

Environmental Refugees

by John Cairns, Jr.

Sea level rise, loss of arable land, inadequate water supplies, exceeding local carrying capacity for humans, and a host of other events might easily produce environmental refugees in unprecedented numbers. These events are also likely to destabilize political systems, adding even more refugees. These probable events pose some serious ethical problems that are rarely discussed in public forums. (1) Should countries that contributed to the problem (e.g., global warming) accept a proportionate number of refugees? (2) How can the more fortunate countries assist countries that are highly probable sources of refugees in a mutualistic way? (3) Is sustainable use of the planet possible for any country if environmental refugees are produced in large numbers anywhere on the planet? (4) Can countries with weapons of mass destruction blackmail countries living sustainably when environmental problems become unmanageable? (5) Should processes that limit populations of other species be allowed to keep human population size within regional carrying capacity if the countries producing the refugees refuse to adopt sustainable practices?

It is almost certain that refugees will cause loss of individual freedom in the country of origin and probably in the countries to which they flee. In resource poor areas, survival will be the primary focus. In the "host" countries, resources will be strained, perhaps even leading to rationing and price control.

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Making a Compassionate Decision

Humans become environmental refugees when they have exceeded the carrying capacity of that portion of the planet that supported them. In some cases, the refugees are not the primary cause of the problem (e.g., sea level rise due to global warming). In other cases, they are directly responsible (e.g., exponential population increase). Should these two groups be treated differently? In the case of the population increase, individuals often do not feel responsible since large families are part of their culture. Afghanistan and the Gaza Strip both have high birth rates and poor resource bases, but this is not frequently part of the public discourse. Until this issue is faced, we will be treating symptoms rather than causes.

When countries capable of absorbing environmental refugees are at or beyond their carrying capacity, every individual on the planet becomes a potential environmental refugee with no place to go. How should human society respond to this situation, which may be closer than we think. The human population is increasing, but natural systems are decreasing.

Estimates of the rate of appearance of environmental refugees are extremely difficult to make. However, the precautionary principle requires that, when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically (Raffensperger and Tickner, 1999). A substantial increase, both for compassionate and environmental reasons, in environmental refugees is likely to cause serious harm to both human health and the environment. The threat of disease is abundantly clear, but the potential for physiological and psychological damage also deserves serious consideration.

The vision of a world teeming with environmental refugees is daunting, even for wealthy countries such as the United States.

The estimated 1.2 billion people living on US\$1/day/capita are already at serious risk. Prudence requires extending this to the over 3 billion with only US\$3/day/capita or less. Arguably, even more important is the increasingly stressed condition of Earth's natural systems: collapsing fisheries, shrinking forests, eroding soils, deteriorating rangelands, expanding deserts, rising atmospheric carbon dioxide levels, falling water tables, rising temperatures, more destructive storms, melting glaciers, rising sea levels, dying coral reefs, and biotic impoverishment/ extinction of species (e.g., Brown, 2001). Under these daunting conditions, Earth is expected to support nearly 90 million additional people each year. Since there seems to be no generally acceptable solution to this problem, the question is not whether the number of environmental refugees will increase, but where, when, and at what rate. How should we respond to this impending crisis?

One hopes that we will respond with compassion, but will it be focused on the symptoms or the causes? Cairns (1998) notes that sustainable use of the planet requires compassion for (1) humans presently alive, (2) future generations, and (3) other life forms, present and future, that constitute the planet's ecological life support system. Wildlife managers may have compassion for individual deer but will thin the population when it exceeds the carrying capacity of its environment. One may feel compassion for wild horses and burros but be unaware that they are having significant deleterious effects upon threatened and endangered plants. Multidimensional compassion requires a modest level of environmental literacy but, most important, it requires making some value judgments that we would rather avoid.

Most of the planet's political units, possibly all, are not living sustainably at present. Some countries, especially in Europe, are on the road to sustainability, but accepting large numbers of environmental refugees might delay or block achieving sustainability. This situation would adversely affect the lives of future generations but would be more emotionally acceptable to people now living. Living unsustainably would also adversely affect future generations of humans and other life forms. Attempting to exclude environmental refugees would be repugnant to many individuals and might be exceedingly difficult if their numbers were of epic proportions. Furthermore, attempting to exclude large numbers of

people in an era when bioterrorism is increasingly possible might lead to extremely unfortunate consequences. As Hardin (2001) remarked, human population control places society in what novelist Joseph Heller called a "catch-22" situation: "If a proposal might work, it isn't acceptable; if it is acceptable, it won't work."

