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Population, development, and human natures

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At the dawn of this new millennium, the human enterprise is quickly becoming a globally unified one. Yet numerous obstacles and pitfalls remain in the path of a full and fair unification. A substantial fraction of the world's population is well-off and increasingly connected through trade and communications systems. But an even larger fraction is struggling to make ends meet and is only sketchily connected to the globalizing economy. And a significant portion are barely surviving, with virtually no connection to the rest of the world. The majority of human beings live in regions where development still falls far short of even modest aspirations, while the already affluent minority strives for even more affluence. The critical challenge of the decades ahead will be to incorporate the lagging four-fifths of the world's still-expanding population into the global economy while preserving the life support systems that make our planet habitable.

In this paper we want to make three basic points about this dilemma. First, the problems of development are intertwined with human population size, population growth rates, and patterns of consumption, including the technologies used to provide that consumption. Second, progress in development will be negatively affected by those variables, primarily through their impacts on humanity's natural capital—the ecosystems that supply civilization with a flow of indispensable goods and services. And, third, the failure of human cultural evolution in the areas of sociopolitical organization and ethics to keep pace with the evolution of technological capability constitutes a major impediment to the achievement of a sustainable civilization. While these are major obstacles to successful development, they also offer significant keys to finding answers.

Taking a global view, it is clear that the 'population–consumption problem' can adversely affect all people, and especially those in developing countries. This is perhaps most obvious in the area of climate change (Intergovernmental Panel on Climate Change, 1996). There is a high positive correlation between both the numbers of people and their consumption levels and the fluxes of greenhouse gases (GHGs) into the atmosphere, although there is substantial variation in consumption levels and GHG fluxes among societies (Yang and Schneider, 1997–1998; Hoffert *et al*. 1998). Furthermore, expansion of population and consumption is

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modifying existing sinks for those gases, the particulate content of the atmosphere, and the reflectivity of the Earth (its albedo) in complex ways. Neither global nor regional impacts of human activities on the climate can be predicted with precision now, although some changes will be likely to occur everywhere.

Nonetheless, most atmospheric scientists believe there is a 10 per cent chance that changes will be rapid and large enough to create severe problems for agriculture and other climate-dependent portions of the human economy (Schneider, 1995) and a much higher chance of creating stress for natural ecosystems (Root and Schneider, 1993). Furthermore, large coastal areas will eventually be flooded, with places such as the Nile Delta, coastal Bangladesh, and small island nations in the southwest Pacific being especially vulnerable. And, of course, everything else being equal, people in the poorest nations will be least able to ameliorate negative climatic impacts successfully, should they occur (Intergovernmental Panel on Climate Change, 2001). The prospects for regional (or even more widespread) famine may be greater than many analysts believe (for example, Johnson, 2000; Smil, 2000). We may have had a small foretaste of climate changes in store for us if the extreme weather events experienced in the past decade were related in part to the build-up of greenhouse gases in the atmosphere. Whether and to what degree their severity was connected to the build-up will never be known, but circumstances, such as intensified hurricane strength, were of the sort predicted for a warming world.

Humanity is already paying some costs in planning and political conflict related to efforts to mitigate and prepare for a destabilized climate—as battles over provisions of the Kyoto Protocol indicate. And even without rapid climate change, overpopulation is already a factor underlying one of humanity's gravest environmental problems: increasing shortages of fresh water in many regions (Postel *et al*., 1996; Gleick, 1998; Gleick, 2000). Indeed, recent work shows that much of humanity is 'currently experiencing water stress' and that the single greatest factor is not yet global warming but 'the socioeconomic equivalent of the Mauna Loa curve, namely, rapid population growth and economic development' (Vörösmarty *et al*., 2000, p. 284).

