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WINDOWS ON THE FUTURE

Global Scenarios & Sustainability

Of all the *environmental policy* concepts to emerge in the last 20 years, none is more compelling than that of sustainability. The reason, of course, is the growing recognition that humanity is currently on an unsustainable path, that our activities have reached the point where they threaten the very life-support systems of the Earth. The need to preserve those systems was first put on the international *policy* agenda by the Brundtland Commission more than 10 years ago, which also formulated the classic definition of sustainable development, namely, development that "seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future."⁽ⁿ¹⁾ The same goal has guided other international *policy* endeavors, notably the Earth Summit in 1992 and the recent climate negotiations in Kyoto.

There is no question that the contradiction between the modern world's imperative toward growth and the Earth's finite resources will ultimately be resolved in some way. The only question is how that will come about--whether through enlightened management, economic and *environmental* catastrophe, or some other means. Unfortunately, no one can predict this with any certainty. Projections that are valid for the short term lose their validity as the time horizon increases from months or years to decades or even generations. This uncertainty stems from our limited understanding of human and ecological systems and the inherent indeterminism of complex dynamic systems. In addition, social futures invariably depend on human choices that have yet to be made.

One way to gain insights into the uncertain future is to construct what are known as *scenarios*. This technique, in fact, has been used since the 1970s to bring the issue of environment and development to the attention of both scientists and policymakers.⁽ⁿ²⁾ This article explores a wide range of long-term *scenarios* that could unfold from the forces that will drive the world system in the 21st century by considering six contrasting possibilities. The *scenarios* were developed by an international and interdisciplinary group of 15 development professionals called the Global Scenario Group.⁽ⁿ³⁾ This scan of the future illuminates the perils and possibilities before us and, more importantly, helps to clarify the changes in policies and values that will be required for a transition to sustainability during coming decades.

The Scenario Approach

A scenario is essentially a story about the future. It indicates what the future may be like along with the way in which events might unfold. Unlike projections and forecasts, which tend to be more

quantitative and more limited in their assumptions, *scenarios* are logical narratives dealing with possibly far-reaching changes.⁽ⁿ⁴⁾ By forcing us to clarify alternative world views and challenging the conventional wisdom, scenario analysis offers us a uniquely valuable way to ponder critical issues.

Scenarios draw on two sources--science (with its understanding of historical patterns, current conditions, and physical processes) and the imagination. Thus, they reflect the insights of quantitative analysis while giving due weight to key qualitative elements such as culture, values, and institutions. Quantitative modeling lends a certain structure, discipline, and rigor to the analysis of socioeconomic, resource, and *environmental* conditions; narratives give it texture, richness, and insight.

The major elements of formulating a scenario are represented in Figure 1 below. First, the current state of the system under consideration must be described and quantitatively represented in enough detail to address the key issues. Next, the driving forces, that is, those that govern the system and propel it forward, have to be identified and characterized. Along with the driving forces are attracting and repelling forces, events that can redirect beliefs, behaviors, policies, and institutions away from some visions of the future and toward others;⁽ⁿ⁵⁾ the third step is to ascertain and evaluate these forces. Finally, one has to consider possible sideswipes, major surprises that can alter an otherwise straightforward outcome. Such surprises might include a world war, miracle technologies, an extreme natural disaster, a pandemic, or the breakdown of the climate system.

All scenario exercises must organize the bewildering array of possible futures into an intelligible structure, generally one based on a few stylized *scenarios* that illuminate the important issues, choices, and uncertainties. In typical *policy* studies, for instance, a "mid-range" (or most probable) scenario is supplemented by additional *scenarios* in which key driving forces such as population, economic growth, and technological change are varied across a certain range. In this respect, however, the *scenarios* that we constructed differ from the standard practice. Rather than reducing the rich diversity of future possibilities to mere variations in quantitative assumptions? we attempted to introduce a framework that would preserve that diversity.

Possible Futures

Our analysis focused on three basic visions of the future, which we call the Conventional Worlds, Barbarization, and Great Transitions *scenarios*. The Conventional Worlds scenario assumes that current trends will continue without fundamental change in institutions and values. By contrast, both the Barbarization and Great Transitions *scenarios* assume that there will be a fundamental change from current trends--in one case leading to a negative vision of the future, in the other to a positive vision. Each scenario has two variants, for a total of six possible outcomes. (See Figure 2 below for a listing of these variants and their principal characteristics.)

The Reference variant of the Conventional Worlds scenario incorporates mid-range population and development projections. In the absence of major new *policy* initiatives, technology gradually evolves to promote clean production, efficient resource use, sustainable agriculture, and so forth. The *Policy* Reform variant adds strong, comprehensive, and coordinated government action to achieve greater social equity and *environmental* protection. In this variant, society acquires the political will to strengthen management systems and rapidly diffuse environmentally friendly technology. Both variants assume continuity in institutions and values, rapid growth in the world economy, and regional convergence toward the norms set by the highly industrialized countries. The principal difference is that in the Reference variant the resolution of the social and *environmental* problems that arise from global population and economic growth is left to self-regulating competitive markets, whereas in the *Policy* Reform variant sustainability is a specific *policy* goal.