The People's Republic of China (PRC) probably has the most realistic solution – the welfare of the group has precedence over individual wishes. The PRC is attempting to keep the human population at a level compatible with what is perceived to be within the country's carrying capacity. Affluent societies view such coercion with horror. But, exceeding the country's carrying capacity will lead to disease, famine, and other equally distasteful conditions, and, although individual reproductive "rights" are severely restricted, the group's survival is not as likely to be endangered. The ethical dilemma is that many humans value individual freedom and cannot bear to stand by while others suffer, even those so geographically remote that we are unlikely to encounter them personally. Many members of human society are also concerned about the fate of other life forms (biophilia) and wish to protect the health and integrity of the interdependent web of life. Last, but far from least, we hope to leave a habitable planet for future generations of our own and those of other species. Doing this is a real challenge.

Sustainability and Carrying Capacity as Ethical Issues

Sustainable use of the planet require that human society not exceed the planet's carrying capacity for *Homo sapiens*. Despite this close relationship, the term *carrying capacity* is not included in the index of *Our Common Future* (The World Commission on Environment and Development, 1987). Perhaps the frequent use of the term *sustainable development* made this connection awkward since *development* is usually associated with growth and sustained growth is not feasible on a finite planet. Of course, growth in quality could theoretically continue indefinitely, but the word *growth* is usually associated with increased abundance of human artifacts (e.g., shopping malls, urban areas, etc.). Sustainable population size is mentioned in *Our Common Future* as well as protecting the environment. It is a paradigm shifting book, but an understanding of carrying capacity is essential to sustainability.

Cohen (1995) analyzes the difficulties in estimating Earth's carrying capacity for humans, which is affected by affluence, life style, etc. Wackernagel and Rees (1996) illustrate how carrying capacity can be increased by reducing the size of the per capita ecological footprint.

Ehrlich and Ehrlich (1970), Grant (1992), Abernethy (1994), Hardin (1993a), Douthwaite (1999), and Smail (1997) feel that we have already exceeded the planet's long-term carrying capacity. One should not get the impression from this long list of citations that they represent the majority view. This idea of exceeding the carrying capacity is definitely a minority view, but it appears to be growing steadily. The majority view, of continual growth and development, is so ubiquitous that it appears to approach a consensus. Publications strongly espousing a contrary view are Simon's part of Myers and Simon (1994), Eberstadt (1997), and Simon (1981). It is well to remember that individuals with strongly held beliefs usually reject contrary evidence and paradigm shifts occur only when the contrary evidence is overwhelming (Kuhn, 1971). Increasing numbers of environmental refugees just might cause a shift from accepting exponential population growth as the norm to a conviction that the world is overpopulated with humans.

If, as seems likely, a paradigm shift does occur toward a belief that the world is overpopulated, this will undoubtedly have a major effect upon the way environmental refugees are regarded. It is exceedingly difficult to predict how people will react to this new awareness. Some illustrative possibilities follow.

(1) Some people will decide that, if they are on the "Titanic" they might as well have a good time since the situation is out of control.

(2) Some societies will concentrate on ways to divert environmental refugees to other countries and to protect their own borders from invasion.

(3) Some societies will treat the symptoms (e.g., providing food and shelter) without getting at the cause (e.g., overpopulation and exceeding the area's carrying capacity).

(4) Some countries producing environmental refugees might try to correct the causes, but this seems unlikely. Correction could occur if aid depends on meeting certain conditions (the World Bank is a good example of this strategy for monetary problems).

(5) Some may try to take over resources of other

countries, as did Germany and Japan during World War II and Iraq during the Gulf War.

(6) Some may attempt to reduce population size through "ethnic cleansing" (i.e., extermination of a subgroup).

(7) Some countries may decide it is in their enlightened self interest to help less fortunate countries with their problems. Since this strategy will require a redirection of resources from their own citizens to those of other countries, there will almost certainly be significant resistance. Even if the plan is accepted, there will undoubtedly be calls for a date beyond which help diminishes or ceases. This time line is likely to be considered unreasonable by the recipient country.

