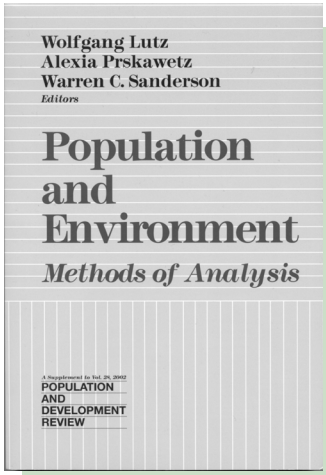
Population and Environment: Methods of Analysis

Wolfgang Lutz, Alexia Prskawetz, & Warren C. Sanderson (Eds.)
New York: Population Council, 2002. 251 pages.

Reviewed by ***Frederick A.B. Meyerson***



Demographic and environmental change are inextricably related at many scales—that much can be said with relative ease. In *Population and Environment: Methods of Analysis*, Wolfgang Lutz, Alexia Prskawetz, and Warren C. Sanderson propose that research into these linkages is now sufficiently advanced to constitute a new and distinct interdisciplinary field called "Population-Environment (P-E) Analysis." To both support this theory and fulfill it, Lutz, Prskawetz, and Sanderson have assembled eight chapters on aspects of P-E research, ranging from literature surveys to synthetic critiques to case studies. This sample is too narrow to do the sprawling field justice; but *Population and Environment*, with its excellent and concluding introductory chapters, is a critical contribution to the growing P-E literature.

The tangle of relationships among environmental and demographic variables has created virtually infinite opportunities for scientific research and speculation over the three decades since Paul Ehrlich, Donella Meadows, and others revived the hypotheses and apocalyptic warnings of Robert Malthus. Lutz, Prskawetz, and Sanderson correctly assert here that P-E research and thought has thus far produced a "somewhat disappointing lack of consistent and generalizable findings" (page 1), which they attribute to the complexity of the issues and the lack of accepted methods and standards. While *Population and Environment* pointedly does not attempt to standardize P-E research or even delineate its fuzzy boundaries, it does identify and begin to address some of the considerable challenges facing a field whose broad scope potentially encompasses most human and non-human processes on the planet.

The editors begin by characterizing P-E analysis as a "chair with four legs" (page 5): population dynamics, environmental dynamics, and the influences of each on the other. Lutz, Prskawetz, and Sanderson note that the overwhelming majority of P-E studies have focused primarily on the impact of changes in the human population on the environment. Many of the studies included in this volume follow or support that pattern, including "Demographic Determinants of Household Energy Use in the United States" (written by Brian C. O'Neill and Belinda S. Chen), "Population Dynamics and the Decline in Biodiversity" (by C.Y.C. Chu and R.-R. Yu), and "Spatial Integration of Social and Biophysical Factors Related to Landcover Change" (by Tom P. Evans and Emilio F. Moran).

Lutz, Prskawetz, and Sanderson suggest that a full P-E study should ideally cover all four aspects jointly. The goal is laudable in theory but may be a tall order in practice, perhaps even encouraging shallow breadth over depth for all but the extravagantly funded. Some of the field's most celebrated studies to date have absorbed millions of dollars and years or even decades of research without venturing much beyond the effect of population on the environment (and not always effectively capturing even that relationship).

But Lutz, et al. are correct that P-E research is rarely convincing unless the research team includes and fully utilizes both demographic and environmental or ecological expertise. For ecologists, the temptation has been to take off-the-shelf human population data and plug it into their models. Demographers have been equally guilty of "dumbing down" or "black-boxing" environmental and ecological data. And economists who troll in the P-E waters have sometimes even managed to over-simplify both demographic and environmental data. The garbage-in, garbage-out results and conclusions of this kind of shortcut have not served the P-E field or its reputation well. *Population and Environment: Methods of Analysis* seeks to avoid or reduce those pitfalls by suggesting a path to standards for the field.