Another area in which population changes are now causing very serious difficulties is in the deterioration of the epidemiological environment. It has long been recognized (for example, Ehrlich, 1968, pp. 70ff) that increasing human numbers carry with them epidemiological risks. Many epidemic diseases cannot persist in small populations; measles, for instance, requires human aggregations of 200,000 to 500,000 people to maintain itself. In smaller societies, all the susceptible individuals contract the disease and either succumb or become immune, and the virus dies out. Virtually all transmittable diseases of human beings are caused by organisms that originally attacked other animals, transferred to human beings, and evolved strains specialized in attacking us. There are countless pathogens in nature that have not yet managed to invade people, either because human beings are too alien an environment for them to invade, or because transfer is a stochastic process and there have not been sufficient opportunities. Meanwhile we seem to be doing everything possible to increase those opportunities. For instance, suburbanization in the United States is increasing contact of people with the ticks that transmit lyme

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disease. And the mice that serve as intermediate hosts of the pathogenic spirochete that causes the disease may be more abundant today because the passenger pigeons that once competed with mice for food have been exterminated (Blockstein, 1998).

Furthermore, rapid transport systems now can make the transfer of a novel pathogen from an animal reservoir into a local human population a global threat. In addition, those systems facilitate the spread of dangerous known vectors and pathogens, as the recent arrivals of Asian tiger mosquitoes and West Nile Virus in North America exemplify. At the same time, a warming climate may make the survival and spread of those imported organisms more likely. It may also allow the poleward spread of the mosquitoes that transmit malaria and dengue fever (for example, Bryan *et al*., 1996). The deterioration of the epidemiological environment thus appears to be exacerbated by human alteration of the climate. As always, the impacts of this deterioration fall most heavily on the populations of the developing nations, which cannot afford the public health measures necessary to prevent or ameliorate them. The most dramatic example is the devastating outbreak of HIV/AIDS in Africa, where 13 per cent of the world's population in some of the poorest nations account for 69 per cent of the world's cases (Population Reference Bureau, 2000). In some African countries, one out of four adults is infected; hundreds of thousands are dying, leaving orphaned children to be raised by grandparents or other relatives and creating massive social disruption.

Not only is human health affected by the expansion of the human enterprise, but the ecosystem health as well. Overall, there are now discernible effects of regional climate change on wildlife, such as poleward extensions of ranges. Such regional climate changes are consistent with expectations for global warming (Root *et al*., 2001). The disastrous forest fires in North America in the summer of 2000 and in tropical regions a few years earlier may be consequences not only of changes in weather patterns, possibly due to the beginnings of global warming, but also to past abuse or poor management of forest resources. The apparent recent increase in severe floods and droughts in many regions from Bangladesh and India to Nicaragua and Texas can also be traced at least partly to land degradation, especially deforestation of watersheds, with devastating consequences for local or regional human populations. Those impacts are in part due to population growth itself, since in general the larger the population the greater the proportion of the people living in marginal areas where they are subject to the worst impacts of climate (Andrewartha and Birch, 1954).

Another example of declining ecosystem health is less appreciated generally. In the last couple of centuries, the marine ecosystems of the western North Atlantic have suffered extreme degradation, which has greatly reduced their value to human beings. Stocks of many large fishes have plummeted due to overfishing and destruction of critical habitat on the continental shelf by mechanized harvesting. Similar problems beset marine ecosystems around the world. Oyster beds have been destroyed by overexploitation and agricultural runoff, and cascading losses from food chains have synergized with eutrophication, climate change, and disease (the latter probably associated with some type of human disturbance) to

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decimate coral reefs (Jackson, 2001). These have added to the losses to poor artisanal fisherman already burdened in many areas by commercial over-exploitation of the reefs.

Humanity's dependence on natural capital and the ecosystem services that flow from it is not widely recognized by political leaders and other decision makers in either developed or developing countries. They do not understand that humanity is utterly dependent on goods and services (Daily, 1997) flowing from natural ecosystems, ecosystems that can be thought of as natural capital (Vogt, 1948). These services include: amelioration of climate and weather; running of the hydrological cycle that brings us fresh water; generation and maintenance of soils and recycling of nutrients essential to farming and forestry; detoxification and disposal of wastes; control of the vast majority of potential crop pests and disease vectors; pollination of many crops and other valued plants; and the supply of timber and other natural products and food from the sea. As a result of this lack of recognition in comparison with other forms of capital, 'ecosystems are poorly understood, scarcely monitored, and (in many cases) undergoing rapid degradation and depletion' (Daily *et al*., 2000, p. 395). Natural capital also is not usually appropriately valued in conventional economics; still less is it properly depreciated in national accounts (Repetto *et al*., 1987).