(8) The United Nations should play a major role in addressing the problem, but will need more authority and allocation of resources than it now has.

A folk proverb states "No single raindrop believes it is the cause of a flood." So, the solution must start with increased environmental literacy at the individual level. Leaders at all levels of political organization (up to the United Nations) will need to think beyond their special interests to view the problem at a systems level. Science and technology can provide critical assistance in addressing this problem, but the primary issues are of an ethical and guiding values nature. Arguably, the resolution of the environmental refugee problem should be primarily the responsibility of the world's religions, but the world's religions seem unable to work in harmony; some have serious internal problems as well. If human intelligence was not an evolutionary mistake, the solution depends on reason guided by ethics. The solution is easy to visualize, but exceedingly difficult to implement. Resources must be redistributed to reduce human suffering, but in a way that does not damage the natural environment or make the planet less hospitable for any descendants. Only major, rapid social evolution will make this goal a reality.

A Microcosm of a Probable Future

The country Tuvalu, a collection of nine small, low islands a considerable distance east of Australia, will be abandoned by its inhabitants in the near future. Tuvalu has endured lower level flooding, salt water intrusion of its drinking water supply, and increased coastal erosion as a result of sea level rise. Tropical cyclones (hurricanes) have also increased in the last decade. Although the population is only about 11,000 people, this

number is particularly significant because the entire population must leave (for more details see Earth Policy News-Sea-Level Rise, news@earth-policy.org). The Tuvaluans have requested that New Zealand accept its entire population, although no decision has been reached yet. Wherever they go, it will doubtless be an enormous cultural shock.

The president of the Maldives refers to his country as an “endangered nation” because it is also threatened by sea level rise. Most of the country’s 1,196 tiny islands are barely 2 meters above sea level. Even a one meter rise in sea level would be hazardous in the event of a storm surge. The Maldives has a population of about 311,000 people, a more serious logistical problem than the 11,000 from Tuvalu.

These small island nations have existed for many

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generations, but future generations will be denied this opportunity. In both cases, the carrying capacity for humans will be reduced to zero, and technology will not save them unless it is employed in the global reduction of anthropogenic greenhouse gases.

No substantive discussion has occurred on the issues raised by these two illustrative situations. These two refugee problems are particularly significant because there is literally no place in their own country for the population to go. Arguably, even more significant is that the situation developed because of anthropogenic greenhouse gases whose origin is virtually entirely outside both countries. Since coastal areas are generally heavily populated, the number of people displaced globally could increase by an order of magnitude or more. The time to react through social change may be as little as 50 years. For example, Smedsrud and Furevik (2000) estimate that the Arctic Ocean could be free of ice during summer in 50 years. A free and open exchange of ideas on these critical ethical issues is essential (Brown, 2000).

Sources and Sinks

There is no place on Earth where humans cannot exceed the carrying capacity. The concept of carrying

capacity assumes limits on the number of individuals that can be supported at a particular level of resource consumption or use without damaging the integrity of the ecological life support system, which would then reduce future carrying capacity. However, as Abernethy (2001) notes, the concept of carrying capacity is widely discounted, in part because it varies and is difficult to quantify. Additionally, new technologies may increase carrying capacity. Finally, technological and economic optimists reject evidence that resource limitations on a finite planet exist (e.g., Simon, 1981). However, rejecting evidence that carrying capacity is not unlimited on a finite planet does not free human society from the consequences of bad judgment as the presence of environmental refugees indicates.

Any area of the world substantially below human carrying capacity might act as a “population sink” if accepting a number of environmental refugees did not add enough to the current population size to exceed carrying capacity. The United States was a major sink for environmental refugees from Ireland during the famine that resulted from the failure of the potato crops. The Americas have accepted a sizable number of immigrants over several centuries. In terms of carrying capacity, the method of a population increase is not the focus, but rather total size and per capita demand on resources.

