 of P. Ehrlich, A. Ehrlich, and G. Daily, 1995, *The Stork and the Plow*, Putnam, New York.

14 E.g., P. Gleick (ed.), 1993. *Water in Crisis*, Oxford University Press, New York, and 1998. *The World's Water*, Island Press, Washington DC; M. Reisner, 1986. *Cadillac Desert*, Viking, New York; S. Postel, 1990. Water for Agriculture: Facing the Limits, *Worldwatch Paper* 93, Worldwatch Institute, Washington D.C.; S. Postel, G. Daily, and P. Ehrlich, 1996, Human Appropriation of Renewable Fresh Water, *Science* 271:785-788.

15 Ehrlich, Ehrlich, and Holdren, 1977, chapters 3, 4, 6, and 11; N. Myers, 1979, *The Sinking Ark*, Pergamon Press, New York; P. Ehrlich and A. Ehrlich, 1981, *Extinction: The Causes and Consequences of the Disappearance of Species*, Random House, New York; E. Wilson (ed.), 1988, *Biodiversity*, National Academy Press, Washington, D.C.; P. Ehrlich and E. Wilson, 1991, Biodiversity Studies: Science and Policy, *Science* 253:758-762; E. Wilson, 1992, *The Diversity of Life*, Harvard University Press, Cambridge, MA; J. Lawton and R. May (eds.), 1995, *Extinction Rates*, Oxford University Press, Oxford; S. Pimm, G. Russell, J. Gittleman, T. Brooks, 1995, The future of Biodiversity, *Science* 269:347-350; E. Hoyt, 1988, *Conserving the Wild Relatives of Crops*, IUCN, Gland and Rome; C. Fowler and P. Mooney, 1990, *Shattering: Food, Politics, and the Loss of Genetic Diversity*, University of Arizona Press, Tucson.

16 E.g., L. Oldeman, V. Van Engelen, and J. Pulles, 1990. The Extent of Human-Induced Soil Degradation, Annex 5 of Oldeman et al., World Map of the Status of Human-Induced Soil Degradation An Explanatory Note (rev. 2nd. ed.), International Soil Reference and Information Centre (ISRIC), Waginengen, Netherlands; R. Repetto, 1994, *The "Second India" Revisited: Population, Poverty, and Environmental Stress over Two Decades*, World Resources Institute, Washington DC; G. Daily, 1995, Restoring Value to the World's Degraded Land, *Science* 269:350-354; National Research Council, Committee on the Role of Alternative Farming Methods in Modern Production Agriculture, Board on Agriculture, 1989. *Alternative Agriculture*. National Academy Press, Washington D.C.

17 P. Vitousek, et al., 1997. Human Domination of Earth's Ecosystems. *Science* 277:494-499.

18 N. Myers, 1996, The World's Forests: Problems and Potentials. *Environmental Conservation* 23:156-168.

19 D. Pauly, 1998. Fishing Down Marine Food Webs. *Science* 279:860-863.

20 S. Postel, G. Daily, and P. Ehrlich, 1996. Human Appropriation of Renewable Freshwater. *Science* 271:785-788.

21 Daily, 1995.

22 P. Vitousek, H. Mooney, J. Lubchenco, and J. Melillo, 1997. Human Alteration of the Global Nitrogen Cycle: Sources and Consequences. *Ecological Applications* 7:737-750.

23 P. Vitousek, P. Ehrlich, A. Ehrlich, and P. Matson, 1986, Human Appropriation of the Products of Photosynthesis. *BioScience* 36:368-373.

24 E.g., S. Buchmann and G. Nabhan, 1996, *The Forgotten Pollinators*, Island Press, Washington, DC; G. Nabhan and S. Buchmann, 1997, Services Provided by Pollinators. In G. Daily (ed.), *Nature's Services*, Island Press, Washington, DC, pp. 133-150.

25 Oldeman, et al., 1990; P. Ehrlich, A. Ehrlich, and G. Daily, 1993. Food Security, Population, and Environment. *Population and Development Review* 19:1, pp. 1-32; Daily, 1995.

26 Postel, Daily, and Ehrlich, 1996.

27 Vitousek et al., 1997.

28 Ehrlich, Ehrlich, and Holden, 1977, *Ecoscience; Population, Resources, Environment*, W.H. Freeman & Co., San Francisco; Myers, 1979; Ehrlich and Ehrlich, 1981; Wilson, 1988; Ehrlich and Wilson, 1991; Wilson, 1992; Lawton and May, 1995; Pimm et al., 1995; P. Raven and J. McNeely, 1996, Biological Extinction: Its Scope and Meaning for Life, in L. Guruswamy and J. McNeely (eds.), *Their Seed Preserves: Strategies for Preserving Global Biodiversity*, Duke University Press, Durham, NC. This is a conservative estimate; see, for example, R. May, 1988, How Many Species Are There on Earth? *Science* 241:1448, 16 September.

29 G. Daily, ed., 1997, *Nature's Services: Their Nature and Value*, Island Press, Washington, DC, in press.

30 Intergovernmental Panel on Climate Change (IPCC), 1996. *Climate Change 1995*, Summary for Policymakers, Working Group I, pp. 10-11.

31 Although there has been some genuine scientific debate, much of this campaign has been outright disinformation (see P. Ehrlich and A. Ehrlich, 1996, *Betrayal of Science and Reason: How Anti-environmental Rhetoric Threatens Our Future*, Island Press, Washington, D.C.; R. Gelbspan, 1998. The Heat is On, Perseus Books, Reading, MA. The most recent incident involved the circulation of a fake reprint designed to look like an article that had been published in the *Proceedings of the National Academy of Sciences, U.S.A.*

32 J. Hansen, M. Sato, R. Ruedy, A. Lacis, and J. Glascoe, 1998, Global Climate Data and Models: A Reconciliation. *Science* 281:930-932.

33 T.R. Karl and R.W. Knight, 1998, Secular Trends of Precipitation Amount, Frequency, and Intensity in the U.S.A. *Bulletin of the American Meteorological Society* 79:231-242.

34 W. Stevens, 1998, As Alaska Melts, Scientists Consider the Reasons Why. *New York Times*, 18 August.

35 E.g., S. Simonich and R. Hites, 1995. Global Distribution of Persistent Organochlorine Compounds. *Science* 269:1851-1854.

36 Simonich and Hites, 1995.

37 C. Edwards, 1993. The Impact of Pesticides on the Environment, in D. Pimentel and H. Lehman (eds), *The Pesticide Question: Environment, Ecnomics, and Ethics*, Chapman & Hall, New York, pp. 13-46; T. Colborn and C. Clement (eds.), 1992, *Chemically-Induced Alterations in Sexual and Functional Development: The Wildlife/Human Connection*, Princeton Scientific Publishing, Princeton, N.J., chapters 6-9; for more details and references, see Ehrlich, Ehrlich, and Holdren, 1977, chapters 10 and 11; and Ehrlich and Ehrlich, 1981.

38 E.g., J. Toppari, et al., Male Reproductive Health and Environmental Xenoestrogens. *Environmental Health Perspectives* 104 (suppl. 4):741-803.

39 T. Colborn, J. Myers, and D. Dumanoski, 1996. *Our Stolen Future*, Dutton, New York; see also Colborn and Clements, 1992, especially chapters 14-21.

40 In 1989-91, the Netherlands had average net imports of more than 3-million metric tons of cereals and 800,000 metric tons of pulses (peas and beans, including soybeans); World Resources Institute, 1994. *World Resources* 1994-95, Oxford University Press, New York.

41 M. Wackernagel, 1993, *How Big is our Ecological Footprint? A Handbook for Estimating a Community's Carrying Capacity*, Discussion draft, Task Force on Planning Healthy and Sustainable Communities, University of British Columbia, Department of Family Practice, Mather Building, 5804 Fairview Avenue, Vancouver B.C., Canada, V6T 1Z3, 15 July. The Netherlands' "ecological footprint" or "appropriated carrying capacity" is defined as "the aggregate land (and water) area in various categories required by the people in a region a) to provide continuously all the resources they presently consume, and b) to absorb continuously all the waste they presently discharge, using current technology" (p. 10).

42 A steady flow of recent information has made ever more pertinent the 1996 warning of Colborn, Dumanoski, and Myers in *Our Stolen Future*.

43 P. Ehrlich, 1997, World of Wounds: *Ecologists and the Human Dilemma*, Ecology Institute, Oldendorf/Luhe, Germany, Chapter 5.

44 E.g., K. Arrow, et al., 1995, Economic Growth, Carrying Capacity, and the Environment. *Science* 268:520-521.

45 P. Hawken, 1993, *The Ecology of Commerce: A Declaration of Sustainability*, Harper Collins, New York; S. Schmidheiny, 1992, *Changing Course: A Global Business Perspective on Development and the Environment*, MIT Press, Cambridge, MA.

Major Publications

Dr. Paul R. Ehrlich

Books

Ehrlich, P.R. and A.H. Ehrlich. *How to Know the Butterflies*. Dubuque, Iowa: Wm. C. Brown, 1961.

Ehrlich, P.R. and R.W. Holm. *The Process of Evolution*. N.Y.: McGraw-Hill, 1963. Second Edition, 1974.

Ehrlich, P.R. *The Population Bomb*. N.Y.: A Sierra Club-Ballantine Book, 1968. Revised Edition, 1978.

Ehrlich, P.R., R.W. Holm and K.B. Armitage. *Principles of Modern Biology* (nine volumes). Palo Alto: Behavioral Research Laboratories, 1968.

Ehrlich, P.R., R.W. Holm and P.H. Raven, ed. *Papers on Evolution*. Boston: Little, Brown, 1969.

Ehrlich, P.R. and A.H. Ehrlich. *Population, Resources, Environment: Issues in Human Ecology*. San Francisco: W.H. Freeman, 1970. Revised edition, 1972.

Ehrlich, P.R. and R.L. Harriman. *How to Be a Survivor: A Plan to Save Spaceship Earth*. N.Y.: Ballantine Books, 1971.

Ehrlich, P.R. and J.P. Holdren, ed. *Global Ecology: Readings Toward a Rational Strategy for Man*. N.Y.: Harcourt, Brace and Jovanovitch, 1971.

Ehrlich, P.R., J.P. Holdren and R.W. Holm. *Man and the Ecosphere*. (Readings from *Scientific American*). San Francisco: W.H. Freeman, 1971.

Ehrlich, P.R., A.H. Ehrlich and J.P. Holdren. *Human Ecology: Problems and Solutions*. San Francisco: W.H. Freeman, 1973

Ehrlich, P.R., R.W. Holm and M. Soule. *Introductory Biology*. N.Y.: McGraw-Hill, 1973.

