

# **EARTH AT RISK**

**An Environmental Dialogue  
between Religion and Science**

*edited by Donald B. Conroy and  
Rodney L. Petersen*



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## **DENYING THE EVIDENCE** **Science and the Human Prospect**

*Timothy C. Weiskel*

### **THE EVIDENCE FROM THE NATURAL SCIENCES**

**T**he evidence from the natural sciences is by now pretty clear. Humankind is facing major adjustments and perhaps dramatic reversals in the coming decades as the cumulative affects of resource constraints, population growth, and global environmental change begin to register in our daily lives.

What used to be an occasional warning from a lonely prophetic figure like Harrison Brown, Paul Ehrlich, Garrett Hardin, Lester Brown, or Herman Daly has now become a veritable chorus of voices repeating largely the same basic theme: if human societies do not change their patterns of energy use, material consumption, and reproductive behavior, life for many humans and other species as well in the twenty-first century is likely to be nasty, brutish, and short.<sup>1</sup> In 1992 a group of over one hundred Nobel Laureates reiterated this message in a document called "World Scientists' Warning to Humanity," declaring quite plainly that

human beings and the natural world are on a collision course.  
Human activities inflict harsh and often irreversible damage on

both the environment and on our critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about.<sup>2</sup>

The Nobel Laureates were not alone in the scientific community to voice concern. In February 1992 the Royal Society of Great Britain and the National Academy of Sciences issued a common statement reflecting their anxiety about present trends of human development and environmental transformation.<sup>3</sup> Addressing themselves specifically to those who think that "thanks to science" humankind can overcome the constraints of the natural systems in which our societies are imbedded, these sober scientists issued a sober reminder that technological optimism may be misplaced.

Scientific and technological innovations, such as in agriculture, have been able to overcome many pessimistic predictions about resource constraints affecting human welfare. Nevertheless, the present patterns of human activity accentuated by population growth should make even those most optimistic about future scientific progress pause and reconsider the wisdom of ignoring these threats to our planet. Unrestrained resource consumption for energy production and other uses, especially if the developing world strives to achieve living standards based on the same levels of consumption as the developed world, could lead to catastrophic outcomes for the global environment.<sup>4</sup>

It is hard to imagine a more stark presentation of the crisis. Terms like "irreversible damage" and "catastrophic" are not normally employed in the staid vocabulary of professional scientists. One can only assume that they have been moved to such extreme expression by the gravity of the situation at hand. However, despite these repeated warnings it does not appear that the public at large is gripped by a sense of crisis or convinced that radically different forms of behavior are required of them in the immediate future.

While the United Nations Conference on Environment and Development (UNCED), known as the "Earth Summit," succeeded in 1992 in drawing up an impressive list of concerns and ambitious proposals for action on a number of important environmental issues, it appears that little has been done since then to reverse worrisome global trends of deforestation, desertification, soil loss, carbon consumption, and human population growth. Industrial countries are openly conceding that they are not likely to meet the agreed targets of reducing carbon consumption to 1990 levels by the year 2000, and without substantial progress in that realm it seems unrealistic to expect developing countries to bear the brunt of global carbon constraints while all parties seem to agree it would be a good idea. Nearly five years after the UNCED gathering in Rio de Janeiro, a sense of discouragement was palpable among global environmental leaders. A Reuters reporter captured the mood at the conclusion of a the recent World Conservation Conference in a brief report in October 1996:

Maurice Strong, . . . Secretary-General of the United Nations Conference on Environment and Development four years ago, told reporters that despite lofty promises made in Rio de Janeiro, the developed world was renegeing on its commitments. During a news conference after a panel discussion at the World Conservation Congress, a ten-day gathering of 2,000 environmental specialists, Strong said the global environment was still deteriorating. "We have not made the fundamental change of course that the Rio [Conference] indicated was absolutely essential if we are going to have a sustainable future in the twenty-first century," Strong said.<sup>9</sup>

## TRouBLING QUESTIONS FOR THE SOCIAL SCIENCES

This state of affairs presents social scientists with major problems of explanation. The basic question is simply this: What accounts for this massive and pervasive social somnolence?

Other questions cascade forward from this basic puzzle. How

can modern society have become so systematically ignorant of or indifferent toward the catastrophic fate that surely awaits it? How could we have been so thoroughly anesthetized to our objective condition? Have any other societies ever faced parallel circumstances? What was their history of perception and reaction to similar crises? How can we have drifted into such a state of collective amnesia and denial? Can contemporary societies hope to learn anything from the ecological dynamics surrounding the growth and subsequent collapse of former civilizations in time to avert similar forms of catastrophe?

These are, admittedly, big questions, ones rarely asked by professional social scientists in these days of controlled microresearch and heightened academic specialization. Yet unless these "macro" questions are focused upon and answered with clear analysis, widespread debate, and collective understanding, social scientists will have little to contribute to preserving the human prospect in the years and decades to come.

