Creeping Environmental Problems

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Lessons learned by studying incremental, low-grade, cumulative, and long-term biospheric changes induced by human activity may help governments avoid costly crisis management.

In our daily lives we are constantly bombarded with bad news about the environment, some of it of a global nature and some at the local level, usually related to urbanization. For the most part, these problems—including air pollution, acid rain, global warming, ozone depletion, tropical deforestation, desertification, droughts, famines, and the accumulation of nuclear and solid waste—are the result of low-grade, long-term, and cumulative processes.

Such problems, which can be called creeping environmental problems (CEP), cut across disciplines and continents. At a recent workshop supported by the National Center for Atmospheric Research and the UN Environmental Programme, experts came from many countries to share their experiences in dealing with a host of CEP. In addition to those CEP mentioned earlier, other topics included coastal pollution, mangrove destruction, skin cancer, and soil erosion. Countries represented included the United States, Canada, Ethiopia, Morocco, South Africa, Russia, Uzbekistan, Australia, and Brazil.

Although the range of problems represented at the conference was quite broad, participants identified some common characteristics. One major feature is that with CEP, conditions are not much worse today than yesterday; nor is the rate or degree of change tomorrow likely to be much different than that of today. So, societies, including both individuals and government bureaucracies, are for the most part unable to see changes that would prompt them to interact with their environments differently than they had before. Yet, these incremental changes in environmental conditions accumulate over time, with the result that, after some threshold has been crossed, the imperceptible increments of change have added up to a major degradation. If no action is taken, as is usual, those incremental changes will continue to mount until a full-blown crisis emerges.

Many changes to the environment do not appear detrimental in their early stages. If those changes were stopped early in the process, they would likely never develop into or be perceived as environmental problems, let alone crises. Such a change might be regarded not as degradation but as transformation. For example, the destruction of a small part of a mangrove forest in Southeast Asia to create a shrimp pond (an example of transformation) would not necessarily signal a stage in the destruction of the forest ecosystem. If, however, shrimp ponds were to be constructed continually and in great numbers in the same locale, then the mangrove forest as a thriving ecosystem would eventually be destroyed.

For each of the various CEP, there is an identifiable threshold (maybe identifiable only after the fact), above which continued “business as usual” will most like-
ly lead to destruction of an ecosystem. However, thresholds are easier to talk about than to detect, especially in advance. In addition, there are several kinds of thresholds with regard to CEP: the first, problem awareness, relates to awareness that an ongoing environmental transformation has become an environmental detriment and hence a problem; a second threshold, crisis awareness, relates to the realization that the problem has reached a crisis stage; a third threshold, action, relates to a concerted effort to cope with the problem. Because these problems derive from low-grade, slow, and cumulative environmental changes, it is not easy to identify objective indicators of thresholds. Hence thresholds are often identified based on subjective factors.

This article focuses on the need to recognize how pervasive CEP are and to identify thresholds, although they would likely vary from one region to another even for the same type of environmental degradation. Societies should not necessarily be blamed for inaction on environmental change before the critical threshold of awareness has been crossed and change becomes recognized as degradation. But once degradation has been recognized, government consideration of the environmental change should be undertaken. This presents a dilemma: when to take action to slow, stop, reverse, or eradicate CEP.

Close scrutiny of a variety of known CEP could be instructive.
in identifying purely objective ways to recognize thresholds before they appear.

_Some examples of CEP_

**Decline in Aral Sea level.** The Aral Sea in Central Asia has declined more than 14 meters (45 feet) since the early 1960s because of increasing amounts of water being diverted from the region's two major rivers, the Amu Darya and the Syr Darya, to irrigate expanding cotton production. Environmental problems were openly acknowledged by the Soviet government in the mid-1980s as a result of Mikhail Gorbachev's policy of glasnost (openness). His government appealed for assistance from the international community. Many point to the threshold of awareness when glasnost exposed the problem. Yet, potential problems associated with major expansion of irrigated cotton agriculture in Central Asia were identified in the early 1960s by some outspoken Russian scientists, as witnessed by their articles in the Journal of Soviet Geography. The truth of the matter is that several signs of degradation could have been viewed as thresholds of awareness and crisis: the Syr Darya's failure to reach the Aral Sea in the late 1970s; the increase in frequency and intensity of dust storms originating in the newly exposed dried seabed along the Aral's southeastern shore; and the increasingly large diversions of water from the rivers. Yet none of these thresholds triggered action, and even today the threshold of substantial action on the dying Aral Sea has not been reached.

_Stratospheric ozone layer depletion._ The threshold of awareness of chlorofluorocarbons (CFCs) as a potential stratospheric ozone-eater was reached in the mid-1970s. Problem identification was followed by a ban on CFC use in aerosol cans by some countries in the late 1970s (among them, the United States and Scandinavia). Some countries (for example, the United Kingdom) actively sought to dis-
At the Earth Summit in mid-1992, a threshold of global action was reached.

credit the ban on CFCs. There was little interest in banning CFC use in refrigerants and foam-blowing agents; as no substitutes were available or even on manufacturers' drawing boards. In the mid-1980s, as scientific information began to accumulate, the problem was acknowledged openly and even by some previously adamant key opponents to CFC reduction. As the threshold of world-level action was reached, the Vienna Convention and Montreal Protocol were accepted in 1985 and 1987, respectively.