Ehrlich, P.R. and D.C. Pirages. *Ark II: Social Response to Environmental Imperatives*. N.Y.: Viking Press, 1974.

Ehrlich, P.R., R.W. Holm and P.C. Hanawalt, ed. *Biocore*. N.Y.: McGraw-Hill, 1974.

Ehrlich, P.R. and A.H. Ehrlich. *The End of Affluence: A Blueprint for Your Future*. N.Y.: Ballantine Books, 1974.

Ehrlich, P.R., R.H. Holm and I.L. Brown. *Biology and Society*. McGraw-Hill, 1976.

Ehrlich, P.R. and S. Feldman. *The Race Bomb*. N.Y.: Quadrangle Books, 1977.

Ehrlich, P.R., A.H. Ehrlich and J.P. Holdren. *Ecoscience: Population, Resources, Environment*. San Francisco: W.H. Freeman, 1977.

Ehrlich, P.R., H. Daly and J. Doyen. *Introduction to Insect Biology and Diversity*. N.Y.: McGraw-Hill, 1978.

Ehrlich, P.R. and S. Feldman. *The Race Bomb*. N.Y.: Ballantine Books, Paperback edition, 1978.

Ehrlich, P.R., L. Bilderback and A.H. Ehrlich. *The Golden Door: International Migration, Mexico, and the United States*. N.Y.: Ballantine Books, 1979.

Ehrlich, P.R. and A.H. Ehrlich. *Extinction: The Causes and Consequences of the Disappearance of Species*. N.Y.: Random House, 1981.

Ehrlich, P.R., C. Sagan, D. Kennedy and W.O. Roberts. *The Cold and the Dark: The World after Nuclear War*. N.Y.: W.W. Norton, 1984.

Ehrlich, P.R. *The Machinery of Nature*. N.Y.: Simon and Schuster, 1986.

Ehrlich, P.R. and A.H. Ehrlich. *Earth*. Methuen, London and N.Y.:Franklin Watts, 1987.

Ehrlich, P.R. and J. Roughgarden. *The Science of Ecology*. N.Y.: MacMillan, 1987.

Ehrlich, P.R. and Robert Ornstein. *New World/New Mind: Moving toward Conscious Evolution*. N.Y.: Doubleday, 1989.

Ehrlich, P.R. and A.H. Ehrlich. *The Population Explosion*. N.Y.: Simon and Schuster, 1990.

—. *Healing the Planet*. N.Y.: Addison-Wesley, 1991.

Ehrlich, P.R., Denis A. Saunders, and Richard J. Hobbs. *Repairing a Damaged World: An Outline for Ecological Restoration.* Australia: Surrey Beatty & Sons, 1993.
Ehrlich, P.R. and A.H. Ehrlich. *Extinction.* (Japanese edition with new introduction). 1993. Translation rights arranged through Japan UNI Agency Inc.
Ehrlich, P.R., Denis A. Saunders and Richard J. Hobbs. *Nature Conservation 3: Reconstruction of Fragmented Ecosystems.* Australia: Surrey Beatty & Sons, 1993.
Ehrlich, P.R., David S. Dobkin, Darryl Wheye, et al. *A Guide to the Natural History of the Birds of St. Lawrence Island, Alaska.* Center for Conservation Biology, 1993.
Ehrlich, P.R., David S. Dobkin, Darryl Wheye, and Stuart L. Pimm. *The Birdwatcher's Handbook: A Guide to the Natural History of the Birds of Britain and Europe.* Oxford Univ. Press, 1994.
Ehrlich, P.R., A.H. Ehrlich and Gretchen C. Daily. *The Stork & the Plow.* N.Y.: Putnam Publishing, 1995.
Ehrlich, P.R., Donald Kennedy, David Holloway, et al. *Environmental Quality and Regional Conflict: A Report to the Carnegie Commission on Preventing Deadly Conflict,* December 1998. N.Y.: Carnegie Corporation, 1998.

Chapters in Books

Ehrlich, P.R. "Butterflies." *Collier's Encyclopedia,* Vol. 4, 274, et seq. 1958.
—. "Lepidoptera." In *McGraw-Hill Encyclopedia of Science and Technology,* 459–473. 1960.
—. "Integumental Anatomy." (reprint) In *The Monarch Butterfly,* by F.A. Urquhart, 215–242. Univ. of Toronto Press. 1960.
Ehrlich, P.R. and R.W. Holm. "A Biological View of Race." In *The Concept of Race. Ed.* Ashley Montague. Free Press of Glencoe, 1964.
Ehrlich, P.R. "Population and Environment." In *Toward Century 2l, Technology, Society and Human Values.* Ed. C.S.Wallia, 53–63. N.Y.: Basic Books, 1970.
—. "Population Control or Hobson's Choice." In *Optimum Population for Britain.* Ed. L.R. Taylor, 151–174. Inst. of Biology Symposium No. 19. London & N.Y.: Academic Press, 1970.
Ehrlich, P.R. and R.L. Harriman. "Primer on Population Growth and Ecology." Part I of *Population Monograph.* Oct. Medcom, 1971.
Ehrlich, P.R. and A.H. Ehrlich. "Population Growth and the Future of Man." *The l971 Compton Yearbook.* Encyclopaedia Brittanica, 1971.
—. "Population Crisis and Plans to Limit Population Growth." *1971 Brittanica Book of the Year.* Chicago: Encyclopaedia Brittanica, 1971.
Ehrlich, P.R. and J.P. Holdren "An Inventory of Disaster." In *Ecocide...and Thoughts Survival.* Ed. Clifton Fadiman and Jean White. Center for Study of Democratic Institutions, 1971.
Ehrlich, P.R. "The Population Crisis: Where We Stand." In *Population, Environment and People.* Ed. Noel Hinriche. The Council on Population and Environment. N.Y.: McGraw-Hill Paperbacks, 1971.
Ehrlich, P.R. and J.P. Holdren "Population and Environment." In *The American Population Debate.* Ed. Daniel Callahan. Doubleday, Garden City: Anchor Books, 1971.
Ehrlich, P.R. "Warnings." In *Environmental Solutions.* Ed. Nicholas Pole. Cambridge, England: Cambridge Univ. Conservation Society, *EcoPublications,* 1972.
—. "Impact of Population Growth." In *Population, Resources, and the Environment.* Ed. Ronald G. Ridker. Vol. III of Commission Research Reports (U.S. Commission on Population Growth and the American Future), Washington, D.C., 1972.
Ehrlich, P.R. and R.W. Holm. "Evolution." *Biocore,* Unit 23 (1974), 1–32.
Ehrlich, P.R. and A.H. Ehrlich. "Between Man and Environment: The Delicate Balance." In *Health in a Changing World. Ed.* P.M. Insel and W.T. Roth. San Francisco: W.H. Freeman, 1974.
Ehrlich, P.R. "The Strategy of Conservation, 1980–2000." Chap. 19, In *Conservation Biology: An Evolutionary-Ecological Perspective.* Ed. Michael Soule and Bruce Wilcox. 329–344. Sunderland,

Mass: Sinauer Associates, 1980.
—. "Diversity and the Steady State." In *Quest for a Sustainable Society*. Ed. James C. Coomer. N.Y.: Pergamon Press, 1981.
Ehrlich, P.R. and A.H. Ehrlich. "What Happened to the Population Bomb?" In *The Social World*. Ed. Ian Robertson. N.Y.: Worth Publishers, 1981.
Ehrlich, P.R. "When the Light is Put Away: Ecological Effects of Nuclear War." In *The Counterfeit Ark: Crisis Relocation for Nuclear War*. Ed. J. Leaning and L. Keyes. Cambridge, MA: Ballinger, 1983.
—. "Genetics and the Extinction of Butterfly Populations." In *Genetics and Conservation: A Reference for Managing Wild Animal and Plant Populations*. Ed. C. M. Schonewald Cox, S. M. Chambers, B. MacBryde, and L. Thomas. 152–163. Benjamin/Cummings, 1983.
—. "The Structure and Dynamics of Butterfly Populations." In *The Biology of Butterflies*. Ed. R.I. Vane-Wright and P.R. Ackery. 11:25–40. Symposium of the British Ent. Soc., 1984.
—. "The Ecology of Nuclear War: Population, Resources, and Environment." In *Nuclear Weapons and the Future of Humanity*. Ed. A. Cohen and S. Lee. Totowa, NJ: Rowman and Allanheld, 1986.
—. Extinctions and Ecosystem Functions: Implications for Humankind." In *Animal Extinctions: What Everyone Should Know*. Ed. R.J. Hoage. 159–173. Washington: Smithsonian Institution Press, 1986.
—. "Why We Should Worry about the Extinction of Other Species." In *Environmental Challenges: Learning for Tomorrow's World*. Ed. P.F. Wilkinson and M. Wyman. London, Ontario: Althouse Press, 1986.
Ehrlich, P.R. and D.D. Murphy. "Monitoring Populations on Remnants of Native Vegetation." In *Nature Conservation: The Role of Remnants of Native Vegetation*. Ed. D.A. Saunders, G.W. Arnold, A.A. Burbidge and A.J.M. Hopkins. 201–10. Australia: Surrey Beatty & Sons, 1987.
Ehrlich, P.R. "The Ecology of Nuclear War, Chapter 10." In *The Cassandra Conference*. Ed. P.R. Ehrlich and J.P. Holdren. Texas A&M Univ. Press, College Station, 1988.
—. "Populations of People and Other Living Things." In *Earth `88, Changing Geographic Perspectives*, 302–315. 1988 National Geographic Society, 1989.
Ehrlich, P.R. and D.D. Murphy. "The Conservation Biology of California's Remnant Native Grasslands." In *Grassland Structure and Function: California Annual Grassland*. Ed. L.F. Huenneke and H.A. Mooney. 201–211. Dordrecht, Netherlands: Kluwer Academic Publishers, 1989.
Ehrlich, P.R. "Discussion: Ecology and Resource Management—Is Ecological Theory Any Good in Practice?" In *Perspectives in Ecological Theory*. Ed. J.Roughgarden, R.M. May, and S.A. Levin. 306–318. Princeton Univ. Press, 1989.
—. "The Attributes of Invaders and Invasion Processes: Vertebrates." In *Biological Invasions, A Global Perspective, SCOPE 37*. Ed. H.A. Mooney and J.A. Drake. 315–328. 1989.
—. "The Global Commons and National Security." In *Climate and Geo-Sciences: A Challenge for Science and Society in the 21st Century*. Ed. A. Berger, et al. 553–562. Kluwer Academic Publishers, 1989.
Ehrlich, P.R. and G. Daily, A. H. Ehrlich, P. Matson, P. Vitousek. "Global Change and Carrying Capacity: Implications for Life on Earth." In *Global Change and Our Common Future; Papers from a Forum*. Ed. R. Defries and T. Malone. 19–27. National Research Council, 1989.
Ehrlich, P.R. and A. H. Ehrlich. "Population and the Greenhouse Warming." In *Greenhouse Glasnost: The Crisis of Global Warming*. Ed. Terrell J. Minger. 167–180. The Ecco Press, 1990.
Ehrlich, P.R., Barbara Bocek, Nona Chiariello, et al. "Jasper Ridge, A Stanford Sanctuary," Ed. Susan Wels. Stanford, California: Stanford Alumni Association, 1990.
Ehrlich, P.R. and A. H. Erhlich. "Population Control: Necessary but Insufficient." In *The Mother Earth Handbook*. Ed. Judith S. Scherff. 17–31. N.Y.: Continuum Publishing, 1991.