Perhaps the first question to pose ourselves is this: How is it that professional social scientists could lose sight of these big issues? There is no doubt that for several decades in the twentieth century—until perhaps the seminal work of Fernand Braudel—doing research on questions of large-scale social change and writing "Grand History" to account for society-wide delusions was considered bad form for a professional social scientist.<sup>6</sup>

This had not always been so. A century ago Grand History was still a flourishing pastime. It seemed especially popular among the elite classes of the reigning imperial powers of nineteenth-century Europe. Indeed, much of modern social science traces its foundation to the early attempts at grand sociohistorical synthesis that sought to discover the origins of social forms and customs from kinship, to marriage, to religion or the state. In accord with the overarching metaphor of evolution which dominated nineteenth-century thought, nineteenth-century scholars of social form sought to account for human history in one or another unilinear scheme of progressive transformation. Fustel de Coulanges, Lewis Henry Morgan, Karl Marx, Frederick Engels, Henry Sumner Maine, and

Johann Jakob Bachofen all elaborated histories predicated on a succession of putative "stages" through which they thought humankind had developed to its present state.<sup>7</sup>

The trouble with these early, ingenious, and intricate schemes was that they were largely conjectural. Apart from the allusions to classical texts and the odd reference to travelers' accounts, evidence for the grand assertions of these armchair theorists was scanty. They had, in effect, engaged in the writing of "pseudohistories," the specifics of which had far more to do with the particular social theories that each thinker was seeking to forward than they did with any verifiable circumstances in the remote or recent past.

Early twentieth-century social science abandoned the historical mode of explanation precisely in order to distance itself from the embarrassing excesses of conjectural pseudohistory. A few masterful European intellectuals continued to pen broad historical narratives, working feverishly to write what might be called "total" or "totalizing" histories of the world. Oswald Spengler's *The Decline of the West* (1926–28) and Arnold J. Toynbee's magisterial twelve-volume *A Study of History* (1934–61) were perhaps the two most famous attempts to try to integrate the newly available historical evidence of the twentieth century within an overarching scheme of historical interpretation. The scope and grandeur were on the scale of the work of Edward Gibbon (1737–74) a century and a half earlier in *The History of the Decline and Fall of the Roman Empire*, and their sweep of historical generalization was every bit as grand even if their data was understandably more massive and complex.<sup>8</sup>

While these works and other big surveys—like that of the history of philosophic thought by Will and Ariel Durant<sup>9</sup>—were fascinating reading for the general public, professional historians and social scientists generally avoided them. Professionals preferred instead to undertake more precise and delimited research monographs on subjects where the historical documentation or social data could be more adequately "controlled." Grand History—if engaged in at all—was something to be done in private, on one's own time, or perhaps at the end of a career when one's colleagues might forgive a dottering mind a wistful glance over the shoulder at the big picture.

Indeed, in the feverish specialization that characterized American academe during the postwar boom of economic and educational expansion, big questions were studiously avoided. Interdisciplinary work was regarded with suspicion, as if it might detract from both the growing budget and the disciplinary loyalty that was expected within each academic department. As one scholar observed, it was commonly acknowledged that an academic discipline was simply "a group of scholars who had agreed not to ask certain embarrassing questions about key assumptions."<sup>10</sup> In this manner, the big questions were shunned. Instead, individuals advanced their academic careers through hyperspecialization and honed more and more narrow forms of expertise on particular subjects, "keeping-all-other-things-equal."

## THE REFOCUS UPON MACRO-HISTORICAL PROCESS

Although this hyperspecialization of social science has proved dysfunctional for our understanding of our current global circumstance, it still persists. Much of the institutional momentum that drove hyperspecialization and the reward structure that produced disciplinary myopia from the 1950s through the 1980s is still very much with us in the universities of the 1990s. Those who established their careers in this earlier period are now in the process of selecting their professional successors, so it is hardly surprising that powerful forces still persist in working to perpetuate this narrowness of vision.

Nevertheless, countertendencies are emerging as well. For purely intellectual reasons, if not for structural ones, it is now becoming more and more apparent that disciplinary boundaries and the departments that enshrine them often function as a threat to necessary inquiry and productive synthesis. Hence, despite institutional pressures that discourage it, there is growing evidence that social scientists are beginning once again to ask the large questions about macrohistorical and metahistorical processes: How do societies, cultures and civilizations emerge? What enabled past civiliza-

tions to flourish? Why did they prove to be so ephemeral—lasting, at most, a few hundred years? Can anything be learned from the sadly repetitive syndromes of growth, expansion, and collapse that have characterized one civilization after another?

Perhaps the urge to answer these questions stems from a mounting sense of precariousness and impending resource decline in our own culture. Or perhaps it is simply that the cumulative evidence, gleaned from decades of painfully detailed archaeological and textual analysis, seems to cry out for an effort to synthesize the newly found material. Whatever the origins for the impulse, it is clear that social scientists are now turning once again with renewed interest and refined methodology to examine processes of metahistorical social transformation.

Two major developments have encouraged the renewed focus on metahistorical processes in recent years: first, the elaboration of laboratory techniques that can be applied to archaeological and historical artifacts; second, the adoption of computer technology for record keeping and data analysis, which has revolutionized the conduct of historically focused social science. These technologies have allowed archaeologists, culture historians, and anthropologists to reexamine a whole range of questions that had for a long time fallen out of intellectual favor.

