2008

The Social Feedback Loop

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Published As: Steven A. Kolmes (2008) The Social Feedback Loop, Environment: Science and Policy for Sustainable Development, 50:2, 57-58, DOI: 10.3200/ENVT.50.2.57-58
http://dx.doi.org/10.3200/ENVT.50.2.57-58

Climate change impacts on worldwide sustainability of communities have been a focus of attention in Environment's pages and elsewhere. In their recent article, "Climate Change Vulnerabilities and Responses in a Developing Country City: Lessons from Cochin, India" (June 2007), Thomas J. Wilbanks, J. Timothy Ensminger, and C. K. Rajan referred to assessing "stresses on city systems and processes." In another article, "The U.S. Hurricane Coasts: Increasingly Vulnerable?" (September 2007), Susan L. Cutter, Laurie A. Johnson, Christina Finch, and Melissa Berry described the Social Vulnerability Index (SoVI) and the relationship of population demographics, poverty, aging infrastructure, and the SoVI in terms of hurricanes reaching our coasts.

According to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, positive feedback loops—self-accelerating nonlinear processes such as decreased carbon dioxide uptake by the oceans as they warm—are responsible for much of the critical uncertainty about the future rate of climate change.[1] Worst-case scenarios, in which multiple positive feedback loops engage early and powerfully, project temperature and sea-level changes that would be difficult to mitigate with any imaginable level of resources. While these scenarios include a wide range of environmental feedback loops, they generally have not acknowledged that social disruption initiated by climate change, especially in the developing world, can itself generate a distinct positive feedback loop leading to self-accelerating rates of societal disintegration.

Reduction of snow and ice threatens to reduce water supplies for drinking and agriculture in many parts of the world, including the Himalayas and the Andes. This reduction in available water is estimated by the IPCC to affect between 75 million and 250 million people in Africa alone by 2020.[2] Unless man- aged with assiduous attention to the needs of all local user groups, this could pit stakeholders ever more against one another as water supplies diminish, making a cohesive society ever harder to maintain. Similarly, self-accelerating social upheaval could accompany projected sea-level rise and increasing numbers of powerful hurricanes/cyclones in Bangladesh, the Nile Delta, and elsewhere, where displacement of millions of environmental refugees is probable.[3] The newest IPCC projections are that sea level will rise between 0.4 and 1.4 meters, even if we succeed according to their most optimistic scenario for 2050 in reducing global greenhouse gas emissions (between 50 and 85 percent below 2000 levels). This provides a virtual certainty that a significant number of environmental refugees will become a reality.[4] Mass movements of environmental refugees could enormously stress infrastructure in their own countries and neigh- boring ones and could produce a widening swath of unlivable territory. As rainfall patterns shift and petroleum production becomes less stable, the biofuel industry's demand for biomass feedstocks—a concern discussed by Rosamond L. Naylor and colleagues in their recent article, "The Ripple Effect: Biofuels, Food Security, and the

Environment" (November 2007)—could increasingly compete with the need for food. Farm products from destabilized agricultural systems, especially in developing nations (stressed by reductions in available irrigation water and increasing fuel prices) could either be distributed relatively equitably or become a catalyst for increasing strife between the hungry and the affluent. The IPCC estimates that rainfed agriculture in Africa may experience reductions in crop yields of up to 50 percent by 2020,[5] and warmer nighttime temperatures have been shown experimentally to significantly diminish the yields of current varieties of rice crops upon which more than two billion humans depend.[6]

It is conceivable that while this positive feedback toward social disintegration occurs in the developed world, wealthy developed nations could experience a mirror-image negative feedback loop. The IPCC Fourth Assessment Report notes that mitigation actions (for example, replacing old coal-fired power plants with clean alternative energy sources) could reduce pollution-related health care costs and act as "near-term co-benefits" that offset the effects of the mitigation costs.[7] A decreased need for society to invest in expensive health care, as air pollution was diminished by mitigation efforts, would be a stabilizing influence counteracting the original societal stress of carbon mitigation demands. On another front, agricultural productivity may be buffered from climate change by the intensive research into temperature-tolerant and drought-resistant crop varieties now under way at agricultural research stations and universities worldwide. Given sufficient resources and will to carry out large-scale carbon mitigation and adaptation actions, human society could find substantially increased levels of opportunity for entrepreneurship, employment, and innovation. As the IPCC Fourth Assessment Report states, "Both bottom- up and top-down studies indicate that there is high agreement and much evidence of substantial economic potential for the mitigation of global GHG emissions over the coming decades that could offset the projected growth of global emissions or reduce emissions below current levels."[8] An era of investment in new energy technologies would provide opportunities that could conceivably spread over all strata of a society.

An informed discussion of global climate change science already recognizes the characteristics of several scientifically based positive feedback loops. Societal destabilization, especially in the developing world, ought to be acknowledged as another potential positive feedback loop, so that we can plan for an uncertain future with a realistic assessment of the consequences of alternative policy decisions. Preventing a social disintegration positive feedback loop from becoming a dominant force among vulnerable populations as the new century progresses must be made a clear priority. The IPCC recognizes that adaptive capacity is unevenly distributed across and within societies. One expression of this is the fact that carbon adaptation and mitigation efforts might act as a negative social feedback loop stabilizing societies (or affluent components of societies) in the developed world, while an incapacity to carry out these actions could produce a positive feedback loop tending toward social disintegration in the developing world (or disadvantaged components of societies in the developed world). We need to find a global vision of mitigation and adaptation actions that overcomes the uneven distribution of adaptive capacity and amounts to what Richard N. L. Andrews discusses as the common good in his article, "Learning from History, U.S. Environmental Politics, Policies, and the Common Good" (November 2006). As he notes, "[S]trong protective policies for the common good have

occurred only under unusually strong and visionary leadership (as under Theodore Roosevelt and Franklin D. Roosevelt, for instance) or in response to intensively mobilized public demand (as in the recent environmental era), which often emerges in response to crises and is itself inherently difficult to sustain."

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