The community of natural scientists finds the human predicament, and its population component, very alarming. To them, the resultant need to limit the growth of the human enterprise is fully apparent (Ehrlich and Holdren, 1971; Vitousek *et al*., 1986; Holdren 1991; National Academy of Sciences USA, 1993; Union of Concerned Scientists, 1993; Vitousek *et al*., 1997). In theory, how that should be accomplished is straightforward: growth of the human population should be halted and a slow decline begun toward a sustainable population size, perhaps to an 'optimum' size in the vicinity of 1.5–2.0 billion people (Daily *et al*., 1994); wasteful consumption in rich nations must be constrained in order to provide room for the needed increases of consumption among the poor (Ehrlich and Ehrlich, 1989; Ehrlich *et al*., 1995); and much more efficient and environmentally benign technologies need to be deployed (for example, Von Wiezacker *et al*., 1990; Johansson *et al*., 1993). It would be to everyone's benefit if rich nations such as the United States would help pay the costs of such deployments in developing nations. While more scientific information would be useful in dealing with the human predicament, more than enough is in hand to know the sorts of changes that will be necessary to establish a sustainable society.

How those essential changes are to be achieved, however, is a much more difficult problem. Humanity possesses a gigantic body of extra-genetic information called 'culture', and that culture is continually evolving. That body of culture is so vast, and has evolved in such diverse directions, that each individual, indeed each society, can possess only a small portion of it. As a result, there is really no singular 'human nature', just a multitude of 'human natures' (Ehrlich, 2000). But there is now a dramatic mismatch in evolutionary rates between two important areas of culture; our technological capabilities have been evolving very rapidly,

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much more rapidly than our ability to understand and alter our behaviour both toward each other and (more recently) the environments on which we all depend. Technological advances in the public health area triggered the population explosion of the past half century, rapidly depressing death rates (Ehrlich *et al*., 1977; Ehrlich and Ehrlich, 1990). Those advances far outpaced cultural evolution in human understanding of the demographic consequences of that spectacular success or the ability of societies to deal with them. Between 1950 and 2000, the world population expanded from 2.5 billion to 6 billion. Development planners were faced with the challenges of tripling global food production and bringing billions of people out of poverty and pre-industrial living conditions in some of the poorest societies while they were doubling their numbers in as little as 20 years. Changing the norms of a recent past of high birth rates (which had been paired with high infant/child mortalities) proved a more formidable task than was first expected. Meanwhile, rates of resource exploitation and consumption leaped ahead even faster than population growth as the industrial model of development was adopted around the world. By the century's end, the consequences for the world's life support systems, in the form of impaired natural services (Daily, 1997) and mounting pollution problems, were becoming more and more apparent. Despite this, however, commentaries are still produced that display ignorance of the environmental impacts of population growth and urge pronatalist policies in places like Singapore, where birth rates have fallen to record low levels (for example, Bowring, 2000).

Leadership now must come from the social sciences, especially economics, to find ways of guiding cultural evolution in attitudes toward both family sizes and resource management and consumption in order to facilitate a transition to sustainability (Ornstein and Ehrlich, 1989; Ehrlich, 2000). Much has been learned about factors that influence reproductive behaviour, such as the relationship of education and opportunities for women to declining fertility rates (Ehrlich *et al*., 1995; Dasgupta, 2001), and the need to ensure that men are supportive of those opportunities (Holl *et al*., 1993). This knowledge has contributed to the relative success of family limitation programs and declines in fertility rates in many areas of the world (Gelbard *et al*., 1999). By the mid 1970s, nearly every nation had established a program for services to provide access to methods of birth control (Ehrlich *et al*., 1995), and significant fertility declines were occurring virtually everywhere by the mid 1990s. The falling birth rates may even have accelerated following the United Nations Conference on World Population and Development in Cairo in 1994 (Population Reference Bureau, 2000), which highlighted the connections for fertility to education and the status of women.

Nonetheless, these efforts have not yet been adequate to halt global population growth, which continues now at an annual rate of 1.4 per cent. That probably will decline further, but because low birth rates have not yet been achieved in all societies, and because of the momentum generated by past high fertility, mainly in developing nations, demographers project the addition of several billion more to the six billion people now on Earth before growth finally ends.