In particular, new and scientifically meaningful statements now can be made about the circumstances surrounding the emergence, efflorescence, and subsequent collapse of ancient civilizations. As the investigation proceeds the ratio between available data and interpretive generalization shifts, and tentative hypotheses become more and more robust with the tests of more comprehensive sets of data. Macrohistorical questions—those dealing with transformations over long periods—now can be meaningfully addressed. Similarly, metahistorical questions—those dealing with the controlled comparison between civilizations—can be posed with new rigor.

## NATURAL SCIENCE, SOCIAL SCIENCE, AND HISTORICAL ECOLOGY

Emerging from this process is a new level of understanding about historical ecology and human affairs. In effect, the stark distinction between what is "natural science" and what is "social science" has begun to fade as insights from each field are used to further the understanding of the other. What is emerging might be referred to as the natural history of human cultures or the historical ecology of social formations, or, more broadly, an understanding of human cultures in the full context of their socioecological evolution.

It is useful to highlight some of the major ways in which a combined natural and social science study of the past can enlarge our understanding of our current circumstance. In particular, historical ecology has emerged as a powerful new field of research synthesis, yielding insights in the realms of (1) climate change and its impact in human history; (2) the origins and ecological impact of urbanization; (3) paleopathology and historical epidemiology; (4) the ecology of colonialism; and (5) the complex circumstances accompanying the collapse of ancient civilizations. Each of these subject areas of historical ecology deserves brief mention.

1. *Climate History and Human Affairs*: The availability of new techniques, including deep-sea sediment core sampling, dendrochronology, limnology, glaciology, and palynology have enabled scientists to reconstruct regional and localized climate sequences, in some cases with a considerable degree of precision, for periods stretching back as far as tens of thousands of years. Because of the complexity of weather phenomena, modeling the global shifts in past climates is considerably more difficult, but as more and more dispersed data is being acquired and correlated, the broad shape of previous climate regimes is being clarified.

The results of climate research suggest several middle-level empirical generalizations that seem both simple and profound. They are simple in the sense that in light of the evidence they seem like straightforward commonsense conclusions. The observations

prove profound, however, when juxtaposed with our contemporary circumstances and the evident folly of common practice and current assumptions in many areas of public policy formulation and popular belief.

Most generally, and perhaps most sobering, is the observation from scientific research that local and regional climates have in the past changed dramatically in relatively short periods of time. These radical shifts have resulted at times in massive, costly, and sometimes traumatic disruption to the infrastructure and patterns of livelihood of cities, regions, and entire civilizations. Just how local alterations in weather have been related to an overall pattern of global climate change is the subject of considerable debate, but periods of rapid climatic shift in particular regions are now beginning to be understood in greater detail.

Because humans and their domesticated plants and animals need a continuous supply of water, shifts in rainfall volume, its periodicity, and its spacial distribution have proved to be some of the most powerful parameters affecting the limits of human social organization. It may not be of much significance that average global climate measures have not varied a great deal in the last 10,000 years because the determinative questions in human affairs have been not so much the mean annual parameters of the system as a whole, but rather the particular performance of localized weather regimes. Reid Bryson and Thomas Murray have demonstrated in a short volume entitled *Climates of Hunger* that some climates—particularly those in the Mediterranean region and the Middle East—have experienced climate fluctuations with major social consequences. More disconcerting still is the realization that large portions of humankind may well have become *even more*—not less—vulnerable to regional climatic perturbation over the course of human history.<sup>11</sup>

This observation may at first seem counterintuitive because of many popular myths about the nature of social evolution in human groups. For a long time in academic circles and popular understanding, the whole combination of changes known as the “agricultural revolution” was thought to have *liberated* humankind from

direct dependence upon nature and its seemingly random fluctuations. We now know that this was not so. The whole package of socioecological changes associated with the agricultural revolution may have changed the scale and scope of human dependence on nature, but it did not *liberate* humankind from nature in any meaningful sense. Scientific research increasingly confirms what common sense and the logic of ecosystems suggest in this instance, and that is simply this: by domesticating selected plants and animals and basing subsistence production on this radically narrowed range of species, humans effectively narrowed their ecological "nicewidth." Henceforth humans were all the *more* subject to the localized perturbations of nature since relatively minor fluctuations could be devastating for the radically narrowed range of tolerance that characterized the domesticates themselves when compared to the wild species.