The Barbarization scenario envisions the possibility that the social, economic, and moral

underpinnings of civilization will deteriorate as emerging problems overwhelm the coping capacity of both markets and *policy* reforms. The Breakdown variant entails unbridled conflict, institutional disintegration, and economic collapse. The Fortress World variant involves an authoritarian response to the threat of breakdown: Ensclosed in protected enclaves, elites safeguard their privileges by managing critical natural resources and controlling the impoverished majority; outside the fortress there is repression, *environmental* destruction, and misery.

The Great Transitions scenario postulates visionary solutions to the sustainability challenge, including new socioeconomic arrangements and fundamental changes in values. This scenario contemplates a society that preserves natural systems, that provides high levels of welfare through material sufficiency and equitable distribution, and that enjoys a large degree of social solidarity. Population is stabilized at a moderate level, and the flow of materials through the economy is radically reduced through less consumerism and the massive use of green technologies. The Ecocommunalism variant incorporates the deep green vision of localism, face-to-face democracy, small technology, and economic autonomy. The New Sustainability Paradigm variant has many of the same goals but pursues them by attempting to build a more humane and equitable global civilization rather than by retreating into localism.

Many other *scenarios* can be constructed as variations and blends of these pure cases. For instance, more sophisticated *scenarios* might reflect regional variations and the possibility of discontinuous jumps at critical points in the development trajectory.(n6) However the six possibilities on which we concentrated provide a useful framework for analysis as well as a point of departure for more detailed explorations. At present, most *policy* discussions focus on some form of a Conventional Worlds scenario. The Barbarization scenario lurks as a danger, however--the punishment that may be imposed on future generations for unwarranted complacency today. The Great Transitions scenario, on the other hand, offers idealistic alternatives, futures that may seem utopian but that are perhaps no less plausible than a transition to sustainability without fundamental social transformation.

The *scenarios* were designed to represent archetypal social visions that have recurred in various forms in treatises on the relatively distant future. Quantitative representations of scenario variants were made using the PoleStar System, which was designed specifically for this purpose, along with data and assumptions drawn from major sectoral studies.(n7)

Conventional Worlds

In the Conventional Worlds scenario, the values and socioeconomic arrangements of the industrial era continue to evolve without major discontinuities. Competitive markets and private investment remain the engines of economic growth and wealth allocation. The globalization of product and labor markets continues apace, catalyzed by free trade agreements, unregulated flows of capital, and advances in information technology. The nation-state remains the dominant unit of governance, while transnational corporations dominate an increasingly borderless economy. Consumerism and possessive individualism endure as the primary motives underlying human behavior; consumer culture permeates all societies via electronic media, eventually reducing diversity, despite fundamentalist, ethnic, and nationalist backlashes. The consumption patterns and production practices of the developing regions converge toward those of the highly industrialized countries.

The Reference variant of this scenario can be represented quantitatively by assuming that current trends and policies are maintained and that development follows a mid-range course (as assumed in many analyses).(n8) Population increases from about 6 billion today to about 10 billion by the year 2050, with nearly all the increase in developing regions. The world economy grows from about \$20 trillion in 1990 to about \$95 trillion in 2050 and continues growing thereafter. The economies of developing countries grow more rapidly than those of Organisation for Economic Cooperation and Development (OECD) countries (their average annual growth rates to the year 2050 are approximately 3.6 percent and 2 percent, respectively). Consequently, the OECD countries' share of

world output decreases from 80 percent in 1990 to 60 percent in 2050. In one sense, incomes in the two groups of countries gradually converge: The ratio of the average gross domestic product (GDP) per capita in the OECD to that in other regions decreases from 20 in 1990 to 15 in 2050. However, the absolute difference increases from an average of \$18,000 per capita in 1990 to \$55,000 per capita by 2050 as incomes in rich countries soar. The structural shift in economic activity from industry to services continues. In particular, the share of materials-intensive industries eventually decreases everywhere, consistent with recent trends in the industrialized countries. The spread of new technology leads to more efficient use of energy and water, growing utilization of renewable energy resources, and cleaner industrial processes. (Figures 3 and 4 on pages 10 and 11 present trajectories for population, economic output, and income disparities for the Reference variant and all the other cases considered in this article.)