At the beginning of the 20th century, a number of areas might have qualified as population sinks. By the end of the 20th century, with dramatic increases in population and use of resources, arguably there were none. The United States has large numbers of legal and illegal immigrants, but its very large per capita ecological footprint (e.g. Wackernagel and Rees, 1996) ensures that a growing population, if maintaining current per capita levels of resource consumption, would be environmentally ruinous. As a consequence, if the United States continues to accept large numbers of immigrants, it should reduce the size of its per capita ecological footprint.

In order to achieve a sustainable world, environmental and other types of refugees must be considered in a global context. This imperative requires that some estimates of the carrying capacity of each country be determined despite the difficulties in doing so. Because of the possibility of error in such estimates, it would be prudent to include a safety factor, as is included for elevators, bridges, airplanes, and the like. This

methodology will doubtless be fiercely resisted by the proponents of continued growth who rarely accept responsibility for “unforeseen” consequences. It is also abundantly clear that some countries have already exceeded their carrying capacity and can only survive by exporting surplus population.

Since population sinks are exceedingly scarce and may disappear entirely early in the 21st century, it is essential that all countries implement sustainable practices, including population stabilization. Since failure to do so will have adverse effects upon the entire planet, all possible help should be given to all areas of the world that need assistance. Staying within the planet’s carrying capacity is a formidable, seemingly impossible task given the ethnic and religious conflicts, plus terrorism, that appear in the news daily. Were it not for the unthinkable consequences of doing nothing, this would appear to be unacceptably visionary and utopian. However, for those aware of the ecological collapse of other civilizations and the fate of other species that exceeded their carrying capacity, it is clear that nature has a solution to every problem – but not always one benefitting human society. On the ecological stage of the evolutionary theater, those “actors” (i.e., species) who blow their lines do not remain on stage very long.

What If?

In the last half century, many environmental catastrophes progressed from possibilities to probabilities. Arguably some, such as aquifer depletion, global warming, loss of arable land, desertification, extinction of species, deforestation, and habitat loss, are so well documented that only those in severe denial ignore the evidence. Prudence requires asking the question “What happens if these trends continue?” Clearly, loss of agricultural water because of aquifer depletion, loss of arable land including desertification, and global warming will result in a reduction in the global food supply despite the urgent need due to continuing population increase. If the glaciers and ice caps continue melting, low elevation coastal lands and even entire islands will be lost. The ethical problems fall into two categories: (1) ones in which refugees are dislocated as a consequence of cumulative effects of widespread practices (for example, production of greenhouse gases) and (2) ones in which refugees are dislocated as a consequence of regional activities.

Refugees Resulting from Cumulative Effects

Rising sea levels will clearly displace large numbers of people from low lying coastal areas and islands. Since the United States produces approximately 25% of the anthropogenic greenhouse gases, should it be responsible for 25% of the global refugees? This number would reach the millions and possibly tens of millions. Since this issue has not been discussed in the depth required, it seems unlikely that the United States, or any other country, is prepared to accept large numbers of environmental refugees. Yet, in terms of responsibility, those who created the problem should bear a proportionate share of the remedial measures. In an ethical sense, this responsibility represents part of the true cost of producing greenhouse gases not included in current economical models. From an ethical standpoint, lives of many people are being adversely affected by economic practices over which they have little or no control. Ignoring responsibility for the problems created by current economic models is not a defensible position from either an ethical point of view or a holistic economic view.

The refugees from distant countries, such as Bangladesh, could not reach the United States in large numbers without assistance. However, if the United States contributed to the global warming problem that displaced them, surely it has an ethical and moral responsibility to provide some proportionate assistance to environmental refugees. India and Burma, Bangladesh’s two largest neighbors, are unlikely to have the resources to host millions of refugees, especially if the sea level rise is rapid. In addition, global sea level rise will produce environmental refugees in virtually every country with coastal areas.

