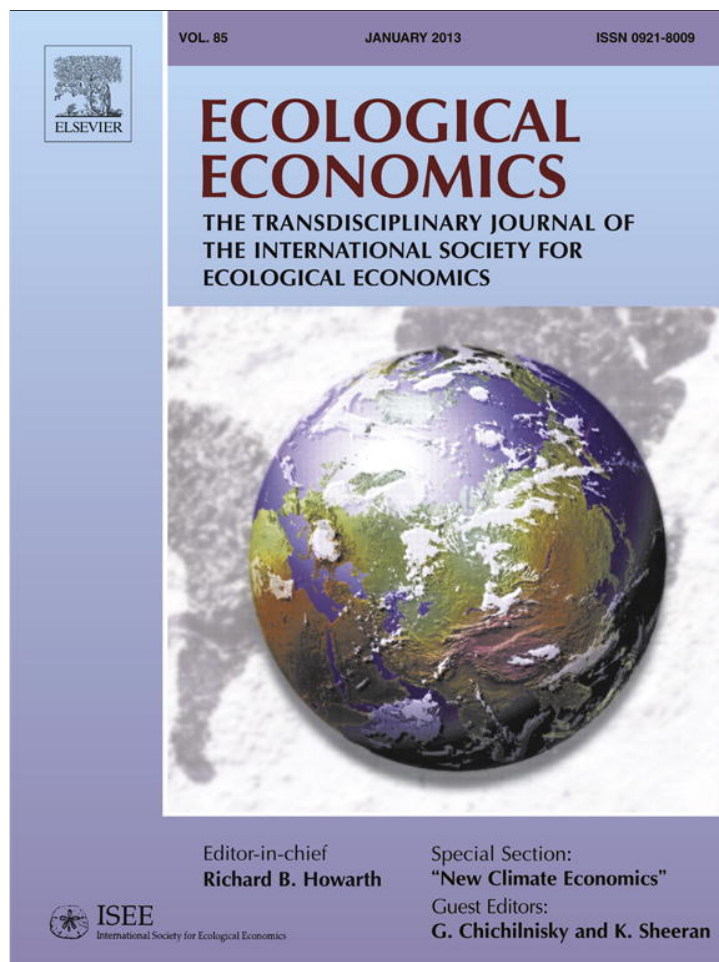


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# Ecological Economics

journal homepage: [www.elsevier.com/locate/ecocon](http://www.elsevier.com/locate/ecocon)

## Introduction

# A changing climate in economics: Responses to crisis

## 1. Introduction

The world economy is facing a series of unprecedented crises. The financial crisis that started in 2007 still grips the world economy. Climate change achieved horrific immediacy when Hurricane Sandy hit New York City in October 2012, engulfing millions of people and bringing a proud city – the financial center of the world – to its knees.

Climate change is not only transforming our physical world, but also our intellectual, social and even moral worlds. The common element in all this is the global economy, which is the root cause of the financial crisis as well as of climate change. The scale of the global economy and its demands on the Earth's source and sink functions endanger the life support systems that sustain us. Through our economic activities, humans are altering the planet's basic metabolism, ushering in a new geological era, the Anthropocene, and creating a legacy that will be read in rock formations for thousands of years to come.

It is not surprising that, as our economic activities are changing the globe, we ourselves face a crisis of economic values. This special issue of *Ecological Economics* addresses the new economics that must emerge if we are to transform from a crisis ridden world to a more resilient and sustainable world in the future.

Climate change is potentially catastrophic. Recent experiences with extreme weather – Hurricane Sandy, historic drought in the U.S. heartland, horrific wildfires in Australia, and the disappearance of Arctic ice – are wake-up calls to the dangers we are potentially unleashing through our fossil fuel use. The financial crisis of 2007 and subsequent global recession are a wake-up call that the global economy needs rethinking and restructuring. In both cases, economics has demonstrated itself inadequate to the charge of responding to systemic crisis. Some are led to question capitalism in response to crisis – but the fault may actually lie in our own limited view of economics. The economic and ecological realities of the twenty-first century demand new economic thinking.

New global financial institutions have emerged to confront the global risks we face. The carbon market of the Kyoto Protocol, which is now trading \$215 Bn/year, has demonstrated significant potential to decrease emissions in the EU ETS nations. This approach has now spread to four continents, most recently, the California mandatory carbon market that started in 2012. The list of successes, however, is too few given the urgency of the civilizational challenges we face.

Progress on global negotiations to reduce greenhouse gas emissions is undermined by the failure of economics to frame the risks appropriately and to answer the urgent concerns of poor nations and vulnerable people in rich nations about the costs of climate change and how the costs of a transition away from fossil fuels will be shared. The integrated assessment models (IAMs) that economists typically use to analyze the expected costs and benefits of climate

policies frequently suggest that the “optimal” policy is to go slowly and to do relatively little in the near term to reduce greenhouse gas emissions. This finding, however, is at odds with recent advances in climate science, and can be traced to contestable out-of-date assumptions in economics. At the same time, we are making slow progress in resolving the conflicts between developed and developing nations that were so evident in Copenhagen COP 15, Cancun COP 16 and Durban South Africa in COP 17 in December 2011. Resolution will be near impossible without new approaches to thinking about global equity, competitiveness, and national security.

Progress on climate protection is slow, in part, because we are caught between the economics of the past and the future in a moment of rapid social, economic, and ecological changes. This special issue highlights innovative research in economics that has the potential to move national policy agendas and international negotiations beyond the current impasse.