The Reference variant provides a benchmark for analyzing the constraints and obstacles to business-as-usual development, as well as what would be required to adopt alternative behaviors, institutions, and technologies. Figure 5 on page 26 shows some of the global demographic, economic, and resource-use patterns for this case. Although energy and water use grow far less rapidly than GDP due to the structural and technological changes described above, pressure on resources and the environment increases as the greater scale of human activity overwhelms these resource efficiency improvements. Several types of destabilizing risks can be identified. First, the cumulative loads on Earth's biogeochemical cycles and ecosystems could exceed natural assimilative capacities. This is shown by the sharp increase in emissions of carbon dioxide, which radically contradicts the climate stabilization goal of reduced emissions. There are similar problems in such areas as habitat destruction, biodiversity loss, and the accumulation of toxic chemicals in the environment.

Second, heightened pressure on natural resources could lead to economic and social disruptions or even conflicts. Without major unexpected discoveries, oil would become scarce over the next several decades, so that prices would rise and oil would again become a major theme in international affairs. Water pollution and the growing demand for water would increasingly stress renewable water resources, threaten aquatic ecosystems, and generate discord over the allocation of fresh water within and between countries. Agricultural output would need to more than double by 2050 to feed a richer and larger population, which would likely lead to further conversion of forests and wetlands, more pollution of soils and water systems, and the continued degradation and loss of arable land due to unsustainable farming practices. Unfavorable climate alterations would further complicate matters in many areas.

Third, social and geopolitical stresses would threaten socioeconomic sustainability. The persistence of poverty on a large scale and the continued inequality between and within nations (exacerbated by *environmental* degradation and resource constraints) would undermine social cohesion, stimulate migration, and put stress on international security systems. Breakdowns in sociopolitical stability could, in turn, provide the necessary conditions for authoritarianism, the flaring of regional, ethnic, and religious conflicts, and the suppression of democratic institutions--that is, for a cataclysmic leap toward Barbarization.

Depending on one's philosophical predisposition, the risks inherent in this variant of the Conventional Worlds scenario will be weighed very differently. Free-market optimists will tend to downgrade the *environmental* and social concerns, trusting in market adaptations and human ingenuity to provide timely solutions. Less ideological observers might simply believe that muddling through is less dangerous than well-intentioned but wrong-headed *policy* activism. Pessimists, distrusting the adequacy of automatic market mechanisms, would fear that business-as-usual would endanger, perhaps catastrophically, the long-range health of social and ecological systems.

Because *policy* complacency risks serious resource, *environmental*, and institutional problems, we formulated a *Policy Reform* variant that assumes strong measures at all levels of government within

the context of current values and institutional structures. This variant would require achieving three goals simultaneously: rapid economic growth, greater distributional equity, and serious protection of *environmental* quality.

The definitive statement of this vision is the report of the Brundtland Commission. This highly influential work offers a comprehensive appraisal of the "interlocking crises" threatening the future, along with an eloquent call for "a new era of economic growth, one that must be based on policies that sustain and expand the *environmental* resource base." (n9) In this formulation, greater social equity is both an ethical imperative and an objective requirement for sustainable development. In support of its various goals, the commission identified a set of policies aimed at reducing poverty, creating better management systems, and hastening the development, transfer, and deployment of environmentally friendly technology.

Do reforms of this nature actually offer a plausible path to sustainability? In practical terms, it would be an immense challenge to marshal the political will for the massive *policy* interventions required. The scope of that challenge becomes clear when one realizes the improvements in energy efficiency and shifts toward renewable energy sources that would be needed to substantially reduce the risk of climate change (see Figure 6 on page 27). Even with these changes, the concentration of carbon in the atmosphere would gradually increase over the next century to a level 25 percent greater than today's (which is already about 33 percent greater than the preindustrial level). In addition to the practical questions, however, there is a major normative consideration: This approach might achieve a sustainable world but not one that is worth living in. That is, the lifestyles and values embodied in the Conventional Worlds scenario could ultimately be deemed undesirable on social, *environmental*, or ethical grounds. A world that achieves sustainability through comprehensive *environmental* management, competition, individualism, and global homogenization might not appeal to those who treasure wild places, cooperative communities, and cultural diversity.

Barbarization

Like the Conventional Worlds scenario, the Barbarization scenario is driven by the ascendancy of global economic forces, but in this case humanity is unable to manage the resulting change and conventional institutions ultimately unravel. Perhaps the most significant element of this scenario is that the number of people living in poverty increases while the gap between rich and poor grows (both within and among countries). To make matters worse, social concern is radically downgraded as governments gradually lose relevance and power relative to large multinational corporations and global market forces. At the same time, development aid decreases and is increasingly limited to disaster relief.

A number of other consequences follow from the growing disparity in income. Inundated by global media and tourism, millions of people in underdeveloped regions become resentful of the immense differences in lifestyle between rich and poor. The poor become convinced that they have been cheated out of development and that their options have been preempted by the wealthy. This leads to strong social polarization.