In effect, human groups became tied to an econiche defined by the tolerance properties of their own domesticates. By mastering plant and animal reproduction humans had become slaves to agricultural production and victims of crop vulnerability. Shortage or excess of rain or merely relatively slight variations in its periodicity and distribution could have devastating impacts upon particular regions. In coming to depend upon domesticates for their food supply, humans had put "all their eggs into one basket"—or, at any rate, a very few baskets. While paleopathological evidence of prehistoric foraging populations suggests that they, too, suffered occasionally from periodic severe nutritional stress, due most probably to drought, the incidence of severe or chronic malnutrition *increases* in absolute terms with the emergence of urban-based agriculture. As archaeologist Mark Cohen has recently concluded, "evidence from both ethnographic descriptions of contemporary hunters and the archaeological record suggests that the major trend in the quality and quantity of human diets has been downward."<sup>11</sup>

2. *Urbanization: New Patterns of Dependence on Nature*: One highly adaptive short-term response to the fluxes of production caused by variable weather conditions in the agricultural econiche was for human groups to hyperproduce storable agricultural commodities

during favorable periods to be able to ride through times of climatic duress. Dessicatable grains including barley, wheat, rice, and sorghum proved most amenable to this kind of accumulation. But once again, by concentrating a high proportion of their activity on the production of these select few domestic species, human groups were not liberated from nature but rather became, in a collective sense, all the more subject to its cycles and variations.<sup>13</sup>

It is probable that one of the reasons why this increased *collective* vulnerability to variations in natural processes has not been widely recognized or commonly understood is that the social adaptations accompanying the agricultural revolution masked the collective costs of the transformation. In effect, new social hierarchies made it possible to distribute nutritional stress in a highly differential manner. Elite groups, upon whom we have depended for accounts of the past and whose skeletal remains have been most carefully preserved, were not among those to have been most severely affected by the new patterns of vulnerability. It was peasants and commoners who probably suffered most severely when natural perturbations diminished food supplies. Until recent paleopathological techniques made it possible to examine their collective plight, our archaeological sample has been skewed in favor of the experience of societal elites. It is hardly surprising that for those classes that benefited most from the new social arrangements, conditions of life improved. For these groups there may well have been a sensation of being "freed" from dependence upon nature, but it would be a major conceptual error to mistake their experience for that of the social collectivity as a whole.

Considered in intervals of decades and centuries, the social groups that proved most successful under this new structure of dependence upon nature were those that could (1) mobilize the labor necessary to overproduce foodstuffs in favorable times; (2) devise effective mechanisms of storage and distribution for deferred consumption; (3) defend and protect *both* their arable land and their accumulated food stocks; and (4) organize labor to construct and maintain artificial environments that served to buffer or regulate fluctuations in water supply so as to deliver it to the simplified

range of domesticates at optimum times for plant growth. Each one of these selective pressures and their mutual interaction over time combined to create a powerful positive feedback loop that favored the rapid growth of hierarchically organized urban societies.

Henceforth cities constituted a major new chapter in the ecological experience of humankind. The intricate dynamics of urban-rural relationships have restructured natural landscapes for millennia ever since the advent of the first urban centers in the ancient world. The urban-rural dynamic is predicated upon an asymmetrical exchange between cities and their supporting countryside. In terms of the flow of matter and energy, cities can be said to be parasitic upon their surrounding countryside. Urban-based elites with no direct experience of agricultural production repeatedly gain inordinate influence over the disposition and control of production decisions in rural areas. These urbanized elites came to exercise this power for a series of strategic reasons relating to their functional role in exchanging, storing, or distributing produce, their managerial role in mobilizing periodic labor *corvées*, their adjudicative role in settling disputes, their ceremonial role in presiding over religious activities, or their military role in defending strategic territory or possessions. The particular combination of roles played by various urban elites in different cultures varied considerably, but their overall relation to rural populations was strikingly similar.

As long as these powerful urban elites recognized and respected the natural limits of the ecosystems of the rural populations upon which they ultimately depended, periods of stable production could endure. Sadly, however, urban-based decisions concerning the rate and nature of resource extraction in rural areas were frequently made with little knowledge or understanding of the limits of rural production systems. The long-term results could be repeatedly catastrophic, engendering cycles of urban growth and collapse, which in turn left whole ecological regions permanently transformed.

3. *Paleopathology and the Natural History of Disease.* There has been another major and enduring ecological consequence of the urban revolution. The evolution of cities afforded new opportunities for the growth, transmission, and chronic persistence of pathogens that

came to use humans and their domesticated species as hosts. In effect, by congregating in cities and engaging in intense local interaction combined with periodic long-distance exchanges with other cities, humans created the ideal conditions for the evolution and expansion of various kinds of bacteria, viruses, parasites, and pests.

As with common myths about agriculture "freeing" humankind from the domination of nature, so, too, it is in the study of disease. It should not be blithely assumed that the health of human populations has simply improved in some sort of uniform or progressive manner since the emergence of sedentary agriculture, the evolution of social complexity, and the elaboration of systematic scientific theories about natural process. To be sure, the development of the microbial theory of disease in this past century has transformed the ecology of human existence in our time, but this change is quite recent in human history and may well prove to be ephemeral in the long run.

In any case, new evidence from archaeologists seems to support the conclusion that many forms of degenerative and lethal diseases were not reduced over the course of culture history but actually emerged along with the growth of civilization. Europeans in this regard may have been until recent times some of the most diseased populations in history. Archaeologist Mark Cohen concludes his work on *Health and the Rise of Civilization* by emphasizing that "we must substantially revise our traditional sense that civilization represents progress in human well-being—or at least that it did so for most people for most of history prior to the twentieth century. The comparative data simply do not support that image."<sup>14</sup> He goes on to point out that our misunderstandings have followed largely, as in the case of nutrition, from the problem of over-representing the case of the privileged classes and from simply projecting our expectations backwards on the basis of an assumed continuum of human improvement.<sup>15</sup> It is, thus, clearly a mistake to portray the history of the world in general as simply an anterior projection of unfortunate European circumstance.