The first article by Julie Nelson issues the challenge of a new economics directly to economists. “Ethics and the Economist: What Climate Change Demands of Us” argues that climate change is changing not only our physical world, but also our intellectual, social, and moral worlds. It forces the recognition that our situation is profoundly unsafe, interdependent, and uncertain. What, then, does climate change demand of economists, as human beings and as professionals? The author argues that a discipline of economics based on Enlightenment notions of mechanism and disembodied rationality is not suited to present problems. This essay suggests three major requirements: first, that we take action; second, that we work together; and third, that we focus on avoiding the worst, rather than obtaining the optimal. The essay concludes with suggestions of specific steps that economists should take as researchers, teachers, and in our other roles.

The second article by Serban Scriciu, Terry Barker and Frank Ackerman is “Pushing the Boundaries of Climate Economics: Critical issues to consider in climate policy analysis,” argues that climate policy choices have been unduly influenced by climate economic models that model the costs and benefits of alternative strategies for climate action. These modeling efforts, which purport to be purely scientific, rest on a series of choices about: the values and assumptions underlying the economic analysis; the methodologies for treating dynamics, technological change, risk and uncertainty; and the assumed interactions between economic systems, society and the environment, including institutional constraints on climate policy. The authors identify and discuss such critical issues, pushing at the boundaries of current climate economic research. They argue that new thinking in this area is gathering pace in response to the limitations of traditional economic approaches, and their assumptions about economic behavior, ecological properties, and sociotechnical responses. They place a particular emphasis on the role of induced technological

change and institutional setups in shaping cost-effective climate action that also promotes economic development and the alleviation of poverty.

The third article in this special issue is by Frank Ackerman and Elizabeth A Stanton and it describes a new model, Climate and Regional Economics of Development (CRED), which is designed to analyze the economics of climate and development choices. Entitled "CRED: A New Model of Climate and Development", its principal innovation is the treatment of global equity, calculation of the optimum interregional flows of resources, and use of McKinsey marginal abatement cost curves to project the cost of mitigation. The unconstrained, optimal climate policy in CRED involves very large capital flows from high-income to developing countries, to an extent that might be considered politically unrealistic. Under more realistic constraints, climate outcomes are generally worse; climate stabilization requires either moderate capital flows to developing countries, or a very low discount rate. In CRED, more equitable scenarios have better climate outcomes; the challenge of climate policy is to persuade high-income countries to accept the need for both international equity and climate protection. The article ends with an agenda for further model development. A technical appendix describes the model relationships and parameters in greater detail.

In "Game Theory and Climate Diplomacy" Stephen DeCanio and Anders Fremstad tackle the complexity of international cooperation on climate change, starting with a "New Periodic Table" (NPT) of  $2 \times 2$  order games, introduced by Robinson and Goforth (2005), and provide an exhaustive treatment of the possible game-theoretic characterizations of climate negotiations between two players (e.g., Great Powers or coalitions of states). Of the 144 distinct  $2 \times 2$  games in which the players have ordinal ranked utilities, 25 are potentially relevant to climate problem. The negotiations may be characterized as a No-Conflict Game, Prisoner's Dilemma, Coordination Game, Chicken, Type Game, or Cycle, depending on the structure of the payoff matrix. Which game corresponds to the actual state of the world depends both on the severity of risks associated with climate change and the perceptions of the governments engaged in the negotiations. Nash equilibrium or Maxi-min equilibrium (or neither) may be the outcome. They show that achieving universal abatement of greenhouse gas emissions may require side payments or enforcement mechanisms outside the game framework, but negotiations themselves may offer opportunities to select between Nash equilibria or alter the payoff rankings and strategic choices of the players.

In "Distributional biases in the analysis of climate change" Peter Skott and Leila Davis explain that the economic analysis of global warming is dominated by models based on optimal growth theory. They argue why these representative-agent models have an intrinsic distributional bias in favor of the rich. The bias is compounded by the use of 'revenue-neutrality' in the allocation of emission permits. The result is mitigation recommendations that are biased downwards.

The last article in this special issue is "Valuing life: experimental evidence using sensitivity to rare events" by Olivier Chanel and one of

the editors, Graciela Chichilnisky. This article argues that global environmental phenomena like climate change, major extinction events or flutype pandemics can have catastrophic consequences, but catastrophes are either ignored or underestimated in standard economic decision theory under uncertainty that emerged from the theoretical structure introduced by Von Neumann and Morgenstern. By assessing the outcomes involved and their probabilities – especially those concerning human life – the standard economic theory of choice under uncertainty is supposed to yield optimal decisions. However, the widely used expected utility theory values life in terms of the low probability of death someone would be willing to accept in order to receive extra payment. Common sense and experimental evidence refute this way of valuing life. This article provides a theoretical alternative tested through experimental evidence. It reports on people's unwillingness to accept a low probability of death that is contrary to expected utility predictions. The article is based on new axioms of choice under uncertainty defined by Chichilnisky (1996, 2009), and it focuses on a new axiom that extends those of Von Neumann and Morgenstern allowing extreme responses to extreme events, fully characterizing the choice criteria that these new axioms imply. The authors show that the implied decision criteria are a combination of expected utility with extreme responses, and they demonstrate experimentally that these criteria – which are new in the literature – are more consistent with experimental observations about how humans make decisions when faced with catastrophic events such as death. From this emerges a new way to value life, using new experimental evidence as well as new theoretical foundations.

This special issue represents just a start and much more work is required. But it certainly pushes the frontiers of economics in the right direction and shows how advance is possible and desirable. The editors hope it will inspire the readers to take the next steps and build the economics of the future, the economics that will move the world forward and help create a human footprint on the planet that is consistent with our continued survival, the economics that fosters a harmonious relationship between our species and the complex web of species that makes life on Earth.

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