With rapid population growth in the poorer regions, a huge international youth culture emerges. Numbering in the billions, teenagers around the world share remarkably similar expectations and attitudes, their consumerist and nihilist tendencies being reinforced by entertainment programs and advertising that reach every corner of the Earth. But these young people ultimately discover that the tantalizing visions of "McWorld" are largely unattainable in their current circumstances. (n10) This leads to massive waves of legal and illegal migration to rich countries (and to areas of prosperity within poor countries).

Despite some improvements in the richest countries, *environmental* conditions continue to worsen. The unfettered expansion of market-based economies leads to increased industrial activity and rising

pollution. Rapid urbanization displaces natural ecosystems and places local environments under severe stress. Deepening rural poverty accelerates soil degradation and deforestation. As fresh water becomes increasingly scarce, conflicts over water emerge among countries that share rivers. Already brittle marine fisheries collapse under the additional pressure, depriving a billion people of their primary source of protein. Climate change causes hardship for subsistence farmers in many regions. Famine becomes more frequent and more severe in Africa and elsewhere, while the response capacity of relief agencies declines. Mortality rates increase as a result of the growing *environmental* degradation, which aids the emergence of new diseases and the resurgence of old ones.(n11)

Owing to the growing socioeconomic inequality, increased morbidity, and reduced access to water, grazing land, and other natural resources, social tensions become more widespread and intense. International discord mounts due to widening disparities between regions as well as growing economic competition and the progressive decline in development assistance. People in rich countries increasingly fear that their well-being is being threatened by factors they associate with poor countries, including migration, terrorism, disease, and global *environmental* degradation. At the same time, a new type of have-not emerges as a significant factor in rich countries, namely, the educated but long-term unemployed.

As such tensions increase, the incidence of violent confrontation rises, sparked by long-standing ethnic and religious differences, politically motivated terrorism, struggles over scarce natural resources, competing nationalisms, and commercial conflicts. By and large, however, military actions take the form of multiple small-scale engagements rather than major wars. At the same time, civil order progressively breaks down as a kind of criminal anarchy prevails in many areas.(n12) These developments take an increasing toll on economic growth, causing more and more resources to be diverted to security and international investment in troubled regions to plummet. In areas of prolonged conflict, both *environmental* protection and the maintenance of infrastructure are neglected, reversing decades of progress.

Politically, a jagged pattern of city-states and nebulous regional formations emerges. Some formerly prosperous industrial countries join the ranks of the impoverished. Economic development ceases, technological progress stagnates except for efforts to provide better security for the privileged, and no individual country is able to assume a leadership role.

Like the Conventional Worlds scenario, Barbarization can assume two basic forms. In this case, the two variants differ in the degree to which the prevailing power structure--governments (individually and in alliance with others), transnational corporations, international organizations, and the armed forces--manage to maintain some sense of order. In the Breakdown variant, it is simply impossible to control the tide of violence flowing from disaffected individuals, terrorist organizations, ethno-religious groups, economic factions, and organized criminals. Civil order largely breaks down, ultimately leading to a general collapse of social, cultural, and political institutions along with the market economy. Many regions experience a return to semitribal or feudal social structures. Although population continues to grow for some time in the poorer regions (in a vicious cycle of poverty and high birth rates), it eventually decreases everywhere as mortality rates surge in response to the economic decline, infrastructural collapse, and the degradation of the resource base. In a bitter irony, equity increases because everyone is poorer. If such a breakdown were to occur, it could persist for many decades before evolution to a higher level was again possible.

In the Fortress World variant of the Barbarization scenario, powerful regional and international entities manage to impose some form of authoritarian order on the populace at large. In this variant, a well-off elite flourishes in protected enclaves (mostly in the historically rich countries) while the majority remain mired in poverty and denied basic human rights.

To preserve their access to the goods and services provided by the environment, the elite place large areas under protected status and exclude the poor from them. Along the same lines, they put strategic

reserves of fossil fuels, minerals, fresh water and germplasm diversity under military control. Pollution is kept low within the fortress by means of increased efficiency, recycling, and external dumping; outside the fortress, *environmental* conditions deteriorate dramatically.

Although the system embodied in the Fortress World variant would probably contain the seeds of its own destruction, it could last for decades if it were able to control popular unrest. Only an uprising by the outside majority could threaten it, and even then their success would probably hinge on fissures in the alliance of dominant groups.

Great Transitions

Not all alternatives to the Conventional Worlds scenario are gloomy. Indeed, it is possible to conceive of a scenario in which we would transcend the industrial culture of the present without descending into chaos. Like the previous two *scenarios*, this one has two variants. In the Ecocommunalism variant, a network of largely self-sufficient communities replaces the huge, highly interdependent institutions of the modern world. In this "small is beautiful" and biocentric vision, an ethic of voluntary simplicity and local autonomy comes to dominate. Material consumption levels fall in wealthy areas as a craft economy rises to complement production from small-scale and locally owned facilities and farms while outside economic links are minimal. Population contracts and urban centers gradually give way to town- and village-scale settlements. Proximity to nature becomes highly valued as a spiritual bond that unifies each community. Because it is difficult to imagine a pathway to this variant, this article will focus on the other variant, namely, the New Sustainability Paradigm.