Although in most industrialized nations population growth has largely

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ended, or has even been reversed, few people seem to realize that overpopulation in rich countries remains a major cause of the destruction of the world's life support systems. Perhaps the most seriously unsustainable situation is that of the United States, where the total fertility rate (TFR) is now 2.1 (the 'replacement rate' at which each generation just replaces itself in the next generation) and has been slowly climbing since the 1970s when it reached a low of 1.7. That high TFR. as well as the high annual rate of growth (1 per cent), is partly traceable to an influx of immigrants from high-fertility nations into the US, but also to the utter failure of the American government to establish a policy to discourage couples from having more than two children. A TFR of about 1.2–1.5, such as prevails in Italy, Spain, Portugal, Germany, Russia, and Canada, among other nations, would be more appropriate.

The global seriousness of US overpopulation is due to the huge size of its population, over 282 million people (the third largest national population), combined with the highest level of per capita consumption found in any large nation. Consequently, about a quarter of the total assault on the global environment (measured either by GNP or total energy use) is caused by the activities of Americans, who make up less than 5 per cent of the world's population. Thus the United States is truly Earth's most overpopulated nation. But generalized ignorance or denial of the seriousness of human impacts on ecosystems results in society's failure to recognize the key drivers of growth in numbers and per capita consumption in the United States and other overdeveloped nations. Unfortunately, this failure of recognition frequently spills over to leaders in developing nations, where they often have at least some appreciation of the social and traditional economic costs of rapid population growth, but usually have at best a hazy view of the externalities associated with ecosystem degradation.

Less understandable, perhaps, is the failure of the inhabitants of the United States, and American decision makers in particular, to recognize even the most basic 'population externality' (Ehrlich *et al*., 1992; Dasgupta, 2001), that of crowding. As American freeways congeal with nearly all-day 'rush hours' and suburbs sprawl increasingly into farmland, desert, and forest, the role of population growth underlying the process is continually ignored by government, the media, and most of the public. The role of population growth in the destruction of human life support systems is rarely mentioned even in environmental and scientific communities. Thus there is no serious discussion of the relative costs and benefits of, say, choosing to limit population size as an adjunct to measures such as carbon taxes for curbing the flux of greenhouse gases.

This lack is not entirely due to ignorance in those communities or among politicians. There is considerable social resistance to the notion that there can be too many people, and there is little institutional structure, outside of a few relatively weak NGOs, to encourage or even mandate that it be part of public discourse. As a result, public discussion of the population problem carries a risk of social or political repercussions. This is exemplified by the presidential campaign in 2000 in which Al Gore (wisely for his election chances) did not raise the population issue, even though we know,

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from his earlier speeches and writings (Gore, 1999) and personal conversations with him, that he is fully aware of its seriousness.

An even more taboo subject in most rich countries is that other major driver of environmental destruction, overconsumption. While consumption has been a topic of substantial interest to economists (for example, Hunt and D'Arge, 1973), there has been little economic analysis of the role of consumption in the degradation of human life support systems. Nonetheless, first principles and simple analyses of the correlation of consumption with losses of biodiversity and ecosystem deterioration (for example, Ehrlich, 1995) indicate that it is just as important as population growth itself. Environmental scientist John Holdren has shown that it is biophysically feasible to close the rich–poor gap *and* limit the impact of the human enterprise on the environment to a level that might be at least temporarily sustainable (see summary in Ehrlich and Ehrlich, 1991, pp. 43–44). But both the urgency of doing so and the opportunities it may open for improving human well-being, unlike the need for population limitation, are only beginning to reach the international agenda. Rather, discussions have largely centred on whether global warming is a 'real problem' and have ignored other ominous trends, such as massive deforestation and land degradation—also resulting from rising consumption—that will make societies even more vulnerable to the adverse effects of global warming.