Ehrlich, P.R. "Can We Respond to the Growing Environmental Threat to Civilization?" In *Environment in Peril*. Ed. Anthony B. Wolbarst. 110–139. Washington: Smithsonian Institution Press, 1992.
Ehrlich, P.R. and A. H. Ehrlich. "The Most Overpopulated Nation." In *Elephants in the Volkswagen: Facing the Tough Questions about Our Overcrowded Country*. Ed. Lindsay Grant. 125–33. N.Y.: W. H. Freeman, 1992.
Ehrlich, P.R., A.H. Ehrlich and G.C. Daily. "Population, Ecosystem Services, and the Human Food Supply." *Morrison Institute for Population and Resource Studies*. Paper No. 0044. Stanford Univ., 1992.
Ehrlich, P.R. and G.C. Daily. "Population, Sustainability, and Earth's Carrying Capacity." *Morrison Institute for Population and Resource Studies*. Paper No. 0046. Stanford Univ., 1992.
Ehrlich, P.R. and A. H. Ehrlich. "Causes and Consequences of the Disappearance of Biodiversity." In *Mexico Confronts the Challenges of Biodiversity*, Comision Nacional para El Conocimiento y Uso de La Biodiversidad, Mexico, 1992. Ed. Jose Sarukhan and Rodolfo Dirzo. 43–55. 1992.
—. "Ecosystem Risks Associated with the Population Explosion." In *Predicting Ecosystem Risk*. Ed. John Cairns, Jr., B.R. Niederlehner, and David R. Orvos. 9–21. Princeton Scientific Publishing, 1992.
Ehrlich, P.R., D.A. Saunders and R.J. Hobbs. "Reconstruction of Fragmented Ecosystems: Problems and Possibilities." In *Nature Conservation 3: Reconstruction of Fragmented Ecosystems*. Ed. D.A. Saunders, R.J. Hobbs, and P.R. Ehrlich. 305–313. Australia: Surrey Beatty & Sons, 1993.
Ehrlich, P.R., N. Myers and A.H. Ehrlich. "The Human Population Problem: As Explosive as Ever?" In *Surviving with the Biosphere*. Ed. N. Polunin and J. Burnett, 1993. 270–281. Edinburgh, UK: Edinburgh Univ. Press, 1994.
Ehrlich, P.R. "Ecological Economics." In *World Affairs Journal: A Compendium*, 1993. 108–116. Los Angeles World Affairs Council, 1994.
—. "Ecological Economics and the Carrying Capacity of Earth." In *Investing in Natural Capital*. Ed. AnnMari Jansson, Monica Hammer, Carl Folke and Robert Costanza. 38–56. Washington, D.C.: Island Press, 1994.
—. "Human Population Growth and Global Change." In *Ecological and Social Dimensions of Global Change*. Ed. D.D. Caron, F.S. Chapin III, J. Donoghue, M. Firestone, J. Harte, L.E. Wells and R. Stewardson. 119–146. Berkeley: Inst. of Itnl. Studies, 1994.
—. "The Scale of the Human Enterprise and Biodiversity Loss." In *Extinction Rates*. Ed. John H. Lawton and Robert M. May. 214–226. Oxford Univ. Press, 1995.
Ehrlich, P.R.and Gretchen C. Daily. "It is Imperative to Estimate the Earth's 'Carrying Capacity.'" In *Population: Opposing Viewpoints*. Ed. Charles F. Hohm. 82–89. Greenhaven Press, 1995.
Ehrlich, P.R., John P. Holdren and Gretchen C. Daily. "The Meaning of Sustainability: Biogeophysical Aspects." In *Defining and Measuring Sustainability*. Ed. M. Munasinghe and W. Shearer. 3–17. N.Y.: United Nations Univ., 1995.
Ehrlich, P.R., A. H. Ehrlich. "Growing beyond Our Limits." In *Scientific American: Triumph of Discovery*, 181–183. N.Y.: Henry Holt, 1995.
Ehrlich, P.R., Fraser D.M. Smith and Gretchen C. Daily. "Human Population Dynamics and Biodiversity Loss." In *The Economics and Ecology of Biodiversity Decline: The Forces Driving Global Change*. Ed. Timothy M. Swanson. 125–141. 1995 Cambridge Univ. Press, 1996.
Ehrlich, P.R. and Harold A. Mooney. "Ecosystem Services: A Fragmentary History." In *Nature's Services: Societal Dependence on Natural Ecosystems*. Ed. Gretchen C. Daily. 11–19. Washington, D.C.: Island Press, 1997.
Ehrlich, P.R. and Rosamond L. Naylor. "Natural Pest Control Services and Agriculture." In *Nature's Services: Societal Dependence on Natural Ecosystems*. Ed. Gretchen C. Daily. 151–174. Washington, D.C.: Island Press, 1997.
Ehrlich, P.R. "A World of Wounds: Ecologists and the Human Dilemma." In *Excellence in Ecology*. Ed.

O. Kinne. Germany: Ecology Institute, 1997.
Ehrlich, P.R. and A.H. Ehrlich. "The Value of Biodiversity." In *The Economics of Transnational Commons*. Ed. Partha Dasgupta, Karl-Goran Maler and Alessandro Vercelli. 97–117. N.Y.: Clarendon Press Oxford, 1997.
Ehrlich, P.R. "A Prime Canadian Natural Resource Lost at Sea." Rev. of "Lament for an Ocean: The Collapse of the Atlantic Cod Fishery," by Michael Harris. Ontario, Canada: McClelland & Stewart, 1998. In *The San Francisco Chronicle*, Jan. 3, 1999, Book Review, 1999, 7.
Ehrlich, P.R., G. Daily, P. Dasgupta, et al. "Food Production, Population Growth, and the Environment." *Beijer Reprint Series*, No. 103. Beijer Intl. Institute of Ecological Economics, The Royal Swedish Academy of Sciences, 1999.
Ehrlich, P.R. and Susan E. Alexander. "Population and the Environment." In *Earth Systems: Processes and Issues*. Ed. W.G. Ernst. 329–345. Cambridge Univ. Press, 2000.
Ehrlich, P.R., Jennifer B. Hughes and Gretchen C. Daily. "The Loss of Population Diversity and Why It Matters." In *Nature and Human Society: The Quest for a Sustainable World*. Ed. Peter H. Raven and Tania Williams. 71–83. National Academy Press, 2000.
Ehrlich, P.R. and Claire Kremen. "Human Effects on Ecosystems, Overview." In *Encyclopedia of Biodiversity*, Volume 3. Ed. Simon Asher Levin. 383–393. Academic Press, 2000.
Ehrlich, P.R. "La sistemática y la conservacifin de la biodiversidad." In *Enfoques Contemporáneos para el Estudio de la Biodiversidad*. Ed. Héctor M. Hernández, Algonso N. García Aldrete, Fernanco Álvarez, Miguel Ulloa. 381–400. Instituto de Biología, Universidad Nacional Autónama de México, 2001.

Articles

Ehrlich, P.R. "Field Notes on the Eye Colors of the Colias Eurythem-Philodice Complex; The Parasitization of Danaus Plexippus and the Use of "Flyways" by Papilio Glaucus." *Lepidopterists' News*, 2 (1948), 92.
Ehrlich, P.R. and N.W. Gillham. "A New Atrytone from Nebraska (Lepidoptera: Hesperio-idea)." *Entomological News*, 62 (1951), 188–189.
Ehrlich, P.R. Rev. of "A Field Guide to the Butterflies of North America, East of the Great Plains," by Alexander B. Klots. *Entomological News*, 63 (1952), 26–27.
—. "The Distribution and Subspeciation of Erebia Rossii Curtis (Lepidoptera: Satyridae)." *Transactions of the American Entomological Society*, 78 (1952), 75–88.
—. "A New Subspecies of Erebia Epipsodea Butler (Lepidoptera: Satyridae)." *Entomological News*, 63 (1952), 225–231.
Ehrlich, P.R. and N.W. Gillham. "The Butterfly Types of Henry Skinner and Co-Authors in the Academy of Natural Sciences of Philadelphia (Lepidoptera: Papilionoidea and Hesperioidea)." *Transactions of the American Entomological Society*, 80 (1954), 91–117.
—. "The Naming of Subspecies in Lepidoptera." *Lepidopterists' News*, 8 (1954), 100.
Ehrlich, P.R. "Notes on Erebia Rossii Curtis (Lepidoptera: Satyridae)." *Entomological News*, 65 (1954), 225–227.
—. "Ecological Observations on Erebia (Lepidoptera: Satyridae) in Northwestern America." *Entomological News*, 67 (1956), 29–35.
—. "The Use of the Leitz 'Ultropak' Microscope for Studying the Scales of Lepidoptera *In Situ.*" *Lepidopterists' News*, 10 (1956), 160.
—. "Systematists and Subspecies." *Lepidopterists' News*, 11 (1957), 4–5, 155–157.
—. "Lepidoptera Collected in the Tundra-Taiga Ecotone at Kotzebue, Alaska." *Entomological News*, 69 (1958), 17–20.
—. "The Higher Systematics of the Butterflies." *Lepidopterists' News*, 11 (1958), 103–106.