The editors also make the important observation that many P-E researchers begin with a "predefined normative goal" and then employ science to buttress it rather than fully

exploring its validity. Julian Simon and the early work of Paul Ehrlich come to mind as archetypal examples of this trap, but there are many instances of the rush to policy conclusions prior to (or ignoring) scientific results and analysis. The melding of population and environment and/or economics, particularly in making projections, has often been ruled by passion and politics rather than statistics.

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There are many other landmines (or more optimistically, challenges) for P-E research, and the introductory chapter of *Population and Environment* does a good job of briefly reviewing them. For example, spatial and temporal scale of both human activities and environmental causes and consequences vary widely across P-E studies. Linking these scales within single studies (even well-funded ones) has not been easy, and synthesizing studies conducted at different scales has been even more problematic. In addition, the disparate disciplines that are part-time residents under the P-E umbrella often use vastly different research, analytical, and statistical methodologies.

Varying approaches to uncertainty—a critical element of P-E analysis—are also a major challenge to those envisioning a unified, coherent field. The editors of *Population and Environment* could have spent more time addressing this significant P-E issue, particularly the task of synthesizing qualitative and quantitative data and analysis. The important but perhaps irresolvable debate about correlation and causality, touched upon in James C. Cramer's "Population Growth and Local Air Pollution" chapter, is an another area that should be fully addressed in a follow-up effort to this volume.

The book seems to have a bias towards quantitative approaches, and while this path may increase the probability of the field's acceptance as a discipline, it may not achieve harmonization and full exploitation of the rich possibilities of P-E research. The interesting chapters "Migration, Social Capital, and the Environment" by Sara Curran, "Managing Population-Environment Systems" by Geoffrey McNicoll, and "Population and Environmental Services" by Vaclav Smil delve into social science, values, ethics, and management issues, but collectively they also raise difficult questions. One concern is that only a tiny subset of scientists may be able to grasp the diverse range of P-E disciplines represented in just this slim volume. Another question is who the "clients" are for P-E research—is there an identifiable set of end-users, and how long will it be before the field generates results useful to them (and therefore stimulates additional funding)?

A related question—whether complex P-E models are better than simple ones—is posed by Lutz, Przkawetz, Sergei Scherbov, Maria Dworak, and Gustav Feichtinger in their chapter "Population, Natural Resources and Food Security." Not surprisingly, their answer is that it depends on the research question. While this lawyerly conclusion is somewhat frustrating and does not appear to clarify or narrow the P-E landscape, it is the right one. Simple diagrams, spaghetti-like flowcharts of unquantified boxes, and highly quantified exercises can all hide poor data quality, failures to recognize essential variables, surreal equations, or the fact that we simply don't know enough yet. But they all can also unveil hidden truths and elegantly frame the right questions. As the authors put it, "both the forest and the trees matter" (page 219).

One of the best features of *Population and Environment* is that it does gesture to the enormous diversity and complexity of P-E's subjects and methods, which for me both excuses the discipline's slow start and points to its promise and endless supply of fascinating and critical research questions. But the book's eight solid chapters represent more of a Noah's Ark than a full debate on and harmonization of the field. Few scientists, if any, can master or even be conversant in all of the central P-E disciplines, and this interdisciplinary dilemma is unlikely to fade over time. P-E research remains an elephant described by a blind committee—but it is a powerful, complex beast that science and policy would be foolish to neglect or ignore. *Population and*

Environment is a valuable and important first step towards gelling this fascinating field.

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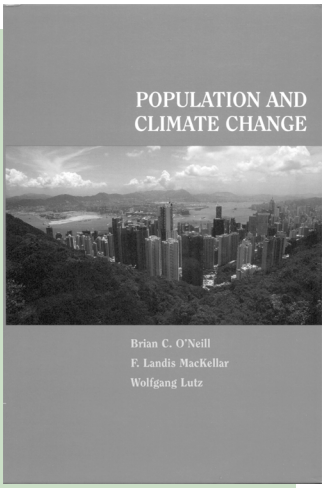
Population and Climate Change

By Brian C. O'Neill, E. Landis MacKeller, & Wolfgang Lutz
Cambridge, UK: Cambridge University Press, 2001. 266 pages.