Desertification. Societies have coped with erosion by wind and water, salinization of soils, and waterlogging from the beginning of civilization. However, the concept of desertification, which encompasses all of these processes, was introduced in 1949 by Henri Aubreville in his classic book, Climate, Forests and Desertification of Tropical Africa. The problem of desertification was formally acknowledged on an international scale by the United Nations at its Conference on Desertification in 1977 in Nairobi. Since then, however, little out of the ordinary has been accomplished by attempts to combat desertification made by the donor community and affected governments. Interest in desertification heightens during periods of extended drought in arid and semiarid areas, only to wane when the drought passes. At the Earth Summit in Rio de Janeiro in June 1992, African governments demanded a desertification convention. Through international negotiations the threshold of action was reached, so that efforts to develop such a framework are currently in progress.

Global warming. The scientific community is concerned that the burning of fossil fuels, along with other human activities, is producing greenhouse gases (carbon dioxide, methane, CFCs, and nitrous oxides) in amounts that could alter the global climate. Although the threshold of awareness that this environmental change was a possible problem was first approached in the mid-1890s, again in the mid-1930s, and yet again in the mid-1950s by various scientists, each time the idea was dismissed by the scientific community. Even if human-induced climate change had been considered a possibility, it was not seen as an environmental evil but as either a potential good that would thwart the onset of the next ice age or as an interesting, value-neutral human experiment with the atmosphere.

It was not until the mid-1970s that scientists reached a crisis-awareness threshold and began to ask if global warming could have negative consequences for societies around the globe. The 1980s saw a rise in media and political interest in the issue. At the Earth Summit in mid-1992, a threshold of global action was reached and a framework climate convention, developed during the previous few years, was initiated by many governments. The convention came into force on March 21, 1994, with the necessary 50 countries agreeing to abide by its provisions.

Tropical deforestation. Concern was raised about the fate of the Amazon rain forest and the Indians who inhabit it during the 1960s as highways were constructed across the region. Assessments of tropical deforestation were undertaken by the Food and Agriculture Organization in the 1970s, and these appeared with articles referring to deforestation as an environmental problem. It was the rapid deforestation rates in Rondônia, as pictured by remotely sensed satellite imagery showing herringbone patterns of dirt roads amid virgin forest, that led to the threshold of crisis awareness. In addition, the misstatement that
after the threshold of crisis awareness. With the green revo-
lution in the 1960s and '70s, it
was felt that agricultural produc-
tion would become buffered from
the vagaries of weather and cli-
mate fluctuations. Yet, with all
our advanced technologies and
food-production methods, famines
still occur. It seems that most
famines result from problems
stemming from the interplay
between drought and human con-

flict. Governments may prefer to
deal with famines rather than the
underlying causes at the root of
the chronic hunger that precedes
the famine. To deal with hunger
requires readjustments in politi-
cal, economic, and cultural power
within a society. Making such
readjustments, however, is more
difficult for governments than
ending a specific famine.

What are CEP?

So far, we have suggested that
not all environmental changes
are degradations; some can be
viewed as transformations. We
have also suggested that there is
a threshold, most likely only iden-
tifiable in retrospect, beyond
which the environmental change
as-degradation becomes appar-
ent. One could argue that before
that threshold is reached, a gov-
ernment cannot be chastised for
not taking action. Once the envi-
ronmental problem has been
exposed, however, the govern-
ment has an obligation to address
it.

Clearly, there are differences
The rising concentration of greenhouse gases like carbon dioxide is a product of global, collective, and highly complicated human intervention. Whether the fires are from the burning of wood for heating and cooking in China (right), or from a chemical plant in France (below right), the carbon dioxide released is the same.

in the time scales during which CEP take place: Global warming and ozone depletion occur on a time frame of decades to centuries; deforestation and desertification take place from years to decades; famines and droughts occur over a period of months to a few years. So, the policymaker’s argument that he avoids acting on global warming or ozone depletion because the consequences are likely to appear in the middle of the next century (that is, so far into the future that there is no need to worry now) cannot realistically be used by national and international bureaucrats whose job is to prevent famine around the globe. The impact of the CEP is but months away when they recognize the possibility of famine.

Each of these CEP has some degree of scientific uncertainty surrounding it, which inevitably blurs the clarity of thresholds of crisis awareness and global action. Generally speaking, there will always be uncertainty surrounding many of these environmental issues. For example, the latest challenge has been to desertification estimates, with scientists suggesting that areas affected by desertification have decreased in the 1980s. Even with regard to ozone depletion, an issue on which most scientists agree, a small but vocal backlash group has emerged. Thus, for most CEP (global warming, ozone depletion, desertification, and tropical deforestation) there has been a backlash, a minority voice, often loud, that plays up what scientists do not know as opposed to emphasizing what they do know.