Ehrlich, P.R. and J.H. Camin. "Natural Selection in Water Snakes (Natrix Sipedon L.) on Islands in Lake Erie." *Evolution*, 12 (1958), 504–511.
Ehrlich, P.R. Rev. of "Insect Migration," by C.B. Williams. *Science*, 129 (1959), 205–206.
—. "A Note on the Systematic Position of the Butterfly Genus Calinaga (Nymphalidae)." *Lepidopterists' News*, 12 (1959), 5–6, 173.
—. Rev. of "The World of Insects," by Paul Pesson; "Grassblade Jungle," by Nesta Pain; "Collecting, Preserving and Studying Insects," by Harold Oldroyd. *Science*, 130 (1959), 261.
—. "Problems of Higher Classification." *Systematic Zoology*, 7 (1959), 180–184.
Ehrlich, P.R. and J.H. Camin. "A Cage for Maintaining Stock Colonies of Parasitic Mites and Their Hosts." *Journal of Parasitology*, 46 (1960), 109–111.
—. "Natural Selection in Middle Island Water Snakes (Natrix Sipedon L.)." Evolution, 14 (1960), 136.
Ehrlich, P.R. "The Integumental Anatomy of the Silver-Spotted Skipper, Epargyreus Clarus Cramer (Lepidoptera: Hesperiidae)." *Microentomology*, 24 (1960), 1–23.
—. "A New Subgenus and Species of Callophrys (s.l.) from the Southwestern United States (Lepidoptera: Lycaeni dae)." *Entomological News*, 71 (1960), 137–141.
Ehrlich, P.R. and E. Munroe. "Harmonization of Concepts of Higher Classification of the Papilionidae." *Journal of the Lepidopterists' Society*, 14 (1960), 169–175.
Ehrlich, P.R. and S.E. Davidson. "The Internal Anatomy of the Monarch Butterfly, Danaus Plexippus L." (Lepidoptera: Nymphalidae). *Microentomology*, 24 (1961), 85–133.
—. "Techniques for Capture-Recapture Studies of Lepidoptera Populations." *Journal of the Lepidopterists' Society*, 14 (1961), 227–229.
Ehrlich, P.R. "Intrinsic Barriers to Dispersal in the Checkerspot Butterfly Euphydryas Editha." *Science*, 134 (1961), 108–109.
—. "The Comparative Morphology of the Male Reproductive System of the Butterflies (Lepidoptera: Papilionoidea). I. Some Nearctic Species." *Microentomology*, 24 (1961), 135–166.
—. "Systematics in 1970: Some Unpopular Predictions." *Systematic Zoology*, 10 (1961), 157–158.
—. "Has the Biological Species Concept Outlived its Usefulness?" *Systematic Zoology*, 10 (1961), 167–176.
Ehrlich, P.R. and A.H. Ehrlich. "The Head Musculature of the Butterflies (Lepidoptera: Papilionoidea)." *Microentomology*, 25 (1962), 1–89.
Ehrlich, P.R. and R.W. Holm. "Patterns and Populations." *Science*, 137 (1962), 652–657.
Ehrlich, P.R. "A Biting Midge Ectoparasitic on Arizonal Lycaenids." *Journal of the Lepidopterists' Society*, 16 (1962), 20–22.
Ehrlich, P.R. and R.W. Holm. "Reply to Amadon." *Science*, 138 (1962), 734.
—. "Reply to Webster." *Science*, 139 (1962), 238–242.
Ehrlich, P.R. and A.H. Ehrlich. "The Thoracic and Basal Abdominal Musculature of the Butterflies (Lepidoptera:Papilionoidea)." *Microentomology*, 25 (1963), 91–126.
Ehrlich, P.R. "Some Axioms of Taxonomy." *Systematic Zoology*, 13 (1964), 109–123.
Ehrlich, P.R. and P.H. Raven. "Butterflies and Plants: A Study in Coevolution." *Evolution*, 18 (1965), 586–608.
Ehrlich, P.R. Rev. of "Phenetic and Phylogenetic Classification, A Symposium." Ed. V.H. Heywood. London: The Systematic Association. In *Evolution*, 19 (1965), 363–364.
—. "1984." *Chemistry*, 38 (1965), 12–17.
—. "The Population Biology of the Butterfly, Euphydryas Editha. II. The Structure of the Jasper Ridge Colony." *Evolution*, 19 (1965), 327–336.
Ehrlich, P.R. and L.G. Mason. "The Population Biology of the Butterfly, Euphydryas Editha. III. Selection and the Phenetics of the Jasper Ridge Colony." *Evolution*, 20 (1966), 165–173.
Ehrlich, P.R. and L.C. Birch. "The Balance of Nature" and "Population Control." *The American Naturalist*, 101 (1967), 97–107.

Ehrlich, P.R. and L.C. Birch. "Evolutionary History and Population Biology." *Nature*, 214 (1967), 349–352.
Ehrlich, P.R. and P.H. Raven. "Butterflies and Plants." *Scientific American*, 216 (1967), 104–113.
Ehrlich, P.R and L.C. Birch. "Evolutionary History and Taxonomy." *Systematic Zoology*, 1 (1967), 282–285.
Ehrlich, P.R. "Paying the Piper." *New Scientist*, 36 (575) (1967), 652–655.
Ehrlich, P.R. and A.H. Ehrlich. "The Phenetic Relationships of the Butterflies. I. Adult Taxonomy and the Nonspecificity Hypothesis." *Systematic Zoology*, 16 (1967), 301–317.
Ehrlich, P.R. "World Population: How Many People and What Kind of Life?" *Stanford Today*, Series 1, No. 22 (1968), 2–7, Winter.
—. "The Coming Famine." *Natural History*, 77 (5) (1968), 6–15.
Ehrlich, P.R. and H.R. Hulett. Rev. of "The Limits of Man," by Hugh Nicol. Constable. *New Scientist*, 38 (1968), 426–427.
Ehrlich, P.R. "The Population Explosion: Fact or Fiction?" *Sierra Club Bulletin*, October 1968.
Ehrlich, P.R. and D.E. Breedlove. "Plant-Herbivore Coevolution: Lycaenids and Lupines." *Science*, 162 (1968), 671–672.
Ehrlich, P.R., L.E. Gilbert and P.H. Raven. (Letter) "More on Forest Defoliation." *Science*, 161 (1968), 964–965.
Ehrlich, P.R. (Letter) "Encyclical Protest." Signed by Paul Ehrlich, Ernest Mayr and Jeffrey W. Baker. *BioScience*, 19 (1969), 400.
—. "Population, Food, and Environment: Is the Battle Lost?" *The Biologist*, 51 (1969), 8–19.
Ehrlich, P.R. and P.H. Raven. "Differentiation of Populations." *Science*, 165 (1969), 1228–1232.
Ehrlich, P.R. and J.P. Holdren. "Population and Panaceas: A Technological Perspective." *BioScience*, 19 (1969), 1065–1971.
Ehrlich, P.R. and P.F. Brussard. "Population Structure of Erebia Epipsodea. I. Population Structure." *Ecology*, 51 (1970), 119–129.
Ehrlich, P.R. Rev. of "Seeds of Change: The Green Revolution and Development in the 1970s," by Lester R. Brown. Praeger Publishers. *Natural History*, 79 (1970), 77–78.
—. "People Pollution." *Audubon*, 72 (1970), 4–9.
Ehrlich, P.R. and P.F. Brussard. "Contrasting Population Biology of Two Species of Butterfly." *Nature*, 227 (1970), 91–92.
Ehrlich, P.R. "A Note on the Systematic Position of Papilio Antimachus." *Journal of the Lepidopterists' Society*, 24 (3), Aug. (1970).
Ehrlich, P.R. and L.E. Gilbert. "The Affinities of the Ithomiinae and the Satyrinae (Nymphalidae)." *Journal of the Lepidopterists' Society*, 24 (4), Nov. (1970).
Ehrlich, P.R. "Man is the Endangered Species." *National Wildlife*, April—May, 8:3 (1970), 38–39.
—. "We're Standing on the Edge of the Earth." *National Wildlife*, 8:6 (1970), 16.
Ehrlich, P.R. and P. Brussard. "Adult Behavior and Population Structure in Erebia Epipsodea." *Ecology*, 51 (1970), 880–886.
Ehrlich, P.R. and A.H. Ehrlich. "Lassa Fever: 1970–1972." *Australian Natural History*, Dec. (1970), 437–441.
Ehrlich, P.R. and J.P. Holdren. "Impact of Population Growth." *Science*, 171 (1971), 1212–1217.
Ehrlich, P.R. and M.C. Singer. "Butterfly Feeding on Lycopsid." *Science*, 172 (1971), 1341–1342.
Ehrlich, P.R., D.E. Breedlove, P.F. Brussard and M.A. Sharpe. "Weather and the 'Regulation' of Subalpine Populations." *Ecology*, 53 (1972), 243–247.
Ehrlich, P.R. (Editorial) "Is the Tide Turning?" *BioScience*, 22 (1972), 277.
—. "One-Dimensional Ecology." *The Ecologist*, Aug. (1972), 11–21.
Ehrlich, P.R. and D.E. Breedlove. "Coevolution: Patterns of Legume Predation by a Lycaenid Butterfly." *Oecologia*, 10 (1972), 99–104.