Reviewed by ***Gayl D. Ness***



The environment has always presented difficult problems for demographers. In contrast to the easily conceptualized and measured categories of fertility, mortality, and age-sex distributions, the "environment" seems boundless, vague, and not easily quantified.

But in 1994 the Austrian demographer Wolfgang Lutz of the International Institute for Applied Systems Analysis (IIASA) led a team that produced a seminal work on population, environment, and development (Lutz, 1994). Lutz and his team modeled the country of Mauritius to show how one would attack that country's population-environment-development issues in a systematic manner. Lutz drew on the work of the 6th century BC Greek philosopher Anaximander in conceptualizing the environment as composed of earth, air, water, and fire (energy). When construed as modules in a dynamic systems model, these four modes permitted that model to provide extensive and insightful examination of their interactions.

For example, Lutz and his team showed how reductions in fertility furthered economic development by freeing women for the labor force and reducing costs of child rearing. The study also demonstrated how production of commodities such as sugar and textiles could obstruct the future development of Mauritius by destroying the marine environment on which its new tourism industry depends.

Now Lutz has teamed up with an IIASA economist (Brian O'Neill) and a climatologist from Brown University (F. Landis MacKeller) to produce in the book under review what I consider the best single work to date on the relationships between population and climate change. Indeed, I would argue that if one could read only one work in this area, this would be the book.

Population and Climate Change is a slim volume, with six chapters of dense arguments and extensive summaries of the most critical findings on population, climate change, and how the two are linked. The references cite more than 700 works. The best way to present *Population and Climate Change* is to summarize each of book's six chapters.

Chapter 1 provides a brief primer on climate change—including the "greenhouse effect," the rise of greenhouse gases (GHGs), and long-term increases in world temperature. Demographers are all too often unfamiliar with biogeochemical cycles. This chapter provides an efficient and useful lesson.

Chapter 2 is a primer on human population change. It notes the growth of world population, the demographic transition, and the recent shift of world population toward less developed countries. The chapter also summarizes recent population projections (which maintain that world population will rise by 2100 to between 8 and 12 billion) and discusses how policies (such as economic development, investment in education and health, and promotion of women's empowerment) can help speed fertility decline and reduce population growth. The authors end the section with an examination of how populations are aging and what are the consequences of this trend. The more developed countries all show slow or even negative population growth rates and aging populations. This dynamic increases the demand for labor (implying a need for immigration) and results in rapidly increasing health costs for the aged.

Chapter 3 provides another primer, this one on the links among population growth, economic development, and the environment. The authors of *Population and Climate Change* review the neoclassical model of poverty's relationship with environment—a model that suggests (among other things) a potential vicious cycle of poverty ► environmental degradation ► more poverty in less developed countries. But O'Neill, MacKeller, and Lutz also explore how interventions can turn this vicious cycle into a virtuous one. These include: population policies that emphasize primary health care; primary education, especially for girls; and family-planning programs. Such measures immediately increase human welfare, especially for women and children, and also reduce longer-term population pressure on the environment.

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Next, *Population and Climate Change* examines the various ways that population growth is linked to GHG emissions. The authors reach the basic conclusion that reducing fertility and population growth (especially in the less developed regions) will have only modest effects on reducing GHG emissions by the middle of this century, but substantial effects by 2100 (page 113). The implication is that current family-planning programs will not produce immediate environmental benefits, but that current population growth has important consequences for decades hence.

The book's fifth chapter deals with the complex issues of adaptation to climate change—specifically, how agriculture and the food supply, human health, and environmental security might be threatened by future climate changes. O'Neill, MacKeller, and Lutz also look here at how societies might adapt to these changes. Increased population growth will require increased agricultural output, which is possible but may have very high costs.