This situation is remarkably similar to Raspail’s (1975) parable *The Camp of the Saints*, but on a global scale. Raspail asks what is to be done at all levels of human society – global consciousness, governments, societies, and especially individuals. Doing nothing at any level is almost certain to further damage the planet’s ecological life support system since there would be more people on less land. Little has changed since Raspail wrote his superb fictional work except the temporal and spatial spans have markedly increased and the next such event may not be fictional. Human society is no better prepared to either live sustainably or to let starving

refugees die in order to preserve the ecological life support system for future generations, other life forms, or even persons alive at present. Humans still do not agree upon a universal ethos or set of guiding values that might prevent such a tragedy from happening. If the ecological life support system is badly damaged, civilization as we know it will collapse as well. Nevertheless, it is difficult to deny that the world is overpopulated (if billions are living on US\$3/day or less), and the global population is still growing. It is also unlikely that the growing disparity in the size of the ecological footprint, either at the individual or sovereign state level, will be reduced voluntarily. Individualism is much more easily practiced than universalism, although one might attribute racism for the situation Raspail (1975) describes. However, he affirms that the confrontations that result from this situation are neither racist nor racial, but rather simply part of the permanent flow of opposing forces that shape human society. Even if we accept this hypothesis, it does not help us to decide what to do if societal practices result in mass migration. By comparison with the events that could produce millions of environmental refugees, the loss of life and damage to property resulting from the September 11, 2001, terrorist attacks on the United States was trivial. This comparison does not diminish the horror of September 11, but rather puts the potential horror of possible environmental catastrophes in perspective.

Even if refugees are predominately non-violent, they would be desperate. As a consequence, they might be unthinkingly merciless to those perceived as denying them access to food, shelter, and other amenities possessed by the inhabitants of the country to which they have migrated. They are seeking access to the “promised land” and, since their chances of dying are already great, will not let anything get in their way. Nature has a brutal way of dealing with populations of any species that exceeds the carrying capacity of its habitat.

Predictably in *The Camp of the Saints*, political and religious leadership and the news media each view the mass migration narrowly in the light of their own restricted paradigms. This fictional account fits the present world situation even better than when it was written. Apocalyptic visions are particularly hard on liberals and even nations choosing to ignore the future. Optimism is a splendid concept until it requires ignoring the most basic laws of nature. The exuberant optimism of

Simon (1981), asserting that technology and human ingenuity can solve all resource problems may have delayed serious attention to the problem. Hardin’s (1993a,b) superb books provide an excellent discussion of human society’s curious reluctance to question conventional wisdom.

Environmental refugees already exist (some even in boats), but, whatever happens, the basic question will remain – will nature address the consequences of natural capital depletion and exceeding Earth’s carrying capacity or will human society attempt to do so? It is very difficult to determine the best compassionate view. One’s instinct is to feed the starving billions, which may then continue exponential growth and create more starving billions. An alternative compassionate view is to cease unsustainable practices (e.g., infinite growth on a finite planet) so that we will leave a habitable planet for our descendants. Above all, natural capital and the planet’s ecological life support system must be protected. To accomplish this protection, there seems to be no alternative but to live sustainably. Balanced compassion for those presently alive and for their descendants is the easy answer, but is difficult to implement. Still, human society may have sufficient reason and wit to learn to live sustainably and the resolve and courage to avert catastrophe.

Regional Perspective

The image of a world teeming with environmental refugees is daunting, even for wealthy countries such as the United States. If global warming raises the sea level, where should the people from Florida, Louisiana, and other states with inundated coastal areas be relocated? How will internal migration affect immigration policy? Is a class action suit against the producers of large quantities of anthropogenic greenhouse gases likely? If not, will there be an alternative form of compensation for property loss?

In China, the world’s most populous country, a huge dust bowl is developing in the northwest (e.g., Yang and Li, 2000). In India, China, and the United States, water tables are falling rapidly and reducing irrigated agriculture (e.g., International Water Management Institute, 2001). In all of these and similar situations elsewhere in the world, a major debate will be whether to send food to the newly impoverished people or take the people to the food while the stressed area is ecologically rehabilitated, a process that may take decades.

Human societies have survived some horrendous

periods. Europe recovered from the “black death” (bubonic plague). China has managed to persist despite devastating famines. The Union of Soviet Socialist Republics (USSR) recovered from staggering loss of human life, both civilian and military, during World War II. Neither the Civil War nor the Great Depression destroyed the United States. The population of tiny Easter Island endured population losses that may have been as much as two thirds of its total and probably included cannibalism.