Ehrlich, P.R. and A.H. Ehrlich. "Wing-Shape and Adult Resources in Lycaenids." *Journal of the Lepidopterists' Society*, 26 (1972), 195–197.
Ehrlich, P.R. Intro. to "Blueprint for Survival," by the editors of *The Ecologist*. Boston: Houghton Mifflin, 1972.
Ehrlich, P.R. and A.H. Ehrlich. "Coevolution: Heterotypic Schooling in Caribbean Reef Fishes." *The American Naturalist*, 107, Jan–Feb (1973), 157–160.
Ehrlich, P.R., D.E. Breedlove and A.J. Beattie. "The Ecology of the Pollinators and Predators of Frasera Speciosa." *Ecology*, 54 (1973), 81–91.
Ehrlich, P.R. and L. Gilbert. "The Population Structure and Dynamics of a Tropical Butterfly, Heliconius Ethilla." *Biotropica*, 5 (2) (1973), 69–82.
Ehrlich, P.R., P. Dolinger, W.L. Fitch and D.E. Breedlove. "Alkaloid and Predation Patterns in Colorado Lupine Populations." *Oecologia* (Berl.), 13 (1973), 191–204.
Ehrlich, P.R. "Human Populations and the Global Environment." Prepared for the United Nations Symposium on Population, Resources, and Environment. Stockholm: September 24–October 5, 1973.
—. "How Long can the Planet Support Us?" *International Wildlife*, 4 (2), March–April (1974), 21–23.
Ehrlich, P.R. and J.P. Holdren. "Human Population and the Global Environment." *American Scientist*, 62, May–June (1974), 282–292.
Ehrlich, P.R. and A.H. Ehrlich. "Ehrlich's Guide to the Apocalypse: Food." *The CoEvolution Quarterly*, Summer (1974), 21–41.
Ehrlich, P.R. "Human Population and Environmental Problems." *Environmental Conservation*, 1 (1974), 15–20.
Ehrlich, P.R., M. Sharp and D. Parks. "Plant Resources and Butterfly Habitat Selection." *Ecology*, 55 (1974), 870–875.
Ehrlich, P.R., P.F. Brussard and M.C. Singer. "Adult Movements and Population Structure in Euphydryas Editha." *Evolution*, 28 (3) (1974), 408–415.
Ehrlich, P.R., R.R. White, M.C. Singer, et al. "Checkerspot Butterflies: A Historical Perspective." *Science*, 188 (1975), 221–228.
Ehrlich, P.R., S.W. McKechnie and R.R. White. "Population Genetics of Euphydryas Butterflies. I. Genetic Variation and the Neutrality Hypothesis." *Genetics*, 81 (1975), 571–594.
Ehrlich, P.R. and J.P. Holdren. "Eight Thousand Million People by the Year 2010?" *Environmental Conservation*, 2 (4) (1975), 241–242.
Ehrlich, P.R. "The Benefits of Saying Yes!" *Bulletin of the Atomic Scientists*, 31 (6) (1975), 23–51.
—. "Human Population and the Global Environment." Prepared for the United Nations Symposium on Population Resources and Environment. In Vol. II, The Population Debate: Dimensions and Perspectives. (Papers of the World Population Conference, Bucharest, l974. UN Dept. Economic and Social Affairs, Population Studies, No. 57). U.N., N.Y., 1975.
—. "Papilio Xuthus (Papilionidae) in Hawaii." *Journal of the Lepidopterists' Society*, 30 (2), 12 July (1976), 149–50.
Ehrlich, P.R. and A.H. Ehrlich. "The World Food Problem: No Room for Complacency." *Social Science Quarterly*, 57 (2) (1976).
Ehrlich, P.R. and J.P. Holdren. (Editorial) "Eight Thousand Million by the Year 2000." *The Ecologist*, London: 6 (4) (1976).
Ehrlich, P.R., R.D. Schrier, M.J. Cullenward, and R.R. White. "The Structure and Genetics of a Montane Population of the Checkerspot Butterfly, Chlosyne Palla." *Oecologia* (Berl.), 25 (1976), 279–289.
Ehrlich, P.R. (Editorial) "Ecologists, Ethics, and the Environment." *BioScience*, 27 (4) (1977), 239.
Ehrlich, P.R. and J.C. Ogden. "The Behavior of Heterotypic Resting Schools of Juvenile Grunts (Pomadasyidae)." *Marine Biology* (1977), 273–280.

Ehrlich, P.R. and A.H. Ehrlich. (Letter) "Reply to Petersen." *Social Science Quarterly*, Vol. 58, No. 2 (1977), 330–331.
Ehrlich, P.R. Rev. of "The Limits of Altruism. An Ecologist's View of Survival," by Garrett Hardin. *Human Nature*, Vol. 1, No. 3, 18–21. March 1978.
—. Rev. of "Sociopolitical Aspects of Biology." *Biology as a Social Weapon*. Ed. Ann Arbor Science for the People Editorial Collective. Minneapolis: Burgess Publishing. *BioScience*, Vol. 28, No. 6 (1978), 404.
—. "Population Biology: Bicentennial Assessment." Rev. of "*Changing Scenes in Natural Sciences*" 1776–1976." *Science*, 201 (1978), 898–899.
—. Rev. of "Steady State Economics," by Herman E. Daly. *Human Nature*. 1 (8) (1978), 20–24.
—. "Recombinant DNA, P.R. Ehrlich, and Friends of the Earth." Letter for FOE by P.R. Ehrlich and reply. *CoEvolution Quarterly*, Spring (1978), 24–27.
Ehrlich, P.R. and A. H. Ehrlich. "Comments on Astropollution." *CoEvolution*, Summer 6 (1978), 1.
Ehrlich, P.R. and J.Camin. "Endocyclic Selection in Natrix." *American Naturalist*, 114: 5 (1979), 747.
Ehrlich, P.R. "Paul R. Ehrlich Considers Silent Spring." *Bulletin of the Atomic Scientists*, 35:8, Oct. (1979), 34–36.
Ehrlich, P.R. and A.H. Ehrlich. "International Year of NO Child?" *Environmental Conservation*, Vol. 6, #1, Spring (1979), 1–2.
Ehrlich, P.R. "Butterflies of Jasper Ridge." *The Coevolution Quarterly*, Summer (1979), 50–55.
Ehrlich, P.R. and A.H. Ehrlich. "What Happened to the Population Bomb?" *Human Nature*, January (1979), 88–92.
Ehrlich, P.R. "Joseph H. Camin." *Journal Kans." Ent. Soc.*, 52:4 (1979), 835–6.
Ehrlich, P.R. and R.R. White. "Colorado Checkerspot Butterflies: Isolation, Neutrality and the Biospecies." *American Naturalist*, 115:3 (1980), 328–341.
Ehrlich, P.R., H.A. Mooney, D.E. Lincoln, and K.S. Williams. "Environmental Controls on the Seasonality of a Drought Deciduous Shrub, Diplacus Aurantiacus, and its Predator, the Checkerspot Butterfly Euphydryas Chalcedona." *Oecologia* (Berl.), 45 (1980), 143–146.
Ehrlich, P.R., J.P. Holdren and A.H. Ehrlich. Response to "Resources, Population, Environment: An Oversupply of False Bad News," by J.L. Simon. *Science*, 210 (1980), 1296–1301.
Ehrlich, P.R., D.D. Murphy, M.C. Singer, et al. "Extinction, Reduction, Stability and Increase: The Responses of Checkerspot Butterfly *(Euphydryas)* Populations to the California Drought." *Oecologia* (Berl.), 46 (1980), 101–115.
Ehrlich, P.R. and D.D. Murphy. "Two California Checkerspot Butterfly Subspecies: One New, One on the Verge of Extinction." *Journal of the Lepidopterists' Society*, 34 (1980), 316–320.
Ehrlich, P.R. and I.L. Brown. "The Population Biology of the Checkerspot Butterfly, Euphydryas Chalcedona." The Structure of the Jasper Ridge Colony. *Oecologia (Berl.)*, 47 (1980), 239–251.
Ehrlich, P.R. "Environmental Disruption: Implications for the Social Sciences. And an Economist in Wonderland." *Social Science Quarterly*, 62:l, March (1981), 7–22; 44–49.
Ehrlich, P.R., G.R.V. Anderson, A.H. Ehrlich, et al. "Community Structure of Coral Reef Fishes." *American Naturalist*, 117 (4) (1981), 476–495.
Ehrlich, P.R. and A.H. Ehrlich. "Extinction or a Strategy of Conservation." *Bulletin of the Atomic Scientists*, June/July (1981), 25–30.
—. "The Politics of Extinction." *Bulletin of the Atomic Scientists*, May (1981), 26–30.
—. "Why Butterflies?" *The Amicus Journal*, 2 (4) (1981), 12:116.
Ehrlich, P.R. and C.E. Holdren. "Long Range Dispersal in Checkerspot Butterflies: Transplant Experiments with E. Gillettii." *Oecologia*, 50 (1981), 125–129.
Ehrlich, P.R., H.A. Mooney and K.S. Williams. "Temporal and Spatial Variability in Interaction between the Checkerspot Butterfly E. Chalcedona and Its Principal Food Source, the California Shrub, Diplacus Aurant Iacus." *Oecologia,* 50 (1981), 195–198.

Ehrlich, P.R. and A.H. Ehrlich. (Editorial) "Dangers of Uninformed Optimism." *Environmental Conservation*, Fall 1981.
Ehrlich, P.R. Rev. of "Overshoot: Ecological Basis of Revolutionary Change," by W.R. Catton, Jr. *American Scientist*, 69 (5) (1981), 559.
Ehrlich, P.R., and Meinwald Eisner, et al. (Letter) "Conservation of Tropical Forests." *Science*, 213 (1981), 1314.
Ehrlich, P.R. "An Ecologist Standing Up among Seated Social Scientists." *CoEvolution Quarterly*, Fall (1981), 24–35.
—. "Human Carrying Capacity, Extinctions, and Nature Reserves." *BioScience*, 32 (5) (1982), 331–333.
Ehrlich, P.R. and A.H. Ehrlich. "Space Age Cargo Cult." *Defenders of Wildlife*, 57 (1) (1982), 2–5.
Ehrlich, P.R., D.E. Lincoln, T.S. Newton, and K.S. Williams. "Coevolution of the Checkerspot Butterfly Euphydryas Chalcedona and Its Larval Food Plant, Diplacus Aurantiacus: Larval Response to Protein and Leaf Resin." *Oecologia (Berl.)*, 52 (1982), 216–223.
Ehrlich, P.R. and Cheryl E. Holdren. "Ecological Determinants of Food Plant Choice in the Checkerspot Butterfly Euphydryas Editha in Colorado." *Oecologia (Berl.)*, 52 (1982), 417–423.
Ehrlich, P.R. Rev. of "World Population and Human Values: A New Reality," by J. Salk and J. Salk. *Bulletin of the Atomic Scientists*, May 2 (1982), 53–54.
Ehrlich, P.R. and A.H. Ehrlich. "Butterfly Retreat: Loss of Habitat Imperils a Growing Number of Species." *Defenders*, April (1982), 21–27.
—. "Social Behavior of Butterfly and Surgeon Fishes on Coral Reefs: Some Mirror Experiments." *Oecologia*, 54 (1982), 138–140.
Ehrlich, P.R. "That's Right—You Should Check It for Yourself." *Social Sciences Quarterly*, 63 (2) (1982), 385–387.
—. "Disarmament: The Lesser Risk." *Bulletin of the Atomic Scientists*, 38 (6) (1982), 7–8.
Ehrlich, P.R. and A.H. Ehrlich. "Coevolution, Drugs, and Pest Control." *Bios.*, 53 (1982), 134–138.
Ehrlich, P.R. and D.D. Murphy. "Butterfly Nomenclature: A Critique." *J. Res. Lepid.*, 20 (1982), 1–11.
Ehrlich, P.R. and A.H. Ehrlich. "Lizard Predation on Tropical Butterflies." *Journal of the Lepidopterists' Society*, 36 (2) (1982), 148–152.
Ehrlich, P.R. Rev. of "The World Environment 1972–1982:" *A Report by the United Nations Environment Programme*. Ed. M. W. Holdgate, M. Kassas, and G. F. White. *BioScience*, 33 (3) (1983), 202.
—. "Down to Earth: Environment and Human Needs." E.P. Eckholm. *BioScience*, 33 (3) (1983), 202.
Ehrlich, P.R., D.D. Murphy and A.E. Launer. "The Role of Adult Feeding in Egg Production and Population Dynamics of the Checkerspot Butterfly Euphydryas Editha." *Oecologia*, 56 (1983), 257–263.
Ehrlich, P.R., K.S. Williams and D.E. Lincoln. "The Coevolution of Euphydryas Chalcedona Butterflies and Their Larval Host Plants. I. Larval Feeding Behavior and Host Plant Chemistry." *Oecologia*, 56 (1983), 3223–3329.
Ehrlich, P.R., K.S. Williams and D.E. Lincoln. "The Coevolution of Euphydryas Chalcedona Butterflies and Their Larval Host Plants. II. Maternal and Host Plant Effects on Larval Growth, Development, and Food-Use Efficiency." *Oecologia*, 56 (1983), 330–335.
Ehrlich, P.R. and H.A. Mooney. "Extinction, Substitution, and Ecosystem Services." *BioScience*, 33 (4) (1983), 248–254.
Ehrlich, P.R. and D.D. Murphy. "Nomenclature, Taxonomy and Evolution." *J. Res. Lep.*, 20 (4) (1983), 199–204.
Ehrlich, P.R. "Summer Butterflies in Dinosaur National Monument." *Journal of the Lepidopterists' Society*, 37 (1) (1983), 91–92.
—. Rev. of "Save Thermosphaeroma Thermophilum!" by S.M. Wells, R. M. Pyle, and N.M. Collins. The IUCN Invertebrate Red Data Book. L. Line and L. and M. Milne, The Audubon Society Book