4. *Historical Ecology of Colonialism*: With a new sensitivity to historical epidemiology, colonial historians have begun to focus upon

the ecology of colonialism in considerable detail. The progression of human colonial enterprises—especially those that emerged from the expansion of Europe since the Renaissance—is often well documented from a sociopolitical point of view. After all, groups set out with explicit intentions that often had to be justified to royal sponsors, state treasuries, or joint-stock companies. Nevertheless, the effort to give an ecological account of colonial phenomena is relatively recent.

In biological terms, of course, the notion of colonization has long been understood as a particular type of biological process having to do with the arrival of exogenous species in new environments or the radical simplification of existing environments and the subsequent restoration of plant and animal communities over time. Forest fires, volcanoes, and receding ice sheets all create circumstances that allow for the colonization of newly created or radically altered environments by invading life forms. Biologists have studied the processes of plant and animal colonization quite independently of human involvement or intentionality for decades.

At this point, social scientists are beginning to examine the insights of these biological studies to analyze colonizing episodes in human history. The results of this new approach to human history are often quite disturbing. Although humans may be very powerful agents in the biological processes that constitute colonialism, they rarely understand the scope or magnitude of their complex role as they proceed to act. It is only years, decades, or centuries later that the underlying patterns of biological and ecological interaction become strikingly apparent.<sup>16</sup>

In broad terms it now seems clear that although colonial episodes frequently can be quite profitable in economic terms, they equally often are likely to be ruinous to localized environments in ecological terms. The nature of the colonial enterprise determines the character of the devastation involved. Some colonial endeavors are based on straightforward resource extraction like mining, timbering, rubber tree tapping or Brazil nut collection. Others involve the explicit attempt to expand the agricultural production of a selected foodstuff or cash crop species. In these instances, massive

soil erosion and the subsequent siltation of rivers and sedimentation of estuaries can frequently create an enduring and devastating ecological signature of colonialism. In still other instances, the importation of exogenous crops and their expanded production—either on newly created plantations or as part of widely dispersed peasant communities—can also substantially transform agricultural land-use practices in very short order.<sup>17</sup>

One of the most alarming phenomena associated with the ecology of colonialism is the syndrome known as “plant genetic collapse”—a patterned sequence of biological transformations that leads to the radical simplification or total extinction of indigenous animals and plant genetic material. Rarely is it the explicit intention of human groups in charge of colonial efforts to destroy or render extinct local species, yet it is equally rare for them to avoid doing so in practice. The process often involves the agronomic displacement of local varieties of food-stuffs in favor of exogenous or putatively “improved” crop varieties which show exceptional economic promise. Local agricultural plant varieties—many of which represent specific adaptive advantages for pest resistance or extreme weather tolerance—can become extinct simply through the neglect of the peasant communities that have found the newly introduced varieties more desirable or immediately profitable under new market conditions.

In the context of the current forms of international aid this kind of progressive biological impoverishment can be the net result of even the most noble assistance program, if careful attention is not given to the socioecological impact of the aid program. In some instances, aid programs seek to extend the cultivation of plant varieties that have been selected specifically to grow best in petro-intensive environments with artificial fertilizer subsidies and the concomitant application of herbicides and pesticides.

In the short run, provided that all the required petroleum inputs are continuously available, the crop in question may do quite well for several years. In the longer run, however, local varieties may have passed completely out of cultivation through neglect, thus impoverishing the range of agricultural variety in the region. In addition, the topsoil and groundwater regimes may have been sig-

nificantly altered and sometimes poisoned with the petrochemicals and fertilizers. Moreover, even when the new petro-intensive cultivars prove entirely successful with minimal off-farm impact, the local populations that grow them are henceforth committed to purchasing petroleum inputs. As petroleum becomes more expensive, their operating costs are bound to increase, sometimes beyond the level that they can afford in order to stay in farming.

Finally, with such highly specialized systems installed for the newly "improved" varieties, farmers lose the flexibility necessary to respond to changing weather and climate conditions. Irrigated rice can only be sustained if irrigation systems have water to run through them. If the rivers or rains fail, farmers are often forced off the land altogether, either into famine centers and refugee camps or off to the urban centers in search of other employment. Once peasants in this circumstance have left the rural regions for the cities, there is a high probability that their farming skills and their expertise concerning local crops and cropping techniques will be lost forever. Third World urban centers are growing at rates that outstrip their already high population growth rates, and many of these cities in Africa and elsewhere can only be sustained with constant food subsidies from western agricultural surpluses.