The New Sustainability Paradigm balances the cosmopolitanism of a global outlook with a strong sense of community, egalitarianism, and environmentalism. Most people feel a strong affiliation with a global family as well as with their own regional and local communities. Governance systems, economic relations, and culture reflect this new multilevel perspective. The materialism of the Conventional Worlds scenario gives way to an emphasis on qualitative goals such as education, leisure, the arts, the experience of nature, service, and spiritual pursuits. The flow of energy and materials through the economy is radically reduced in wealthier areas through efficient technologies, lower-input lifestyles, and the widespread use of renewable resources. Poorer regions rapidly converge toward this revised concept of development. Values, institutions, and the very notion of the good life have indeed undergone a great transition.

How might the New Sustainability Paradigm emerge? Most likely it would be through a sequence of events such as the following: During the next few decades, the biosphere is widely perceived to be threatened by cumulative *environmental* stressors. There is growing evidence that both ecosystems and human health will suffer serious harm as certain related problems reach critical levels (examples include global warming, acidification, disease, and toxification). New insights from the science of complexity lead to greater awareness of the risk of "mega-flips" in the planetary system, that is, of massive, irreversible changes in the climate and life-support systems.⁽ⁿ¹³⁾ At the same time, governments, business, and the general public are increasingly anxious about worsening social polarization and conflict.

A new international polity emerges around these concerns and the widespread feeling that life has lost much of its meaning. The conviction grows that reliance on the profit motive to guide the economy has been environmentally and socially costly and that government has become too weak. Disenchantment with the consumerist lifestyle mushrooms, gradually affecting all groups but particularly the young. The values of simplicity, tranquillity, and community begin to displace those of consumerism, competition, and individualism. Many people opt to work (and earn) less to free up time for study, art, relationships, and myriad hobbies, crafts, sports, and other pastimes.

Almost imperceptibly, these processes slowly coalesce into a worldwide ferment of untold millions

searching for new ideals, meaning, and forms of social existence (some turn toward esoteric sects, but they are the minority). Young people around the world discover a collective identity in a new idealism that is directed toward creating a planetary community. The Internet becomes an important forum for this new consciousness, helping to forge a sense of unity. Global meetings and festivals explore the new values of equity, human rights, the environment, and spiritual and aesthetic exploration as a global network of civic groups organizes politically to promote freedom and plurality. Eventually, many communities and some regions opt for alternative lifestyles and economic practices. Some stress high-technology solutions, others prefer frugality, and still others adopt the utopian vision that small is beautiful, emphasizing the protection of the wilderness and a mystical relationship with nature. Gradually, a federation of diverse global constituencies emerges. Initially a reaction against homogenization and manipulation, it leads to a collective discussion about the destiny of humankind.

At this point, the tension between the forces of conventional development (or barbarization) and the new planetary consciousness has reached the critical moment. Progressive reconstruction then overcomes all resistance. Equity and sustainability, rather than economic growth per se, become the goals of development. Material simplicity becomes the preferred lifestyle, while ostentatious consumption is viewed as primitive and a sign of bad taste. Interestingly, some translational corporations accept (or even advocate) general limits on growth as part of the new business ethic of eco-efficiency. Others resist change, but under popular pressure governments and corporations begin negotiations for a planetary New Deal. This includes international agreements on the redistribution of wealth in the context of reduced material consumption in the rich countries. Income transfers are tied to developing countries' voluntarily reducing family size and meeting globally agreed upon *environmental* targets. New technologies for sustainability flourish as public preferences and prices shift.

Complementing the above changes, a new metropolitan vision inspires the redesign of urban neighborhoods. Integrated settlement patterns place home, work, shops, and leisure activities in closer proximity. Dependence on the automobile is reduced radically, and a sense of community connectedness is reestablished. The basis for this renaissance of diverse and secure communities is the elimination of the urban underclass, the ubiquitous signal of social distress during the previous era. For many people, the town-within-the-city provides the ideal balance of a human scale and access to cosmopolitan culture.

Small towns also become popular as communication and information technologies increasingly allow for the decentralization of activities. The migration from rural to urban areas begins to reverse as many people opt for the lower stress level and increased contact with nature offered by smaller communities. A new spirit of community is reinforced by more self-reliant production patterns (including decentralized renewable energy systems) and pride in local environments. The mall culture fades as new urban and rural alternatives underscore the sterility, hidden costs, and isolation of suburbia.

In the new economy, markets still play a major role in achieving efficiencies in the production and allocation of goods and services, but the aggregate level of economic activity is constrained by social, cultural, and *environmental* goals. In addition, the time-horizon for economic decisions is lengthened to decades to take meaningful account of ecological processes. A variety of mechanisms are used to enforce these principles, including a new tax system that discourages *environmental* "bads" and certain types of consumption as well as regulation that adheres strictly to the polluter-pays principle. Antisocial corporate behavior is further discouraged by thorough public disclosure of key information. Well-designed *environmental*, economic, and social indicators measure the effectiveness of policies, giving the public an informed basis for seeking change.