of Insects. *Natural History*, 92 (10), Oct. (1983), 77–83.
Ehrlich, P.R. and A.H. Ehrlich. (Editorial) "Old Myths Die Hard!" *Environmental Conservation*, 10 (2) (1983), 89–90.
Ehrlich, P.R. "Butterflies and Biospecies." *J. Res. Lepid.*, 21 (4) (1983), 219–225.
Ehrlich, P.R., M.C. Singer and P. J. DeVries. "The Cissia Confusa Species-Group in Costa Rica and Trinidad (Lepidoptera: Satyrinae)." *Zool. J. Linnean Society*, 79 (1983),101–119.
Ehrlich, P.R. and D.D. Murphy. "Butterfly Nomenclature, Stability, and the Role of Obligatory Categories." *S. Zool.*, 32 (1983), 451–453.
Ehrlich, P.R., et al., (Senior author with 19 contributors). "Long-Term Biological Consequences of Nuclear War." *Science*, 222 (4630) (1983), 1293–1300.
Ehrlich, P.R. and D.D. Murphy. "Crows, Bobs, Tits, Elfs, and Pixies: The Phoney 'Common Name' Phenomenon." *J. Res. Lepid.*, 22 (2) (1983), 154–158.
Ehrlich, P.R. "North America after the War." *Natural History*, 93 (3) (1984), 4–8.
—. "Discovering the Ecology of Nuclear War." *The Amicus Journal*, 5 (3) (1984), 42020–42030.
—. Rev. of "Coevolution." Ed. D. J. Futuyma. *Evolution*, 38 (1) (1984), 226–227.
Ehrlich, P.R. and D.D. Murphy. "Biosystematics of the Euphydryas of the Central Great Basin with the Description of a New Subspecies." *J. Res. Lepid.*, 22 (4) (1984), 254–261.
Ehrlich, P.R., D.D. Murphy and M.S. Menninger. "Nectar Sources as a Determinant of Oviposition Host Species in Euphydryas Chalcedona." *Oecologia*, 62 (1984), 269–271.
Ehrlich, P.R. "Nuclear Winter Update for Coevolution Quarterly." *CoEvolution Quarterly*, Summer 1984, 94 (accompanies reprint of Amicus Article).
Ehrlich, P.R. and D.D. Murphy. "On Butterfly Taxonomy." *J. Res. Lepid.*, 23 (1) (1984), 19–34.
Ehrlich, P.R., E.H. Williams and C.E. Holdren. "The Life History and Ecology of Euphydryas Gilletti Barnes (Nymphalidae)." *J. Lepid. Soc.*, 38 (1) (1984), 1–12.
Ehrlich, P.R., N.D. Johnson, C.C. Chu, and H.A. Mooney. "The Seasonal Dynamics of Leaf Resin, Nitrogen, and Herbivore Damage in Eriodictyon Californicum and Their Parallels in Diplacus Aurantiacus." *Oecologia*, 61 (1984), 398–402.
Ehrlich, P.R. "Citation Classic—Butterflies and Plants: A Study in Coevolution." *Evolution*, 18 (1964), 586–608. Current Contents 15 (37) (1984), 16.
Ehrlich, P.R., A. E. Launer and D. D. Murphy. "Can a Sex Ratio Be Defined or Determined? The Case of a Population of Checkerspot Butterflies." *Amer. Natur.*, 124 (4) (1984), 527–539.
Ehrlich, P.R. Rev. of "Biophila: The Human Bond to Other Species," by E. O. Wilson. *Natural History*, Nov. 93 (1984), 92–94.
Ehrlich, P.R., C. Sagan, V. V. Alexandrov, A. S. Pavlov. "Washington Forum on the World-Wide Consequences of Nuclear War." *Disarmament, Autumn*, 7 (3) (1984), 32–72.
Ehrlich, P.R. and D.Wheye. "Some Observations on Spatial Distribution in a Montain Population of Euphydryas Editha." *J. Res. Lep.*, 23 (1984), 243–252.
Ehrlich, P.R. and F. J. Odendaal. "A Migration of Urania Fulgens (Uraniidae) in Costa Rica." *Biotropica*, 17 (1) (1985), 46–49.
Ehrlich, P.R., F.J. Odendaal, and Y. Iwasa. "Duration of Female Availability and Its Effect on Butterfly Mating Systems." *American Naturalist*, 125 (1985), 673–678.
Ehrlich, P.R., N.D. Johnson and S.A. Brain. "The Role of Leaf Resin in the Interaction between Erio Dictyon Californicum (Hydrophyllaceae) and its Herbivore, Trirhabda Diducta (Chrysomelidae)." *Oecologia*, 66 (1985), 106–110.
Ehrlich, P.R. Rev. of "The Resourceful Earth: A Response to 'Global 2000'." Ed. J.L. Simon and H. Kahn. Oxford: Basil Blackwell. *Bulletin of the Atomic Scientists*, February (1985), 44–47.
Ehrlich, P.R., L.E. Mueller, D.D. Murphy, and B.A. Wilcox. "A Direct Assessment of the Role of Genetic Drift in Determining Allele Frequency Variation in Populations of Euphydryas Editha." *Genetics*, 110 (1985), 495–511.

Ehrlich, P.R. "Human Ecology for Introductory Biology Courses: An Overview. Science as a Way of Knowing." *American Zoologist*, 25 (1985), 379–394.
—. "Humankind's War against Homo Sapiens." *Defenders*, Nov.—Dec. (1985), 4–12.
Ehrlich, P.R. and D.D. Murphy. Rev. of "The Audubon Society Handbook for Butterfly Watchers," by R. M. Pyle. N.Y.: S. Charles Scribner's Sons, 1984. *J. Res. Lepid.*, 24 (1985), 381–382.
Ehrlich, P.R. and A.H. Ehrlich. "Invaders." *The Mother Earth News*. Jan—Feb. 97 (1986), 118–120.
Ehrlich, P.R. "Ecological Understanding is Not Free: The Case for Basic Research" Excerpt from *Machinery of Nature*. N.Y.: Simon and Schuster, 1986. *The Amicus Journal*, 7 (1986), 7–8.
Ehrlich, P.R. and A.H. Ehrlich. "World Population Crisis." *Bulletin of the Atomic Scientists*, 42 (1986), 13–19.
Ehrlich, P.R. and D. Wheye. "Non-Adaptive "Hilltopping" Behavior in Male Checkerspot Butterflies (Euphydryas Editha)." *Am. Nat.*, 127 (1986), 447–483.
Ehrlich, P.R. and A.H. Ehrlich. "Needed: An Endangered Humanity Act?" *The Amicus Journal*. Spring (1986), 12–14.
Ehrlich, P.R., B.A. Wilcox, D.D. Murphy and G.T. Austin. "Insular Biogeography of the Montane Butterfly Fauna in the Great Basin: Comparison with Birds and Mammals." *Oecologia*, 69 (1986), 188–194.
Ehrlich, P.R., F.R. Stermitz, D.R. Gardner, and F.J. Odendaal. "Euphydryas Anicia (Lepidoptera: Nymphalidae) Utilization of Iridoid Glycosides from Castilleja and Besseya (Scrophulariaceae) Host Plants." *J. Chemical Ecology*, 12 (1986), 1459–1468.
Ehrlich, P.R., P.M. Vitousek, A.H. Ehrlich and P.A. Matson. "Human Appropriation of the Products of Photosynthesis." *BioScience*, 36 (1986), 368–373.
Ehrlich, P.R., D.D. Murphy, M.S. Menninger, and B.A. Wilcox. "Local Population Dynamics of Adult Butterflies and the Conservation Status of Two Closely Related Species." *Biol. Cons.*, 37 (1986), 201–223.
Ehrlich, P.R. "Paul R. Ehrlich Speaks Out on Population and Health." *Complementary Medicine*, 2 (1986), 25–27.
Ehrlich, P.R. and A.H. Ehrlich. "Population and Development Misunderstood." *The Amicus Journal*, Summer (1986), 8–11.
—. "Chernobyl, Cancer, and Cheating." *The Amicus Journal*. Fall (1986), 16–18.
—. (Letter) "Exhausting Mother Nature." *Wilson Quarterly*, New Year's Issue, 1987.
Ehrlich, P.R., and A.H. Ehrlich, Peter Vitousek and Pamela Matson. (Letter) "How Many Creatures?" *BioScience*, April, Vol. 37, 4 (1987), 246.
Ehrlich, P.R., A.H. Ehrlich and Harold Mooney. (Letter) "Marshall's Article on Nuclear Winter Overlooks Several Critical Points." *Science*, February 20 (1987), 832.
Ehrlich, P.R. and A.H. Ehrlich. "Why Do People Starve?" *The Amicus Journal, Spring*, Vol. 9, No. 2 (1987), 42–47.
Ehrlich, P.R. "Why the Club of Earth?" *Trends in Ecology & Evolution*, May, Vol. 2, No. 5 (11) (1987).
Ehrlich, P.R. and D.D. Murphy. "Conservation Lessons from Long-Term Studies of Checkerspot Butterflies." *Conservation Biology*, Vol. 1, No. 2 (1987), 122–131.
Ehrlich, P.R. "Back to Birding." *American Birds*, 41 (2) (1987), 237–245.
Ehrlich, P.R., S.B. Weiss, R.R. White, and D.D. Murphy "Growth and Dispersal of Larvae of the Checkerspot Butterfly Euphydryas Editha." *Oikos*, 50 (1987), 161–166.
Ehrlich, P.R., D.S. Dobkin and I. Olivieri. "Rainfall and the Interaction of Microclimate with Larval Resources in the Population Dynamics of Checkerspot Butterflies (Euphydryas Editha) Inhabiting Serpentine Grassland." *Oecologia*, 71 (1987), 161–166.
Ehrlich, P.R. and A.H. Ehrlich. "Back from the Abyss." *Sierra*, March—April (1987), 55–60.
Ehrlich, P.R. "Population Biology, Conservation Biology, and the Future of Humanity." *BioScience*, 37:10 (1987), 757–763.