Too little attention has been paid by social scientists to ways that growth of consumption among the rich might be discouraged, especially given the widespread conclusion that consumption among the poor—which can be viewed as a form of investment (for example, Dasgupta, 1993, p. 249)—needs to be increased in order to provide them with decent lives. Indeed, there is little understanding that growth in consumption by the rich *should* be curbed. In detail, it is a difficult problem (for example, How is consumption to be defined and measured? What kinds and forms of consumption are important? Into what units should it be decomposed for analysis? How would overconsumption be detected?). But even with those questions unanswered, the dimensions of the problem are clear (see for example, Daly, 1996, pp. 14–15). Social scientists have not focused their attention on how cultural evolution might be guided—indeed they rarely think about the process of getting issues on to the agenda for public discussion as the critical part of cultural evolution that it clearly is. A major step in accelerating the needed cultural evolution would be to bring population, consumption, and other crucial but presently largely neglected issues, such as nuclear weapons policy (Committee on International Policy and Arms Control, 1997; O'Hanlon, 1999), to the forefront of political consciousness and debate.

These are all issues of great importance to developing nations as well, and they should be using their diplomatic voices and their ethical capital to keep them alive in the international arena. At the moment, however, there are no institutional arrangements that would encourage social discourse on or analysis of the dimensions of consumption. And there certainly is no substantial constituency for limiting aggregate consumption—quite the contrary, political leaders call for its further

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expansion almost everywhere—despite the obvious point that, if it continues to expand, the damage to the environment is bound to escalate, perhaps to the point of catastrophe.

There is an ethical dimension as well to our behaviour relative to population, consumption, and the environment. Human beings are distinguished from all other living animals by, among other things, a combination of intense consciousness, empathy , social attribution, language with syntax, and an enormous, expanding body of culture. Our combination of unique characteristics has led to the evolution of ethics—culturally shared values that involve notions of right and wrong. Ethics themselves evolve constantly. To see that, one only need consider the different views of ancient Greek and modern western philosophers on the issue of slavery. That, in turn, suggests that there is no transcendental source of values and that the so-called 'naturalistic fallacy', that 'is' carries implications for 'ought' is appropriately named.

The area of attitudes toward population and the environment is one where ethics are now evolving rapidly, as can be seen in the variety of views on many related topics. In the United States for instance, the following questions will elicit very different answers from different individuals. Is it ethical for people to have large families despite well-known population externalities (Ehrlich *et al*., 1992)? Is driving a fuel-inefficient vehicle ethical? Is building a 600 square meter house for a family of four on relatively undisturbed land ethical, when hundreds of millions of people have no semblance of decent shelter and when human life-support systems are threatened by habitat destruction? Similar questions are being discussed in nations as diverse as Australia, Mexico, India, and China. That cultural evolution is involved in such environmental ethical issues is clear; these questions would not have made sense even to most educated people 50 years ago.

A great hope for building a sustainable society is that the evolution of ethics apparently can be guided, despite conflicting ethical views and differences in the distribution of power and ethics that may prevent people from acting on their ethics. Examples of attempts to guide ethical evolution abound—even though participants would not describe their efforts in those terms. In the United States, the abolition, women's rights, and temperance movements, and after World War II, the civil rights, environmental, and anti-abortion movements, are outstanding examples. Similarly, numerous attempts have been made to guide ethical evolution in other nations, from campaigns to support decolonization after World War II to those to revive religious fundamentalism today. Perhaps the most impressive effort as the new century begins is being launched by the government of Bhutan, a tiny Himalayan nation of some 700,000 people sandwiched between the giants of India and China. The nation is working toward what it calls gross national happiness (GNH), focusing on four things: economic development, cultural promotion, environmental preservation, and good governance (Centre for Bhutan Studies, 1999). There are many issues to be resolved in this program, but we know from personal experience that it has had considerable impact. For example, Bhutan is the only area of the Himalayas that retains most of its territory in a pristine

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state, preserving its amazing flora and fauna virtually intact. And the government is very concerned about the expansion of consumption, and has the power to constrain it.

With possibly a few exceptions, such movements have involved 'moral entrepreneurs', in sociological terms (Becker, 1963), who did not think of themselves as trying to steer cultural evolution—but that is what they were doing. In Bhutan the entrepreneurs are a cultural elite led by the King, who has promoted the democratization of a once absolute monarchy. Sociologists and political scientists have examined the history of changes in social norms, such as the Bhutanese movement toward democracy (Gupta, 1999). One such norm is the proscription against political discussion of population issues in the United States. Analyses and theories of 'deviance' abound (Adler and Adler, 2000), and deviance is obviously an important feature of cultural evolution, for most major changes arose from deviant ideas. Without deviance there would be stasis.