To the public, policymakers, and the media, such interactions within the scientific community—which verge on open combat in professional journals, the newspapers, and the electronic media—tend to weaken the resolve of those from whom action
is expected. In other words, one can find in the scientific literature viewpoints as well as numbers with which to support or attack any policy action.

Associated with these CEP is a spatial-scale dimension. These problems may be global in cause (greenhouse gas emissions), global in effect (ozone-layer depletion), or global in concern (desertification). With regard to global warming, every society produces greenhouse gases, whether in fueling industrial metabolism or cooking with firewood and charcoal. With regard to the production of ozone-depleting CFCs, only a score or so of corporations are responsible for their production, although stratospheric ozone is depleted globally. Desertification can be shown to be a national problem, with desertified areas going right up to but not across some straight-line or jagged international borders. But the photos of desertified areas and their impact on human populations in sub-Saharan Africa, for example, have captured the attention of people worldwide.

**Why do they continue?**

An improved understanding of the CEP process and societal responses would enable us to deal with such problems in an optimal way, that is, before a costly crisis response becomes the only option. However, we must be careful not to reduce the reasons why CEP continue to only one factor, as many interactions can foster environmental degradation. It would be fairly easy to reduce the primary reasons for government inaction on CEP to one of a variety of disciplinary views, including economics (for example, high discount rates for the future or short-term profit over long-term environmental degradation); politics (avoidance of coping with environmental problems that most voters do not consider important or bureaucratic inertia); and psychology (discounting the future; lack of a dread factor; perception of risk; and selective inattention). Each of these perspectives will provide insights into how societies deal with CEP. However, taken alone, each disciplinary view would provide an incomplete picture, and action based on that viewpoint would most likely lead to insufficient coping responses with regard to CEP.

There are many excuses or reasons for not taking action. As noted earlier, reasons often heard with regard to global warming are its time scale and the scientific uncertainty surrounding the issue. Yet, policymakers are constantly making decisions on issues of distant impact that are tainted with varying degrees of uncertainty regarding outcomes and impacts. Scientific uncertainty should not be an excuse for issue avoidance.

Another factor affecting governmental responses to CEP is that most environmental problems do not affect an entire country in a visible way. As a result, only people who are directly confronted by the local environmental degradation directly concern themselves about it, and government is likely to accord a low priority to addressing the problem.

Yet another constraint on timely societal responses to CEP involves “dread factors.” Unless a populace fears the consequences of a CEP and those consequences have some perceived high probability of occurring, little action will likely be taken. The recent history of the global-warming issue is instructive. There have been several attempts to identify dread factors to prompt political action to arrest emissions of greenhouse gases. For decades, beginning in the 1890s, scientists viewed global warming resulting from coal burning as a positive thing, staving off the imminent return of an ice age. Therefore, although environmental change was recognized, it was not seen as a problem.

In the mid-1970s, modeling experiments were proposed using four times the preindustrial level of carbon dioxide. It turned out that the scenario was highly unlikely, and the experiments were dropped. The next fear was of a doubling of preindustrial levels of carbon dioxide. Although there was really nothing significant about a doubling, the idea became something of a dread factor.

In the late 1970s, scientists raised the possibility of a breakup of the west Antarctic ice sheet, which would raise the sea level about eight meters. Further scientific research sharply reduced
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the likelihood of such an event.

Another apparent dread factor was suggested by Wallace Broecker of the Lamont-Doherty Earth Observatory, who wrote about abrupt changes in ocean currents. Occurring over a period of a few decades in response to a warmer atmosphere, such changes would disrupt regional and global climates.

In the global-warming issue, the search for thresholds of awareness, if not crisis, continues. As previous dread factors have not panned out, a small community of disbelievers or naysayers represents a backlash against the issue. This controversy notwithstanding, governments are cooperating through the Intergovernmental Panel on Climate Change (IPCC).

We must also realize the possibility that for such "invisible" issues as global warming (where changes in climate at a regional or local level might not be proof of global climate change) or ozone depletion (in the absence of an ozone hole), some CEP may not yield a readily identifiable threshold of change in advance. As Vice President Gore often states, "We are not unlike the laboratory frog that, when dropped into a pot of boiling water, quickly jumps out. But when placed in lukewarm water that is slowly heated, the frog will remain there until it is rescued."

Can we do anything?

Societies must identify ways to cope with CEP, not only those affecting their own countries but those in other nations as well. In the process of assessing CEP, we should focus on strengthening the scientific capability of people at the local level, so they can deal with their own environmental problems. This will enable Third World scientists to join their colleagues in developed countries in addressing these insidious environmental changes. Creeping environmental problems must be directly challenged if governments are to have hope of achieving sustainable development. The overriding purpose of elucidating the nature of CEP and the human response to them is to aid governments and societies in making timely and wise responses to CEP. In this way, the governments may be able to avoid being forced into costly and crippling crisis management, for which many are ill prepared.

The Russian proverb "Tears alone will not solve the problem," on this poster in Uzbekistan, refers to the CEP of pollution from industrial metabolism.

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