Unfortunately, the future impacts of climate change on agricultural output are uncertain: adaptation is possible, but the need to adapt to both population growth and climate change will be highly challenging. As in the two previous chapters, the authors argue that population policies that help reduce fertility and population growth can reduce population pressures on natural resources and make societies more resilient to the negative impacts of climate change.

Finally, Chapter 6 of *Population and Climate Change* takes on the issue of policy implications. The authors note that the official policy literature in both population and climate change has done little to translate reviews into policy implications. What is to be done in view of the likely impacts of climate change on food production, health, and environmental change? The policy implications of such changes and challenges are too often unexplored in the scientific literature. Modern population policies, on the other hand, are clearer. They can lead to fertility reduction and increased human welfare: such policies promote primary education and health care, increase empowerment of women and girls, and promote family-planning programs.

But in addition to their significant positive impact on human welfare, sound population policies can also mitigate long-term trends in GHG emissions and thus reduce the extent of likely climate change. O'Neill, MacKeller, and Lutz also note, however, that population policies may not be the key strategies to reducing GHG emissions and climate change. Other, more direct policies (e.g., to produce a cleaner technology or to reduce fossil fuel consumption) may well have a larger impact on climate change. Nonetheless, a more effective portfolio of climate-change policies should certainly include consideration of population dynamics.

One could quibble with parts of the analysis in *Population and Climate Change*. In examining the food supply, the authors cite the more pessimistic reviews and omit that of Vaclav Smil (1994), who sees the possibility of feeding 10 billion people. And while it is difficult to argue with the authors' use of earlier IIASA population projections—which Lutz authored (1996)—it is worthwhile pointing out that almost all of the United Nations population projection revisions of the past three of four decades have been revised

downward. There have been more positive demographic changes than most demographers have anticipated.

The authors might also have given more consideration to how temperature increases will affect the natural reservoirs of fresh water in the form of mountain snowpack. Adapting to this problem by replacing snowfields with man-made reservoirs would entail immense and probably prohibitive expenditures. Not adapting would imply massive disruptions in seasonal water flows, with serious impacts on food production. But these are all minor points that do not in the least distract from this excellent summary and analysis.

The IIASA group has always excelled in putting together interdisciplinary teams to deal with fundamental issues. *Population and Climate Change* strengthens this record. Readers can now hope for another interdisciplinary approach that explores effective policy and program approaches to the links between population and climate change.[1]

We know much about the social, economic, and political conditions that have led to low population-growth rates. (The revolution in population policies, for example, has certainly been one of the most dramatic in improving human welfare.) But what accounts for the dramatic variance in GHG emission rates among the low population-growth countries? It would be most useful for IIASA and its associates to tackle this question, which would seem to have practical implications for the future of population and climate change.

Regarding climate change, O'Neill, MacKeller, and Lutz note that popular and elite concern for GHG emissions and climate change potential has only emerged in the past two or three decades, and that some useful policies have in fact emerged. Since the 1960s, there has also been extensive political support for policies and programs to address poverty and promote economic development. While resistance has been relatively slight to these policies (especially in comparison with population or GHG emission policies), the failure of both these policies and programs has been legion and has attracted a great deal of attention. It would be most useful now for someone to write a systematic assessment of population, development, and climate-change policies that parallels this fine volume—to give us a better sense of what is needed and what is possible in moving us toward a more sustainable future.

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Notes

[1] Such an approach might investigate, for example, the consequences of the radical difference between population and climate-change dynamics of the world's 25 richest and 25 poorest countries. The 25 poorest countries show a narrow range of relatively high population growth rates (2-3 percent per year) and exceptionally low GHG emission rates (100 to 800 kilograms per capita)—neither of which is difficult to explain. The 25 richest countries show a narrow range of population growth rates (1 percent or less) but high and *highly variable* GHG emission rates, running from 5 tons for Sweden and Hong Kong to 24 tons for Singapore. High emissions are found in large land-mass countries (20 tons for the United States, 15 for Canada, and 18 for Australia) as well as tiny countries (18 for Luxembourg and 24 for Singapore, for example). This poses a challenge for researchers. We need (a) to understand what policies are responsible for the highly efficient and the highly inefficient consumption processes of wealthy nations, and (b) target those policies for change.