Ehrlich, P.R. and A. H. Ehrlich. Rev. of "The Birth Dearth," by Ben Wattenberg. *The Amicus Journal*, Winter, Vol. 10, No. 1 (1988), 38–40.
Ehrlich, P.R., J.F. Baughman and D.D. Murphy. "Emergence Patterns in Male Checkerspot Butterflies: Testing Theory in the Field." *Theor. Pop. Biol.*, 33 (1988), 102–113.
Ehrlich, P.R. Rev. of "The Preservation of Species: The Value of Biological Diversity," by B.G. Norton. *BioScience*, 38 (1988), 424–425.
Ehrlich, P.R., J.F. Baughman and D.D. Murphy. "Population Structure in a Hilltopping Butterfly." *Oecologia*, 75 (1988), 593–600.
Ehrlich, P.R. and D.D. Murphy. "Plant Chemistry and Host Range in Insect Herbivores." *Ecology*, 69 (1988), 908–909.
Ehrlich, P.R. "Winged Warning." *Sierra*, September/October (1988), 57–61.
Ehrlich, P.R., D.D. Murphy and B.A. Wilcox. "Islands in the Desert." *Natural History*, 97:10, October 1988, 59–64.
Ehrlich, P.R. and D. Wheye. "Hilltopping Checkerspot Butterflies Revisited." *The American Naturalist*, 132 (3), Sep. (1988), 460–461.
Ehrlich, P.R., S. Harrison and D.D. Murphy. "Distribution of the Bay Checkerspot Butterfly, Euphydryas Editha Bayensis: Evidence for a Metapopulation Model." *The American Naturalist*, 132 (3) (1988), 360–382.
Ehrlich, P.R. and Gretchen C. Daily. "Red-Naped Sapsuckers Feeding at Willows: Possible Keystone Herbivores." *American Birds*, Vol. 42, No. 3, Fall (1988).
Ehrlich, P.R. and A.H. Ehrlich. "Population, Plenty, and Poverty." *National Geographic*, Vol. 174, No. 6, December 1988, 914–945.
Ehrlich, P.R., P.F. Brussard, J.F. Baughman, et al. "Complex Population Differentiation in Checkerspot Butterflies (Euphydryas spp.)." *Can. J. Zool.*, 67 (1989), 330–335.
Ehrlich, P.R. "Facing the Habitability Crisis." *BioScience*, Vol. 39, No. 7, July/August (1989), 480–482.
Ehrlich, P.R. "The Mission of AIBS." *BioScience*,. Vol. 39, No. 11, Dec. (1989), 810.
Ehrlich, P.R. and Anne H. Ehrlich. "The Environmental Dimensions of National Security." *Proceedings of the Thirty-Eighth Pugwash Conference on Science and World Affairs*. "Global Problems and Common Security," Dagomys, USSR. 29 August—3 September 1988, 443–455. Also published in *Global Problems and Common Security: Annals of Pugwash 1988*. Ed. J. Rotblat and V.I. Goldanskii. N.Y.: Springer-Verlag, 1989, 180–190.
Ehrlich, P.R. "Population and Environment." *Environmental Awareness*, Vol. 12, No. 3 (1989), 107–109.
Ehrlich, P.R. and A.H. Ehrlich. "The Population Explosion: Why Isn't Everyone as Scared as We Are?" *The Amicus Journal*, Vol. 12, No. 1, Winter (1990), 22–29.
Ehrlich, P.R. "Birding for Fun: Enjoying Being a Non-Expert." *American Birds*, 43:5, Winter 1989 (1990), 1249–1250.
Ehrlich, P.R. and A. H. Ehrlich. "Growing, Growing, Gone." *Sierra*, March/April (1990), 36–40.
—. Rev. of "Global Warming: Entering the Greenhouse Century," by Stephen H. Schneider. *BioScience*, 40 (1990), 305.
Ehrlich, P.R. "Birding for Fun: Garbage Birds." *American Birds*, 44:1, Spring (1990), 7–8.
—. "AIBS Task Force for the '90s." *BioScience*, 40:7, July/August (1990), 527.
—. "Birding for Fun: People vs. Birds." *American Birds*, 44:2, Summer (1990), 193–196.
—. "Habitats in Crisis: Why We Should Care about the Loss of Species." *Forest Ecology and Management*, 35 (1990), 5–11. The Netherlands: Elsevier Science Publishers, Amsterdam.
Ehrlich, P.R. and J.F. Baughman and D.D. Murphy. "A Reexamination of Hilltopping in Euphydryas Editha." *Oecologia*, 83 (1990), 259–260.
Ehrlich, P.R. "Birding for Fun: Evolutionary Theory and Birding." *American Birds*, 44:3, Fall (1990), 353–355.

Ehrlich, P.R., J. Baughman, P. Brussard, and D. Murphy. "History, Selection, Drift, and Gene Flow: Complex Differentiation in Checkerspot Butterflies." *Can. J. Zool.*, Vol. 68 (1990), 1967–1975.
Ehrlich, P.R. and Gretchen C. Daily. "Birding for Fun: Seeking Sapsucker Secrets." *American Birds*, 44:5, Winter 1990 (1991), 1067–1070.
Ehrlich, P.R., Karen Holl and Gretchen Daily. "Integrated Pest Management in Latin America." *Environmental Conservation*, 17:4, Winter 1990. (1991) 341–350.
Ehrlich, P.R., Stuart C. Weiss, Paul M. Rich, et al. "Forest Canopy Structure at Overwintering Monarch Butterfly Sites: Measurements with Hemispherical Photography." *Conservation Biology*, 5:2, June (1991).
Ehrlich, P.R. "Birding for Fun: The Sex Life of Birds." *American Birds*, 45:1, Spring 1991, 21–22.
Ehrlich, P.R., S. Harrison, J.F. Baughman, et al. "Estimating the Effects of Scientific Study on Two Butterfly Populations." *Amer. Nat.*, 137:2, February (1991), 227–243.
Ehrlich, P.R. "Biodiversity and Humanity: Science and Public Policy." *Environmental Awareness*, 14:1, Jan—Mar (1991), 27–35.
—. "Birding for Fun: Sexual Selection." *American Birds*, 45:2, Summer (1991), 200–202.
Ehrlich, P.R. and E. O. Wilson. "Biodiversity Studies: Science and Policy." *Science*, Vol. 253, Aug. 16, 1991, 758–762.
Ehrlich, P.R. (Letter) "Population Diversity and the Future of Ecosystems." *Science*, Vol. 254, October (1991), 175.
—. "Birding for Fun: Displays and Dominance." *American Birds*, 45:3, Fall (1991), 366–368.
Ehrlich, P.R., Gretchen Daily, Harold Mooney and Anne Ehrlich. "Greenhouse Economics: Learn before You Leap." *Ecological Economics*, 4 (1991). Amsterdam: Elsevier Science Publishers 1–10.
Ehrlich, P.R. and A.H. Ehrlich. Readings from "Healing the Planet: Strategies for Solving the Environmental Crisis," Addison-Wesley. *Sierra*, Nov/Dec 1991 (1992), 107–108.
Ehrlich, P.R., G. Daily and D. Wheye. "Determinants of Spatial Distribution in a Population of the Subalpine Butterfly Oeneis Chryxus." *Oecologia*, December 1991, 88:4 (1992), 587–596.
Ehrlich, P.R. "Birding for Fun: Counting Birds." *American Birds*, 45:5, Winter 1991 (1992), 1041–1043.
Ehrlich, P.R. and Peter F. Brussard. "The Challenges of Conservation Biology." *Ecological Applications*, Vol. 2, No. 1, Feb. (1992), 1–2.
Ehrlich, P.R. and A. H. Ehrlich. "Now, If I Ruled the World." *Sierra*, Vol. 77, No. 3, May/June 1992, 118–119.
Ehrlich, P.R. "Population Biology of Checkerspot Butterflies and the Preservation of Global Biodiversity." *Oikos*, 63:1, Copenhagen 1992, 6–12.
—. "Birding for Fun: Birds and the Literature." *American Birds*, 46:1, Spring (1992), 18–20.
—. "Environmental Deterioration, Biodiversity and the Preservation of Civilization." *The Environmentalist*, 12:1 (1992), 9–14.
Ehrlich, P.R. and A. H. Ehrlich. "The Scale of the Human Enterprise: What Should the Earth Summit Accomplish?" *Environmental Awareness*, 15:2, April—June (1992), 73–76.
—. "The Value of Biodiversity." *Ambio.*, 21:3, May (1992), 219–226.
Ehrlich, P.R. "Birding for Fun: Birds in Jeopardy." *American Birds*, 46:2, Summer (1992), 188–192.
Ehrlich, P.R. and A. H. Ehrlich. "Needed: An Endangered Humanity Act?" *The Amicus Journal*, 14:3, Fall (1992), 26–27.
Ehrlich, P.R. "The Professional Biologist: One Ecologist's Opinion on the So-Called Stanford Scandals and Social Responsibility." *BioScience*, 42:9, Oct. (1992), 702–705.
Ehrlich, P.R. and Gretchen C. Daily. "Population, Sustainability, and Earth's Carrying Capacity." *BioScience*, 42:10, Nov. (1992), 761–771.
Ehrlich, P.R. "Birding for Fun: Thoughts on Sparrows." *American Birds*, 46:3, Fall (1992), 354–356.
—. "Birding for Fun: Avian Coevolution." *American Birds*, 45:5, Winter 1992 (1993), 1078–1081.