Experiments with alternative forms of governance proliferate from local to global scales. Regions and communities have considerable control over their own affairs, being constrained only by the

impacts of those decisions on others. Energy offers a good example: Local energy systems vary greatly, but all of them meet per capita greenhouse gas emissions guidelines set by global agreements. Similarly, local water management is compatible with ecosystem goals for the entire watershed from which water is drawn. Global governance is based on a federation of regions that effectively fosters cooperation, security, and *environmental* health through a rejuvenated United Nations and a truly global civil service. A fully interactive Internet offers powerful new channels for communication, education, and the democratic process, undercutting any reappearance of authoritarianism. The politics of diversity through global unity has found its natural medium.

Conflicts are resolved by negotiation, collaboration, and consensus. Armies are abolished and defense systems dismantled, and the massive peace dividend is used to speed the transition to sustainability and to eradicate the last vestiges of poverty. Economic development continues indefinitely, but it is mostly concentrated in the low-material-use realm of services, culture, art, sports, and research. A labor-intensive crafts economy rises spontaneously on the platform of the high-technology base, providing a rewarding outlet for creative expression and a dizzying diversity of highly aesthetic and treasured goods. A pervasive exhilaration about pioneering a socially and environmentally superior way of life becomes a powerful attracting force in its own right, a self-fulfilling prophecy that is able to draw the present to itself. Humanity has at last reached the end of its childhood.

Reflections from the Present

Humanity is just beginning to grasp the full meaning of sustainability and what might be required to create a truly sustainable global society. Constructing *scenarios* can be an important part of the learning process, helping to clarify the scientific, philosophical, and *policy* dimensions of this great historical challenge. *Scenarios* aid scientific research by highlighting major conceptual uncertainties and gaps in the data and by providing key parameters for the complex quantitative models of global change. As readily understandable stories about the future, *scenarios* can also alert the general public to the problems we face and the choices before us. Finally, scenario analysis can enrich the *policy* process by identifying emerging risks and required actions.

In constructing *scenarios* of the future, it will be essential to work from the bottom up as well as from the top down, that is, to consider the local, national, and regional implications of alternative *scenarios* along with the global implications. The global perspective, of course, is indispensable: It enables us to identify the forces that increasingly shape and constrain development everywhere. But the local, national, and regional perspectives offer important insights of their own. For example, an adequate strategy for sustainable development within the confines of a shared river system requires both a detailed analysis geared to the specific circumstances in the river basin and an appreciation of the ways in which larger forces can influence local *environmental*, demographic, and economic conditions.

Because most *policy* discussions currently focus on the Conventional Worlds alternative, it is natural that scenario analysis begin there. But this scenario cannot be taken for granted, any more than significant tilts toward the Barbarization or Great Transitions *scenarios* can be entirely ruled out. One need not be excessively cynical to observe troubling portents of the Fortress World outcome in the growth of the underclass, the emergence of gated communities, and the mounting social polarization of the present. At the same time, many people throughout the world are increasingly desirous of having a sustainable relationship with nature, of rejecting material profligacy and resurrecting a strong sense of community, and of finding more meaning in their lives. Although such values are at present inchoate and unsystematic, they may herald the appearance of the New Sustainability Paradigm at some point in the future.

The *scenarios* presented in this article also point to another highly important development, namely, that the destinies of the rich and poor are becoming much more tightly coupled through their sharing

of the planet's resources. Social disintegration in poor regions now threatens the security and well-being of the affluent: If they can export nothing else, the poor can export their misery through migration, crime, terrorism, and disease. This coupling of destinies means that there are no separate solutions, one for the South and one for the North. Only a truly global solution can achieve a humane and sustainable future. **Policy** discussions and planning must rise to the level of humanity as a whole as well as to that of the biosphere. The challenge for current generations is to think and act in ways that reduce social and ecological stresses while keeping future opportunities open.

NOTES

(n1.) World Commission on Environment and Development Our Common Future (Oxford, U.K.: Oxford University Press, 1987), 40.