Even if the huge loss of human life is ignored, there are persuasive reasons for living sustainably. Arguably, the most compelling reason is that earlier civilizations that collapsed for environmental reasons did so in comparative isolation from the others. Globalization has changed this possibility dramatically, especially with the advent of weapons of mass destruction. Globalization increases the risks to both human society and the planet’s ecological life support system. However, life forms exist in all sorts of odd places, such as thermal vents in the ocean floor. One might reasonably conclude that some life forms will survive regardless of the fate of humans and will be able to manage quite well without humans, as some life forms did for billions of years. Presumably, diversification would then occur as it did following five great extinctions.

A human society that lives sustainably might do so entirely as a matter of enlightened self interest despite considerable benefits to the planet’s ecological life support system and a diverse array of other life forms. Living sustainably might be pleasurable to quite a few humans, perhaps even enough to make sustainable use of the planet possible.

The Lessons of Pearl Harbor and September 11

The United States was both unprepared for and shocked by the Japanese attack on Pearl Harbor on December 7, 1941, and the terrorist attacks on the World Trade Center and the Pentagon on September 11, 2001. The lesson from Pearl Harbor and the September 11 terrorist attacks is that complacency can be dangerous, often fatal. The United States and some other countries are also complacent about the ability of society to assimilate culturally the present large number of immigrants and still display the cultural cohesion displayed nearly to the end of the 20th century. Cultural diversity did not fare well in the former Yugoslavia and

the Middle East and may yet be an obstacle rather than a strength in Afghanistan. The pious wish that inhumanity will cease has done little to improve the human condition. It would be better to assume that conflicts will continue and to determine realistically how they can be resolved intelligently, perhaps even with wisdom and civility.

If, as is becoming increasingly probable, there will be teeming millions of environmental refugees, it will mean that we were terribly wrong about the carrying capacity of the world for our species. Disease, starvation and resource wars will doubtless occur simultaneously but the root cause will be a social disequilibrium resulting from overpopulation and bad long-term management of natural capital. Persuasive evidence has been available that the carrying capacity has been exceeded for the last half of the 20th century, and the evidence is unmistakable in the 21st century. World War II and the Gulf War were resource wars. Hitler wanted “living room” for the German people and resource poor Japan needed almost every kind of resource. The Gulf War was unmistakably an oil war. The ideal of proportionately sharing resources is unlikely unless there is a limitation on the “right” to breed. China has imposed such limitations to both avoid exceeding carrying capacity and to lessen the disparity within the country between the “haves” and the “have nots.” Menzel’s (1994) stunning family portraits show both the vast difference in material possessions and our common humanity. This illustrates how illusory the process of moving from poverty to wealth has become. Unless there are effective restraints on individual freedom to breed, average per capita resources on a finite planet will be reduced resulting in either resource wars or forcible redistributing of resources. Individual freedom, as defined at present, will necessarily be restricted unless human society is prepared to let the impoverished suffer and die. In an age with abundant terrorists with access to weapons of mass destruction, this does not appear to be a viable alternative even if there were no ethical and moral objections to it.

Economic Discount Rates

The fatal flaw for humans may well be our view of economic discount rates – that is the damage is far off, but the pleasures or other perceived benefits are now. In the United States (and doubtless elsewhere) diets to reduce weight mostly don’t work. So how does one make living sustainably and reducing the likelihood of producing huge numbers of environmental refugees possible?

Alternatively, one might increase the short-term penalties for living unsustainably. But that would be regarded as an unacceptable invasion of the “rights” of nations, organizations, and individuals. Of course, human society is beginning to live more sustainably (e.g. Brown, 2001) but at a rate unlikely to prevent the appearance of large numbers of environmental refugees. One hopes, that if this does occur, the damage will not be too severe to permit a mid-course increased rate of implementing sustainable practices at a global level. The third alternative is to let nature take its course, probably with very large numbers of environmental refugees and greatly intensified resource wars as resources become increasingly depleted. The outcome in an era of increased terrorism and ubiquitous presence of weapons of mass destruction is not pleasant to contemplate. However, if present trends continue, this outcome is more than a possibility; it is, regrettably, an increasingly likely outcome. Afghanistan may well be a microcosm of this global scenario.