Ehrlich, P.R. and Gretchen C. Daily. "Population, Extinction and Saving Biodiversity." *Ambio.*, 22:2–3, May (1993), 64–68.
—. "Birding for Fun: Sapsuckers, Swallows, Willow, Aspen, and Rot." *American Birds*, 47:1, Spring (1993), 18–20.
Ehrlich, P.R., Erica Fleishman, John F. Baughman, et al. "The Effect of Fluorescent Pigments on Butterfly Copulation." *Ecological Entomology*, 18:2, May (1993), 165–167.
Ehrlich, P.R. "Birding for Fun: Avian Adaptation." *American Birds*, 47:2, Summer (1993), 195–198.
—. "Is the Extinction Crisis Real?" *Wildlife Conservation*, Sept./Oct. (1993), 66–67.
Ehrlich, P.R. and Gretchen C. Daily. "Birding for Fun: Dominance and Dickey-Bird Dining." *American Birds*, Vol. 47, No. 3, Fall (1993), 343–345.
Ehrlich, P.R. and Gretchen C. Daily. "Science and the Management of Natural Resources." *Ecological Applications*, 3 (4) (1993), 558–560.
Ehrlich, P.R. "Ehrlich on Immigration: Separate Science from Politics." *Audubon Activist*, Nov. (1993), 4.
Ehrlich, P.R., A.E. Launer, D.D. Murphy, et al. "Puddling Behavior by Bay Checkerspot Butterflies (Euphydryas Editha Bayensis)." *J. Res. Lep.*, 32 (1993), 45–52.
Ehrlich, P.R., S. Weiss, D. Murphy, "Adult Emergence Phenology in Checkerspot Butterflies: The Effects of Macroclimate, Topoclimate, and Population History." *Oecologia*, 1993, 96:2 (1994), 261–270.
Ehrlich, P.R. "Birding for Fun: Birds, Butterflies, and Forest Patches." *American Birds*, Winter 1993. (1994), 1044–1046.
Ehrlich, P.R. and M.C. Singer. "Host Specialization of Satyrine Butterflies, and Their Responses to Habitat Fragmentation in Trinidad." *J. Res. Lep.*, 30 (3–4), 1991 (1994), 248–256.
Ehrlich, P.R. "Enhancing the Status of Population Biology." *Trends in Evolution and Ecology*, 9:4, April (1994), 157.
Ehrlich, P.R., Karen D. Holl and Gretchen C. Daily. "The Fertility Plateau in Costa Rica: A Review of Causes and Remedies." *Environmental Conservation*, 20:4, Winter 1993 (1994), 317–323.
Ehrlich, P.R. "Energy Use and Biodiversity Loss." *Philosophical Transactions: Biological Sciences* (The Royal Society), 344 (1994), 99–104.
—. "Population and Sustainable Development." *Environmental Awareness*, 17:2 (1994), 53–58.
Ehrlich, P.R., G.C. Daily and A.H. Ehrlich. "Optimum Human Population Size." *Population and Environment*, 15:6, July (1994), 469–475.
Ehrlich, P.R., H.R. Sparrow, T.D. Sisk, et al. "Techniques and Guidelines for Monitoring Neotropical Butterflies." *Conservation Biology*, 8:3 (1994), 800–809.
Ehrlich, P.R., T.D. Sisk, A.E. Launer, and K.R. Switky. "Identifying Extinction Threats." *BioScience*, 44:9, Oct. (1994), 593–604.
Ehrlich, P.R., J.H. Cushman, C.L. Boggs, et al. "Estimating Female Reproductive Success of a Threatened Butterfly: Influence of Emergence Time and Host Plant Phenology." *Oecologia*, 99 (1994), 194–200.
Ehrlich, P.R. and Gretchen C. Daily. "Influence of Social Status on Individual Foraging and Community Structure in a Bird Guild." *Oecologia*, 100 (1994), 153–165.
Ehrlich, P.R. "Wild Birds are in Jeopardy." Intro. to *Audubon Wild Bird Desk Diary 1995*. N.Y.: Macmillan, 1995, 4 pp.
Ehrlich, P.R., Gretchen C. Daily and Anne H. Ehrlich. "Socioeconomic Equity: A Critical Element in Sustainability." *Ambio.*, 24:1, Feb. (1995), 58–59.
Ehrlich, P.R. and Gretchen C. Daily. "Preservation of Biodiversity in Small Rainforest Patches: Rapid Evaluations Using Butterfly Trapping." *Biodiversity and Conservation*, 4 (1995), 35–55.
Ehrlich, P.R., T. Sisk, A. Launer, and K. Switky. (Letter) "Response to Woodwell." *BioScience*, 45:6 (1995), 380.

Ehrlich, P.R., Gretchen C. Daily and Anne H. Ehrlich. (Letter) Response to Bartlett and Lytwak "Population and Immigration Policy in the United States." *Population and Environment*, 16:6 (1995), 521–526.
Ehrlich, P.R., Lynn E. Dwyer and Dennis D. Murphy. "Property Rights Case Law and the Challenge to the Endangered Species Act." *Conservation Biology*, 9:4 (1995), 725–741.
Ehrlich, P.R. "Call it Brownlash." *World Watch*, Sept./Oct. (1995), 5–6.
Ehrlich, P.R., M.E. Power, D. Tilman, S.T. Carpenter, et al. (Letter) "The Role of Experiments in Ecology." *Science*, Vol. 270, Oct. 27 (1995), 561.
Ehrlich, P.R. and Stephen H. Schneider. "Bets and "Ecofantasies." *Environmental Awareness*, 18:2 (1995), 47–50.
Ehrlich, P.R. "Our Demographic Future: Predictions for the Next 50 Years." *Population Today*, 23:1, Dec. (1995), 3.
Ehrlich, P.R., Karen D. Holl and Gretchen C. Daily. "Knowledge and Perceptions in Costa Rica Regarding Environment, Population, and Biodiversity Issues." *Conservation Biology*, 9:6 (1995), 1548–1558.
Ehrlich, P.R. and Gretchen C. Daily. "Nothing New." *BioScience*, 46:1 (1996), 5.
Ehrlich, P.R., Sandra L. Postel and Gretchen C. Daily. "Human Appropriation of Renewable Fresh Water." *Science*, 297:5250 (1996), 785–788.
Ehrlich, P.R., Gretchen C. Daily and Marina Alberti. "Managing Earth's Life Support Systems: The Game, the Players, and Getting Everyone to Play." *Ecological Applications*, 6 (1) (1996), 19–21.
Ehrlich, P.R. (Letter) "The Business of Butterflies." *Audubon*, 98:3 (1996), 12.
Ehrlich, P.R. and Anne H. Ehrlich. "Biodiversity and the Brownlash." *Defenders*, Fall (1996), 6–17.
Ehrlich, P.R. and Gretchen C. Daily. "Socioeconomic Equity, Sustainability, and Earth's Carrying Capacity." *Ecological Applications*, 6 (4) (1996), 991–1001.
Ehrlich, P.R. "Conservation in Temperate Forests: What Do We Need to Know and Do?" *Forest Ecology and Management*, 85:1–3 (1996), 9–19.
—. "1990: Population Biology and AIBS." *BioScience*, 47:10 (1997), 653–654.
Ehrlich, P.R., Jennifer B. Hughes and Gretchen C. Daily. "Population Diversity: Its Extent and Extinction." *Science*, 278, Oct. 24 (1997), 689–692.
Ehrlich, P.R., Thomas D. Sisk, and Nick M. Haddad. "Bird Assemblages in Patchy Woodlands: Modeling the Effects of Edge and Matrix Habitats." *Ecological Applications*, 7 (4) (1997), 1170–1180.
Ehrlich, P.R., Erica Fleishman, Alan E. Launer. "Effects of Microclimate and Oviposition Timing on Prediapause Larval Survival of the Bay Checkerspot Butterfly, *Euphydryas Editha Bayensis* Lepidoptera:Numphalidae)." *J. Res. Lep.*, 36 (1997), 31–44.
Ehrlich, P.R. and Brian Walker. "Rivets and Redundancy." *BioScience*, May (1998), 387.
Ehrlich, P.R., Gretchen Daily, Partha Dasgupta, Bert Bolin, et al. "Food Production, Population Growth, and the Environment." *Science*, 281:5381 (1998), 1291–1292.
Ehrlich, P.R. and Fakhri Bazzaz, Gerardo Ceballos, Margaret Davis, et al. "Ecological Science and the Human Predicament." *Science*, 282:5390 (1998), 879.
Ehrlich, P.R., E. Fleishman, G.H. Wolff, C.L. Boggs, et al. "Conservation in Practice: Overcoming Obstacles to Implementation." *Conservation Biology*, 13 (1999), 450–452.
Ehrlich, P.R., Karen D. Holl, Gretchen C. Daily. "Knowledge of and Attitudes toward Population Growth and the Environment: University Students in Costa Rica and the United States." *Environmental Conservation*, 26:1 (1999), 66–74.
Ehrlich, P.R. and Gretchen C. Daily. "Managing Earth's Ecosystems: An Interdisciplinary Challenge." *Ecosystems* 2 (1999), 277–280.
Ehrlich, P.R., Gary Wolff, Gretchen C. Daily, Jennifer B. Hughes, et al. "Knowledge and the Environment." *Ecological Economics*, 30 (1999), 267–284.

Ehrlich, P.R. and Harry Recher. "The Essence of Science: The Social Responsibility of Communicating." *Pacific Conservation Biology*, 5:3 (1999), 161–162.
Ehrlich, P.R. (Letter) "Evolution of an Advocate." *Science*, 287, Mar. 24 (2000), 2159.
—. "Donald Kennedy – The Next Editor-in-Chief of Science." *Science*, 288:1349, May (2000).
Ehrlich, P.R., C. Kremen, J.O. Niles, M.G. Dalton, et al. "Economic Incentives for Rain Forest Conservation across Scales." *Science*, 288 (2000), 1828–1832.
Ehrlich, P.R., Gretchen C. Daily, Tore Soderqvest, Sara Aniyar, et al. "The Value of Nature and the Nature of Value." *Science*, 289:21, July (2000), 395–396.
Ehrlich, P.R. and A. H. Ehrlich. "Keeping the Blue Planet Habitable: A Multidisciplinary Challenge." *Environmental Awareness*, 23:2 (2000), 55–68.
Ehrlich, P.R., Jennifer B. Hughes and Gretchen C. Daily. "Conservation of Insect Diversity: A Habitat Approach." *Conservation Biology*, 14:6 (2000), 1788–1797.
Ehrlich, P.R., Gretchen C. Daily and G. Arturo Sánchez-Azofeifa. "Countryside Biogeography: Use of Human-Dominated Habitats by the Avifauna of Southern Costa Rica." *Ecological Applications*, 11 (1) (2001), 1–13.
Ehrlich, P.R. and A. H. Ehrlich. "The United States: Another Leap Backward?" *World Watch*, 14:2 (2001), 5.
Ehrlich, P.R., Patricia Balvanera, Gretchen C. Daily, Taylor H. Ricketts, et al. "Conserving Biodiversity and Ecosystem Services." *Science*, 291:5511, 16 Mar (2001), 2047.
Ehrlich, P.R. and Thomas Eisner. (Editorial) "New World Pathogen Strategy Disclosed." *Science*, Vol. 292, 29 June (2001), 2397.