(n2.) Earlier studies include D. H. Meadows, D. L. Meadows, J. Randers, and W. W. Behrens, *Limits to Growth* (New York: Basic Books, 1972); A. D. Herrera et al., *Catastrophe or New Society?: A Latin American World Model* (Ottawa, Canada: International Development Research Centre, 1976); M. D. Mesarovic and E. Pestel, *Mankind at a Turning Point* (New York: Dutton, 1974); H. Kahn and A. Wiener, *The Year 2000* (New York: MacMillan, 1967); H. Kahn, W. Brown, and L. Martel, *The Next 2000 Years: A Scenario for America and the World* (New York: Morrow, 1976); and G. O. Barney, *The Global 2000 Report to the President of the US: Entering the 21st Century* (Washington, D.C.: U.S. Government Printing Office, 1980). Recent studies include B. Burrows, A. Mayne, and P. Newbury, *Into the 21st Century: A Handbook for a Sustainable Future* (Twickenham, U.K.: Adamantine, 1991), L. W. Milbraith, *Envisioning a Sustainable Society: Learning Our Way Out* (Albany, N.Y.: SUNY Press, 1989); Dutch Central Planning Bureau, *Scanning the Future: A Long-Term Scenario Study of the World Economy, 1990-2015* (The Hague: SDU Publishers, 1992) U. Seven and B. Aniansson, eds., *Surprising Futures: Notes from an International Workshop on Long-Term World Development* (Stockholm: Swedish Council for Planning and Coordination of Research, 1987); F. I. Toth, E. Hizsnyik, and W. C. Clark, eds., *Scenarios of Socioeconomic Development for Studies of Global Environmental Change: A Critical Review*, RR-89 4 (Laxenburg, Austria: International Institute for Applied Systems Analysis, 1989); United Nations, *Global Outlook 2000: An Economic, Social, and Environmental Perspective* (New York, 1990); and Intergovernmental Panel on Climate Change, 1992 IPCC Supplement (Geneva: World Meteorological Organization, 1992).

(n3.) The members of the Global Scenario Group all have long experience in scenario and **policy** analysis at the global and regional levels. This article is based on the group's first report, G. Gallopin, A. Hammond, P. Raskin, and R. Swart, *Branch Points: Global Scenarios and Human Choice* (Stockholm: Stockholm Environment Institute, 1997). A forthcoming report will present the **Policy Reform** variant in considerable detail. See G. C. Gallopin, P. Gutman, A. Hammond, P. Raskin, and R. Swart, *Bending the Curve: Toward Global Sustainability* (Stockholm: Stockholm Environment Institute, forth-coming). These reports may be accessed on the World Wide Web (www.gsg.org), which also provides information on the participants in and activities of the Global Scenario Group. Primary support for the group's work comes from a grant by the Nippon Foundation.

(n4.) See P. Schwartz, *The Art of the Long View* (New York: Doubleday, 1991); S. Cole, "Methods of Analysis for Long-Term Development Issues," in United Nations Economic, Social, and Cultural Organization, *Methods for Development Planning* (Paris, 1981), 11; I. Miles, "Scenario Analysis: Identifying Ideologies and Issues," *ibid.*, page 31; and M. Godet, *Scenarios and Strategic Management* (London: Butterworths, 1987).

(n5.) See P. Raskin, M. Chadwick, T. Jackson, and G. Leach, *The Sustainability Transition: Beyond Conventional Development* (Stockholm: Stockholm Environment Institute, 1996).

(n6.) The sudden breakup of the Soviet Union is a dramatic example of a developmental

discontinuity. More gradual, but no less important, are the transition to settled agriculture and the Industrial Revolution.

(n7.) The PoleStar System is a comprehensive and flexible computer-based framework for organizing data pertinent to sustainability studies and for creating alternative *scenarios* (visit www.tellus.org/polestar.html for details).

(n8.) These assumptions are summarized in Raskin et al., note 5 above. Details may be found in P. Raskin and R. Margolis, *Global Energy in the 21st Century: Patterns, Projections, and Problems* (Stockholm: Stockholm Environment Institute, 1995); P. Raskin, P. Gleick, P. Kirshen, G. Pontius, and K. Strzepek, *Water Futures: Assessment of Long-Range Patterns and Problems* (Stockholm: Stockholm Environment Institute, 1997); and G. Leach, *Global Land and Food Supply in the 21st Century* (Stockholm: Stockholm Environment Institute, 1995).

(n9.) World Commission on Environment and Development, note 1 above.

(n10.) Se B. Barber, *Jihad vs. McWorld* (New York: Random House, 1995).

(n11.) Se J. A. Miller, "Diseases for Our Future: Global Ecology and Emerging Viruses," *BioScience* 39, no. 8 (1989): 509.

(n12.) See R. D. Kaplan, "The Coming Anarchy," *The Atlantic Monthly*, February 1994, 44.

(n13.) One possible change of this nature is the disruption of major ocean currents due to global warming. (Warmer sea surface temperatures would lead to more evaporation and increased salinity, thus hampering the downwelling necessary for currents to flow.) This could have drastic implications for humanity. Scientists already have evidence of frequent, large, abrupt (on the order of a few decades), and global cooling episodes during the last glacial period owing to sudden shifts in the operation of ocean currents. See W.S. Broecker, "Thermohaline Circulation, the Achilles Heel of Our Climate System: Will Man-Made CO₂ Upset the Current Balance?," *Science* 278 (1997): 1,582. Other insights from the science of complexity include the discovery of chaotic behavior in deterministic nonlinear systems; the possibility of self-organization in complex systems; and the existence of irreducible unpredictability in the evolution of complex systems. See G. Nicolis and I. Prigogine, *Exploring Complexity: An Introduction* (New York: W. H. Freeman, 1989); and M. M. Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon & Schuster, 1992).