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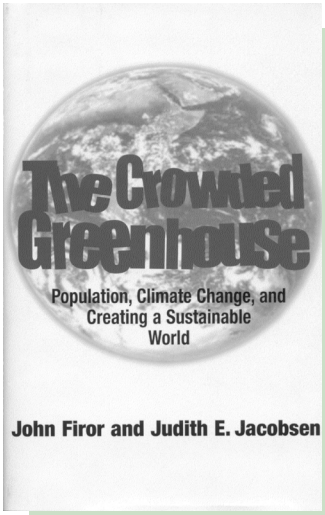
The Crowded Greenhouse: Population, Climate, Change and Creating a Sustainable World

By John Firor & Judith E. Jacobsen
New Haven, CT: Yale University Press, 2002. 237 pages.

Reviewed by ***Elizabeth Chalecki***



Aimed at a lay reader, *The Crowded Greenhouse* is the collaborative effort of John Firor, director emeritus of the National Center for Atmospheric Research, and his wife, population expert Judith Jacobsen. The first three chapters (written by Jacobsen) deal with population issues, and the second three chapters (written by Firor) assess climate change. This volume proceeds from the assumptions that the earth is finite, that human population cannot grow indefinitely, and that humans must act now to avoid negative environmental consequences from population growth.

Jacobsen presents an interesting synopsis of the modern population movement that begins with an outline of two contrasting arguments (Malthus versus economics) made by the first population activists. Traditional Malthusian theory argues that the earth has a finite carrying capacity and that humans will experience an ecological dieback if they continue to use resources faster than they can be replenished. For Malthusians, the best way to limit population growth is to control fertility. The economic argument, on the other hand, holds that the best way to limit population growth is to promote economic development.

This philosophical division has prompted continual debate within the population movement over how to frame population initiatives, policies, and their implications. Jacobsen points out that, while the Malthusian imperative is the baseline ecological argument for limiting population growth, successful population policies may include any or all of these points of view. To illustrate such an initiative, Jacobsen takes us through the inspirational story of Chief Bisi and the women who work with her in Nigeria to affect reproductive and economic choices on the community level. Well ahead of the famous Grameen Bank, Bisi founded the Country Women's Association of Nigeria (COWAN) for rural women to raise the necessary resources to change their standard of living. COWAN started with $45 and now has 1300 cooperatives across Nigeria. Its ability to integrate women's health, family planning, and economic development highlights the levels of policy change that can be accomplished with local grass-roots initiatives and sufficient funding from developed countries.

Jacobsen then outlines six principles she believes will best guide future work on population issues. She asserts that the ecological principles underlying the concern about rapid population growth are complex and non-linear, and that population issues must be approached in tandem with other issues such as peace and poverty. Jacobson also rightly points out that legislation—such as laws restricting immigration—can only solve part of the problem, and that non-legislative initiatives (such as providing immigrants with access to reproductive-health care) can help gain voluntary cooperation where laws cannot. Finally, Jacobson argues that there are many roads to Mecca regarding population policy; while activists cannot always change their opponents' minds, they must attempt to succeed without unanimity of belief.

The Crowded Greenhouse then shifts abruptly to the issue of climate change. John Firor takes us through the basic arguments for the existence of global warming, from the calculations of Svante Arrhenius (the Swedish chemist who first predicted climate change in 1899) to a clear and succinct discussion of the benefits and liabilities of current global climate models. Firor goes on to draw an interesting parallel between the controversy over whether climate change is actually occurring and the continuing flap over Darwin's theory of evolution. He argues that, since both Darwinism and prevailing analyses of recent climate change challenge well-entrenched social, religious, and economic interests, both theories continue to engender controversy in spite of overwhelming

amounts of supporting evidence. His synopsis of the international negotiations leading up to and including the Kyoto Protocol is also clear and informative.