Perceived Economic Opportunity

Abernethy (1979, 1993) hypothesizes that a sense of expanding economic opportunity encourages people to raise their family size targets; falling expectations and the perception of heightened competition for limited resources results in reproductive caution. Abernethy (in review) calls this the *economic opportunity hypothesis*. If this hypothesis is correct, the likely outcome is an increased reproductive rate for environmental refugees since their perceived economic opportunities should be much greater in the host country than in the country from which they fled. Of course, the economic opportunity hypothesis should be self-correcting over a long time span because reproductive caution is triggered by the tougher economic, social, and environmental conditions usually associated with rapid population growth. Undoubtedly, the outcome will vary according to the rapidity with which the refugees share perceived economic opportunities of local residents, which, in turn, will be influenced by many other factors. However, if a sense of expanding opportunity encourages the refugees to raise their family size targets, the effects of the first perception will last at least one generation.

Conclusions

Environmental refugees already exist. The only uncertainty deals with future numbers and the rate at

which they will be produced. Living sustainably would reduce both actual numbers and the rate at which they are produced. Already established trends increase the probability that there will be a significant number of environmental refugees in the next few decades. Perhaps these numbers might provide an early warning of future realities that could cause a pronounced shift toward sustainable practices. At the very least, the consequences of not living sustainably should become more apparent to the general public and heads of state.

Two primary scenarios emerge: (1) human society learns to live sustainably within Earth’s carrying capacity for the human species or (2) human society does not learn to live sustainably, and nature (i.e., disease, starvation, etc.) reduces population size to a sustainable level, which might well be substantially below current population size if the ecological life support system is damaged. Environmental refugees are particularly important because the circumstances that produced them are almost certain to have reduced the area’s carrying capacity.

The number of environmental refugees could be substantially reduced by acceptance of a few basic assumptions:

1. Infinite growth on a finite planet is not possible.
2. Humans are dependent upon the planet’s ecological life support system, which they cannot continue to damage without suffering severe consequences.
3. Achieving sustainable use of the planet will not be possible if human population or per capita consumption of resources continues to increase.
4. Just because carrying capacity is difficult to estimate does not mean that it does not exist.
5. Although living sustainably will require many difficult adjustments, nature’s solutions to exceeding carrying capacity (e.g., famine and disease) are even less acceptable than the conditions necessary for achieving sustainability.

Arguably, the major obstacles to avoiding the appearance of large numbers of environmental refugees are: (1) the shocking low level of environmental and scientific literacy of most individuals, particularly among decision makers, (2) the ecstatic pronouncements that things are getting better and better despite enormous damage to the environment and the billions of humans living on a few U.S. dollars per day, (3) the robust

evidence that many unsustainable practices that cause severe environmental damage are subsidized, (4) a discounting system that favors short-term results to the detriment of long term benefits, and (5) human society has chosen to give a higher priority to material capital than to social capital.

Sustainable use of the planet would not only reduce the number of environmental refugees but, if practiced with compassion, would provide a fair and equitable use of ecological resources without damaging them. Such practices would improve the quality of life for those now alive and would leave a more habitable planet for future generations. Sustainable use would emphasize the care and nurture of the planet's ecological life support system upon which the future of humankind depends. Sustainable use of the planet provides exciting new opportunities for all components of human society. Moreover, it would benefit other life forms and ideally would diminish or eliminate worldwide species extinction rates and biotic impoverishment.

All great social change begins with a vision, which often seems utopian and unattainable. Depletion of resources and environmental damage may already be too extensive to permit a transition to sustainability without producing a huge number of environmental refugees.

Environmental refugees are the direct result of the failure or disequilibrium of the ecological life support system. Ecosystem damage is increasingly of anthropogenic origin, which means that human society has the opportunity to reduce the damage, and thus, the number of environmental refugees. If the ecological carrying capacity has been reduced, humans are increasingly controlled by the same factors that reduce population size of other species. Technology may soften the blow but is unlikely to eliminate it. Since individual freedom is an important issue on much of the planet, steps taken to reduce the number of environmental refugees should be given serious and immediate attention. All countries should demand that carrying capacity is not reduced either by ecological damage or by increased human population size and per capita resource consumption. War and preparation for war diverts resources from civilian consumption, and war usually results in considerable ecosystem damage. Ecological restoration can repair some of the damage but is difficult to implement when there is a war or a serious threat of war.