But social scientists have made little progress in understanding why some attempts at guiding cultural evolution have been successful (abolition of slavery) and others have not (prohibition, although temperance remains a minor cultural current). One possible cause of the lack of progress in changing attitudes toward population and the environment, which could make solving the human predicament even more challenging, is that people raised in different cultures actually have different systems of thought (Nisbett *et al*., 2000). Just as an organism's genetic system must be considered if one is attempting to understand its biological evolution (Ehrlich *et al*., 1974), understanding of a society's cognitive system may be prerequisite for influencing its cultural evolution. And, of course, care must be taken to see that attempts to guide cultural evolution occur in open, democratic forums, to avoid Stalinesque or 'brave new world' sorts of social engineering. A partial model might be found in the *Intergovernmental Panel on Climate Change* (IPCC), in which large numbers of climate scientists meet regularly with representatives of government and industry to evaluate the climatic situation and recommend possible ameliorating efforts (for example, Intergovernmental Panel on Climate Change, 1996). IPCC deliberations are 'transparent'—open so that anyone with an interest can follow the entire process. But mechanisms are not in place to bring those deliberations to the public at large (media coverage is hardly extensive), and thus to expand public discourse on the problems that may accompany climate change and to build a broad consensus on actions to be taken. But the IPCC seems a step toward a more rational approach to cultural evolution.

Important changes occurring rapidly have been a feature of cultural evolution ever since the 'great leap forward' some 50,000 years ago. (Sahlins, 1968; Diamond, 1989; Mellars, 1991) ended a long human history in which periods of technological stasis (Oldowan, Acheulean, Middle Palaeolithic) lasted for hundreds of thousands to more than a million years (Klein, 1999). In recent centuries, the speed of technological revolutions appears to have been accelerating, as is apparent from comparison of the technologies of 1500 with those of today. Social change also seems to be accelerating, as attested by changing attitudes about slavery, colonialism,

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economic equity, and racial, religious, and gender prejudice, in the past century or so. To a degree, the technological changes may have set the stage for the social ones, as modern transport and communications brought people more and more into contact with others from different backgrounds and cultures, and that contact has led to familiarity and increased tolerance and understanding. This change in attitudes may in turn lead to a change in values relating to equity, which will be essential for obtaining the cooperation needed to resolve the human predicament. That cooperation will remain elusive as long as millions of people are living lives of severe deprivation while others enjoy a lavish lifestyle, prominently displayed on global television (Ehrlich *et al*., 1995; Daily and Ehrlich, 1996).

The question is whether social evolution can be pointed in the right direction and accelerated sufficiently to catch up with the technology-driven degradation of human life support systems. We may hope that the same technology that is knitting myriad cultures into a global economy, and almost a superculture shared globally, could also raise awareness of the impacts of overconsumption. Global trade could be a blessing or a curse, depending on how it is developed. It will be a curse if it tries to extend the late twentieth-century industrial mode of life to more than six billion people, or if the rich and powerful plunder the planet while further impoverishing the poor. It will be a blessing if it permits civilization to support itself in decades to come as the population explosion winds down and helps to raise the well-being of the billions now in poverty without compromising our ability to support the generations who will come after us. But wise cultural leaders are needed, who can see and explain the profound importance of these choices. Lacking such leaders to guide our cultural evolution, the blessings may never materialize.

Continued population growth, runaway consumption, and the use of damaging technologies, abetted by a failure to understand the social drivers behind them, are an enormous threat to the persistence of civilization. Major changes in all three factors must be made if there is to be any hope of achieving a sustainable global society, one in which cultural diversity will persist (we hope) but where today's yawning economic gap between rich and poor will have faded away. For this to happen, many more people must become familiar with the dimensions and risks of the predicament and help instill some important changes in values. The most important challenge before us is, therefore, to find ways to change the natures of very many human beings—to guide cultural evolution toward effecting changes in values as rapidly as possible.

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