Firor closes the climate-change section of the book with some general economic prescriptions to ensure that the U.S. economy truly reflects energy prices. He espouses a revenue-neutral tax shift, whereby the tax burden is shifted away from desirable economic sectors such as employment and onto undesirable sectors (e.g., those that emit pollutants and use raw materials wastefully). Firor also recommends (a) a new method of national economic accounting that would record "withdrawals" of raw materials, and (b) campaign-finance reform to pry open the disproportionate grip that resource-consuming industries have on the U.S. political process.

The final chapter of *The Crowded Greenhouse* outlines two revolutions—an *equity* revolution and an *efficiency* revolution—that the authors argue Western society must undergo to solve the issues and ramifications of both population growth and climate change. The equity revolution, Firor and Jacobson stress, would address population issues by ensuring that women and girls around the world have adequate access to health care and participation in democratic government. The efficiency revolution would maintain our economic development and standard of living while using less energy. Firor and Jacobsen conclude both by noting the gains that the population and climate-change movements have made and by encouraging those who wish to work in the population and/or environmental movements not to give up in the face of continuing obstacles.

The Crowded Greenhouse is quite readable for environmentally minded newcomers to these issues. But Jacobsen and Firor may be preaching to the converted, as exemplified by their admonishment at the end of Chapter 8 to "Have a thought. Join the insurrection" (page 202). Their book is also heavy on general advice and extremely light on concrete proposals. At the risk of sounding too much like Sun Tzu, there is very little in *The Crowded Greenhouse* that will help population and climate-control activists outwit their enemies.

While Jacobsen's principles regarding population are reasonable and conciliatory, they are also very broad. Her section lacks the benefit of her years of work in the population movement—namely, some specific recommendations of policies that would help stabilize population growth here and abroad. Firor's section also suffers from similar non-specificity. While he rightly points out that climate change may have positive effects and that studies of the impacts of climate change are hindered by great complexity, these uncertainties have already been well documented by researchers in the Intergovernmental Panel on Climate Change and the U.S. Global Change Research Program. What the climate-change debate needs is a roadmap for implementing specific policy recommendations to reduce greenhouse emissions—or, at the least, concrete recommendations on how to move the Bush administration toward the precautionary principle when dealing with global environmental matters. Firor fails to provide such a roadmap.

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It would also have been helpful to read how Firor would approach the task of disarming or disproving the critics of evolution and climate change. Instead, Firor argues that these critics assume that climate change is already occurring. This is mistaken: many opponents of climate-change mitigation measures such as the Kyoto Protocol, clean air legislation, and carbon taxes do not proceed from this assumption. Given that the present U.S. administration has effectively dropped climate change as an issue, strong arguments for the fact and full consequences of climate change would seem essential to the agenda to reduce global warming.

Firor and Jacobsen do encourage those working in population and environment to study the values and beliefs of those who

oppose their efforts and to use any common ground to advance their own agendas. This is excellent advice, since much anti-environmentalist sentiment is grounded in either religion or economics, both of which are often seen as absolutes. But the advice is again very general. For example, Firor recommends the removal of natural-resource extraction subsidies in an effort to make the U.S. economy account fully for the cost of using them. However, he does not specify which ones should be removed or how this might be achieved in the face of almost certain industry opposition.

Finally, the bilateral structure of the book effectively and unhelpfully segregates the two issues of population and climate change, and the final chapter fails to bring them together sufficiently. By simply prescribing two revolutions that Western society must undertake, Firor and Jacobsen do no more than outline the many ways in which solving one problem can make an impact on the other.

But *The Crowded Greenhouse* is a good explanation of these issues for those who already acknowledge their importance. The breadth of Jacobsen and Firor's passion on these topics is impressive, and one hopes that their work in these fields continues well into the future they envision.

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