Since 90% of the human population growth is in third world countries and since exponential growth almost always outstrips the ability of the social system to keep up, this situation requires immediate attention. An obvious beginning is to provide free methods of family planning for those who wish to employ them. Clearly, freedom of choice is highly desirable unless it leads to populations that exceed the country's carrying capacity. China has undertaken exemplary but not perfect actions to stay within carrying capacity. Some of the measures seem extreme to many people in countries with more per capita resources, but no viable alternative has been offered. Doing nothing could result in millions of deaths, loss of political stability, and dramatic reduction of quality of life.

For a few decades early in the 21st century, countries with declining populations might offer temporary relief by accepting large numbers of immigrants. However, if the immigrants increase their numbers exponentially and the country of origin continues to do so as well, the "benefits" will be strictly short-term.

The worst case scenario is for the country exporting environmental refugees to continue to do so after the recipient country exceeds its carrying capacity. This could happen if the sea level rise put the receiving country over its carrying capacity while the same sea level rise increased the number of environmental refugees from the country exporting them. A loss of arable land due to salinization or exhaustion of ground water aquifers could produce a similar result. The worst case scenario could easily destabilize a region further and increase the rate and number of environmental refugees, thus exacerbating the problem and requiring more resources to cope effectively with it. Disease, famine, and war are likely outcomes of the worst case scenario. The best way to avoid this situation is for all countries to get within their carrying capacity expeditiously. Given the vast religious, cultural, and ecological diversity in the world, this task will not be menial. Terrorism and ethnic conflict worsen the situation still further. Finally, carrying capacity is difficult to calculate, and the prerequisites will only be known with confidence when sustainability has been achieved.

Cultural and social changes of this magnitude will probably not be possible until some catastrophic event demonstrates the concept of carrying capacity so that even the most environmentally illiterate persons can understand it. One hopes intelligence and reason will

prevent such a situation, but we have to remember that *Homo sapiens* evolved as a small group species and has not yet become proficient in addressing huge group (regional, continental, or global) problems.

Former U.S. President Carter (2002) states the basic problem succinctly. He feels that the most important challenge is to share wealth, opportunity, and responsibilities between the rich and the poor because, if the chasm between rich and poor grows wider, the world will be neither safe nor secure. Carter then noted that nearly a billion people are illiterate and more than half the world's people have little or no health care and inadequate funds to obtain food, shelter, and clothing. With over half of the world's people already living precariously, it would not take much to create a massive environmental refugee problem. Over half the refugees from many areas might well be 15 years of age or younger. Integrating these refugees into the indigenous population would be a daunting task for even the wealthiest country, and, arguably, an impossible task for an impoverished country. As Dickinson (1999a) remarked, anyone traveling the world today encounters a sea of young men and women. In the poorer nations of Asia, Africa, Latin America, and the Middle East, fundamentalist revolutions and unrest find their acolytes among jobless young males. Dickinson (1999b) maintains that nature is the final arbiter. Denial, ignorance, self interest, and the like will not persuade nature to alter natural law or grant exceptions or variances to it. Hardin (1999) remarked that even if we were able to talk with other animals it is not likely we would hear them debating the problem of population control. Debate is unnecessary for other species since nature takes care of the problem by ensuring that a successful species does not become too successful. Nature's solution to the problem is not "nice," but it is the most likely outcome if we refuse to debate and resolve the problem within our own species. Hardin's message is simple – if human society does not voluntarily live within limits (i.e., carrying capacity), nature will see that it does. Denial that the problem exists is not an acceptable solution.

In many areas of the world, fertility rates are now falling, possibly because maintaining current standards of living is becoming more difficult. Still, ecological collapse, economic collapse, and a number of other factors might well dramatically increase the total number of refugees, of which environmental refugees may represent a

significant portion. It is possible that all or most of the problems explored in this article may never occur. It is probable that some will. It would be prudent to at least consider how these problems will be resolved, who is responsible for doing the work, who will pay for the work, and, finally, who will take corrective action if the trends are very unfavorable. A sizable number of refugees would most probably destabilize the environment, the host society, and its economy. Each time this occurs, the number of environmental refugees will increase and the number of countries willing and able to host them will decrease. Precautionary measures to reduce the probable number of environmental refugees would benefit global society and make whatever problems occur more manageable. •

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