The cumulative effect of the innumerable local transformations resulting from the ecology of colonialism has been to mold the world's agricultural production systems in several distinctive ways. Increasingly, Third World agricultures have come to focus on producing cash crops for export while these same countries have become dependent upon higher and higher levels of foodstuff imports. The industrialized countries for their part are correspondingly addicted to a pattern of foodstuff overproduction and export to earn foreign exchange, while they continue to import cash crops from tropical countries. The impact of this global food web on the soils, forests, water quality, and water supply has been in many cases devastating to local ecosystems in *both* the Third World and in the rural areas of the industrialized world. Roy Rappaport summarizes the linked and asymmetrical character of the global situation from his observations as a field anthropologist and suggests that the

future biological stability of such a radically simplified and hypercoherent global food system is by no means assured: "The anthropocentric trend I have described [e.g., redesigning all local ecosystems primarily to meet *human* needs] may have ethical implications, but the issue is ultimately not a matter of morality or even of *Realpolitik*. It is one of biological viability."<sup>18</sup>

5. *The Decline of Ancient Civilizations*: The accelerated deterioration of colonial ecosystems in the contemporary world has encouraged some historians to reexamine long abandoned questions about the decline and fall of ancient civilizations. The seeming ubiquity of the syndromes of decline in the Third World suggests that similar syndromes of deterioration may well have been operative in other periods of history. While "decline and fall" speculations in the past were heavily grounded in ideological and philosophic argumentation, now historians come armed with new scientific data and computer models to interpret that data. General climate models have been used to clarify the agro-climatological conditions of past civilizations as they enter collapse phases. In one instance, scholars have applied analytical techniques similar to those used by Jay Forrester, Donella Meadows and others in their early presentations to the Club of Rome concerning *The Limits to Growth* in order to model the parameters of the collapse of Classical Mayan civilization.<sup>19</sup>

The results of these modeling attempts and other comparative studies in decline are mixed, as one might expect from early stages of any investigation.<sup>20</sup> Nevertheless, two suggestive insights emerge from the whole range of recent studies on the collapse of ancient civilizations. First, civilizational decline and collapse seem to involve syndromes of accelerated deterioration caused by multiple feedback processes; second, in times of crisis the "intelligentsia" in ancient cultures (taken here to mean all those included in the urban-based elites) may well have failed to perceive the crisis at hand and may have actually contributed to systemwide collapse by blindly pursuing fallacious and quite partial remedies to systemwide problems or simply by projecting their own special interests as those of the general public.

Material circumstances and ecological constraints played a fundamental role in the circumstances leading up to the decline of civilizations, but also important as syndromes of collapse got underway were two further factors that might be considered "ideological" in nature. On the one hand the accelerating nature of the complexity in the system as a whole exceeded the perceptual apparatus of the elites that were supposed to act as regulators or governors of systemic process. In general systems terms, the information mechanisms necessary to trigger the negative feedback processes that would stabilize the system failed to function properly. In a sense their "science"—that is, their ability to observe, integrate, synthesize, and explain events—lagged behind the quickening pace of the events themselves.

Beyond this, the social capacity for cooperation that would have been required in any attempt to reverse the syndromes of decline was itself strained beyond its level of tolerance. Anthropologists have pointed out that initially a crisis situation can engender improved social cooperation in small-scale groups, but after certain thresholds of heightened or prolonged stress social groups tend to fragment, as each special interest tries to make the best of a declining circumstance for itself and its immediate allies.<sup>21</sup> The intelligentsia and the religious elites are no exception to this pattern. Indeed, their self-interested arguments are often the most thoroughly dysfunctional for the crisis at hand, yet they are proposed in the heightened rhetoric of systemwide necessity and absolute virtue. Lowe summarizes a salient case of this kind of behavior, drawing upon the Classical Mayan material. Briefly, according to his understanding of the archaeological data, it is clear that the Mayan ritual priesthood actually functioned to accelerate the Classical Mayan collapse by reacting inappropriately to a circumstance of declining agricultural production. The priests were thought to mediate between humans and the gods to assure agricultural productivity. When the agricultural system began to decline, however, the priests sought to extract greater and greater taxes from the peasantry in order to undertake heightened sacrificial activity.<sup>22</sup>

## CONCLUSION

These observations from the study of historical ecology resulting from a combined synthesis of natural and social science research suggest some very sobering insights about our current ecological predicament. To begin with, it is clear that several major tenets of our modern public belief system now require substantial revision. Contrary to popular belief, for example, from an ecological point of view the development of agriculture in human history did not "free" humankind from its dependence on nature. On the contrary, the development of the agricultural econiche has restricted the range of plant species upon which humans came to depend and made them collectively more vulnerable to the variations of nature, perturbations of climate, and new forms of crop blights and pestilence.

Moreover, since the benefits of agricultural production were not uniformly distributed, poorer classes were often the first to suffer constraints in time of scarcity. Prolonged urban settlement also led to the emergence of endemic and epidemic diseases, often striking those classes that were under most nutritional stress.

Furthermore, it is clear that the urban elites that came to dominate the sociopolitical structures of these agricultural societies did not always clearly understand the ecological limits or precariousness of their circumstance. In ecological terms cities have always proved to be parasitic upon their supporting rural peasantries. As biologists have emphasized, however, parasitism is a delicate position to maintain over time. While there is by definition an asymmetrical flow of goods and services in parasitic relationships, there nonetheless has to be enough vitality remaining in the supporting population for the system to remain viable. If parasitism deteriorates into a predator-prey relationship, the entire structure can collapse quickly.