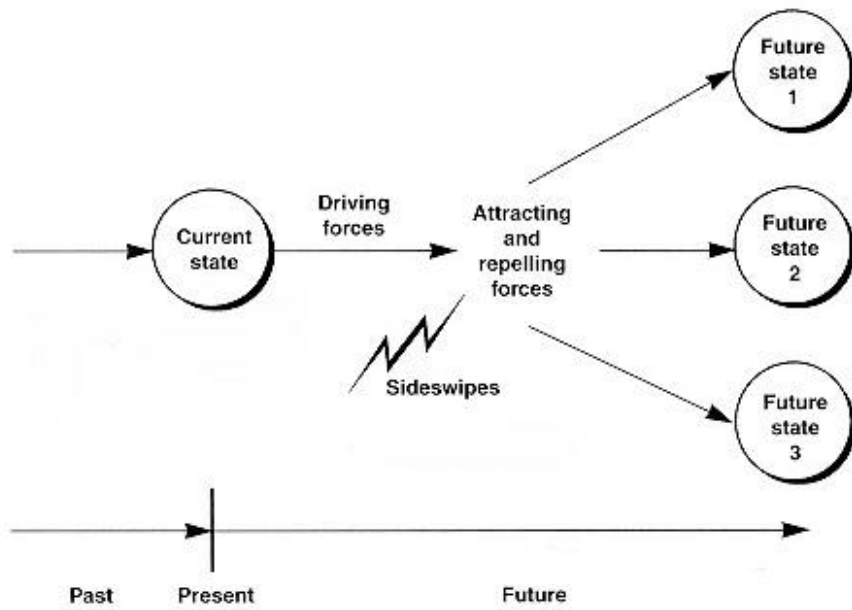


Figure 1. Elements of a scenario

Scenario	Population	Economy	Environment	Equity	Technology	Conflict
Conventional Worlds						
Reference	↗	↗	↘	↘	↔	↔
Policy Reform	↗	↗	↔	↔	↗	↘
Barbarization						
Breakdown	↖	↖	↘	↗	↘	↗
Fortress World	↖	↖	↘	↔	↔	↗
Great Transitions						
Ecocommunalism	↖	↖	↗	↗	↗	↘
New Sustainability Paradigm	↖	↖	↗	↗	↗	↘

SOURCE: G. C. Gallopin, A. Hammond, P. Raskin, and R. Swart, *Branch Points: Global Scenarios and Human Choice* (Stockholm: Stockholm Environment Institute, 1997).

Figure 2. Scenario overviews

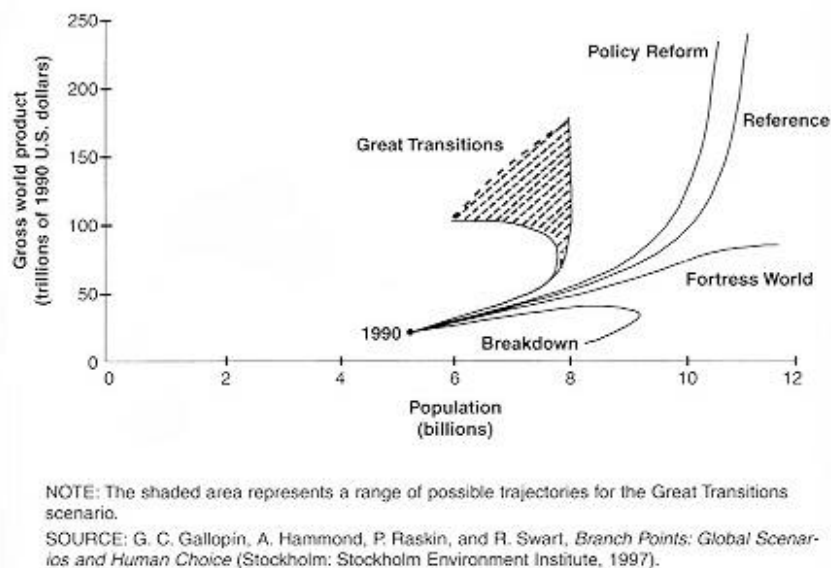


Figure 3. Economic output and population patterns, 1990-2100, by scenario

GRAPH: Figure 4. Incomes in poor and rich areas, 1990-2100, by scenario

GRAPH: Figure 5. Global patterns in the Conventional Worlds-Reference scenario

GRAPHS: Figure 6. Energy consumption patterns in the Conventional Worlds scenario

ILLUSTRATION

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