In other words, if urban elites failed to impose some restraints on their growing power over the lives of rural populations, it was frequently the case that they preyed upon these populations beyond the point of sustainability. Either they attempted to extract more surplus

than the land itself would generate or they sought to squeeze peasants beyond the point that they would endure. In either case, when urban-rural relationships shifted from parasitism to predator-prey relations, the entire social system frequently experienced upheaval.

The combination and interaction of all of these factors has meant that human history since the advent of urban organized agriculture has been a turbulent affair, marked by recurrent famine, disease, pestilence, and open warfare. Humans have, in effect, fashioned for themselves what ecologists would call a "hypercoherent" ecosystem—that is to say, a system which is so tightly interwoven that any shift in its external parameters or internal components can have rapid, disequilibrating and potentially destructive consequences for the system as a whole.

The human population is no more secure than its food supply. In spite of its technological capacities and marvelous industrial achievements, our contemporary society remains in a very important sense an agricultural society. We may think we are a postindustrial society with a postmodern culture, but there is simply no such thing as a postagricultural society. Despite our dazzling technological achievements, we have not transcended the natural world in any significant sense. Indeed, we have made our societies ever more vulnerable to any systemwide shifts in its parameters—some of which, like the climate, we may already be altering by our patterns of unsustainable consumption.

If the social sciences have anything enduring to contribute to understanding our current predicament, it is that our system of public belief is in radical need of revision if we are to survive as a species. The myth that continuous growth is both good and possible is ubiquitous in the public sphere in our day. It is a blind and worshipful obedience to this article of public faith that misdirects our public policy and makes us incapable of formulating the kind of measured policies of self restraint that are called for by scientists and environmental leaders alike.

## NOTES

1. Occasional warnings about localized population growth and resource constraints have been made ever since the seminal work of Thomas Malthus in the late eighteenth century. In the modern era, a small number of social and natural scientists began to focus on the global nature of these problems in the 1950s and 1960s. See particularly: Harrison Brown, *The Challenge of Man's Future: An Inquiry Concerning the Condition of Man during the Years That Lie Ahead* (New York: Viking Press, 1954), and his book *The Next Hundred Years: Man's Natural and Technological Resources* (New York: Viking Press, 1957); Paul Ehrlich, *The Population Bomb* (New York: Ballantine Books, 1968); Garret Hardin, *Nature and Man's Fate* (New York: The New American Library, 1959), and his *Biology: Its Principles And Implications* (San Francisco: W. H. Freeman, 1966); and Lester R. Brown, *Man, Land, and Food: Looking Ahead at World Food Needs* (Washington, D.C.: U.S. Department of Agriculture, Economic Research Service, Regional Analysis Division, 1963).

By the 1970s the number of warnings increased, particularly in conjunction with the United Nations' first environment conference in Nairobi, Kenya in 1972. See Paul R. and Anne H. Ehrlich, *The End of Affluence: A Blueprint for Your Future* (New York: Ballantine Books, 1974); Herman Daly, *Steady-State Economics* (San Francisco: W. H. Freeman, 1972); and his edited volume *Toward a Steady-State Economy* (San Francisco: W. H. Freeman, 1973); see also Donella H. Meadows et al., *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind* (New York: Universe Books, 1972); and Lester Brown, *Population and Affluence: Growing Pressures on World Food Resources* (Washington, D.C.: Overseas Development Council, 1973), *In the Human Interest: A Strategy to Stabilize World Population* (New York: Norton, 1974), and *The Global Politics of Resource Scarcity* (Washington, D.C.: Overseas Development Council, 1974).

The recent scientific statements of alarm of the 1990s are largely extending, refining, and amplifying the warnings that have been made by these early prophetic voices since the 1950s.

2. Union of Concerned Scientists, introduction to *Scientists' Warning to Humanity* (Cambridge: UCS, 1992).

3. The Royal Society and the United States National Academy of Sciences, *Population Growth, Resource Consumption, and a Sustainable World* (issued February 1992), from the preface by Sir Michael Atiyah, President,

The Royal Society of London and Dr. Frank Press, President, The U.S. National Academy of Sciences. This report was issued by these scientific bodies in preparation for and anticipation of the United Nations Conference on Environment and Development (UNCED), held in June 1992 in Rio de Janeiro.

4. Royal Society and the National Academy of Sciences, "The Reality of the Problem," section of the *Population Growth* report.

5. "Earth Summit Pledges Abandoned, Official Says," *Reuters*, October 1996, published in *ENN Daily News*, 21 October 1996.

6. The French social historian Fernand Braudel is the exception to the trend toward microspecialization. He drew upon and extended the *Annales* school of social research in France and focused his attention upon what he termed *l'histoire de la longue durée*—"long-term" or "large-scale" history. This corresponds to what we refer to here as "Grand History." More than any other single historian he has drawn the attention of social scientists back to the "big questions" of the persistence and transformation of cultural forms in the face of constraint throughout history. For example, much of the research by the American sociologist Immanuel Wallerstein and his associates and students on "world-systems theory" has been undertaken at the Fernand Braudel Center for the Study of Economies, Historical Systems and Civilizations, established at the State University of New York at Binghamton in tribute to Braudel's lifelong work. Braudel's numerous works include *The Mediterranean and the Mediterranean World in the Age of Philip II* (New York: Harper & Row, 1972-74); *Capitalism and Material Life, 1400-1800* (New York: Harper & Row, 1973); *Méthodologie de l'histoire et des sciences humaines* (Toulouse: Privat, 1973); and *The Structures of Everyday Life: the Limits of the Possible* (New York: Harper & Row, 1981).

7. Most notable of these grand theories of the stages of human progression were those of Lewis Henry Morgan, *Ancient Society* (Tucson: University of Arizona Press, 1985); Fustel de Coulanges, *La cité antique* (Paris: L. Hachette et cie, 1870); Henry Sumner Maine, *Ancient Law: Its Connection with the Early History of Society, and Its Relation to Modern Ideas* (London: J. Murray, 1866); and Karl Marx himself. See particularly Karl Marx and David McLellan, *Marx's Grundrisse* (London/New York: Macmillan, 1980).

8. Oswald Spengler, *The Decline of the West*, trans. Charles Francis Atkinson (New York: A. A. Knopf, 1926-28); Arnold Joseph Toynbee, *A Study of History* (London: Oxford University Press, 1934); Edward Gibbon, *The History of the Decline and Fall of the Roman Empire* (London: Printed for W. Strahan and T. Cadell in *The Strand*, 1776).

9. Will and Ariel Durant, *The Story of Civilization*, 11 vols. (New York: Simon and Schuster, 1935).
10. Mark Nathan Cohen, *Health and the Rise of Civilization* (New Haven: Yale University Press, 1989), p. viii.
11. Reid A. Bryson and Thomas J. Murray, *Climates of Hunger: Mankind And the World's Changing Weather* (Madison: University of Wisconsin Press, 1977).
12. Cohen, *Health and the Rise of Civilization*, p. 132.
13. *Ibid.*, p. 134.
14. *Ibid.*, p. 141.
15. *Ibid.*
16. See in particular Alfred W. Crosby Jr., *The Columbian Exchange: Biological Consequences of 1492* (Westport, Conn.: Greenwood Press, 1972); and his *Ecological Imperialism: The Biological Expansion of Europe, 900-1900* (New York: Cambridge University Press, 1986).
17. For more detailed discussions of these rapid transformations, see Timothy C. Weiskel, "Agents of Empire: Steps Toward an Ecology of Imperialism," *Environmental Review* 11, no. 4 (1987): 275-88; "Toward an Archaeology of Colonialism: Elements in the Ecological Transformation of the Ivory Coast," in Donald Worster, ed., *The Ends of the Earth: Perspectives on Modern Environmental History* (New York: Cambridge University Press, 1988), pp. 141-71; and "The Ecological Lessons of the Past: An Anthropology of Environmental Decline," *The Ecologist* 19, no. 3 (May/June 1989): 98-103. In addition, see Timothy C. Weiskel, *Environmental Decline and Public Policy: Pattern, Trend, and Prospect* (Ann Arbor: Pierian Press, 1992), chaps. 2-4.
18. *Ibid.*
19. D. Hosler, J. A. Sabloff, and D. Runge, "Simulation Model Development: A Case Study of the Classic Maya Collapse," in *Social Process in Mayan Prehistory*, ed. N. Hammond (London: Academic Press, 1977), pp. 553-84. See Donella Meadows, *Limits to Growth*, for elaboration of the dynamic systems model used as a basis for this study.
20. See John W. G. Lowe, *The Dynamics of Apocalypse: A Systems Simulation of the Classic Maya Collapse* (Albuquerque: University of New Mexico Press, 1985); Joseph A. Tainter, *The Collapse of Complex Societies* (New York: Cambridge University Press, 1988); and Norman Yoffee and George L. Cowgill, eds., *The Collapse of Ancient States and Civilizations* (Tucson: University of Arizona Press, 1988).
21. For a more extended discussion of both the tendencies toward a

decline in objective perception and the collapse of social cooperation, see *Environmental Decline and Public Policy*, chapter 5; and Charles D. Laughlin Jr. and Ivan A. Brady, "Introduction: Diaphasis and Change in Human Populations," in *Extinction and Survival in Human Populations*, ed. Charles D. Laughlin Jr. and Ivan A. Brady (New York: Columbia University Press, 1978), pp. 1-48.

22. Lowe, *The Dynamics of Apocalypse*, p. 98. Lowe's work is based upon that of D. Hosler, J. A. Sabloff, and D. Runge, "Simulation Model Development," and their work draws in turn upon that of G. R. Willey and D. B. Shimkin, "The Maya Collapse: A Summary View," in *The Classic Maya Collapse*, ed. T. P. Culbert (Albuquerque: University of New Mexico Press, 1973), pp. 63-115.