Population, Consumption and Environment Dynamics: Theory and Method

Workshop Summary

Workshop Sponsored by the
Population-Environment Research Network (PERN)

Location: Mont Royal Room, Wyndham Hotel, Montréal, Canada (side event of the 2003 Open Meeting of the Human Dimensions of Global Environmental Change Research Community)
Date & Time: 19 October 2003, 9 a.m.-1 p.m.
Organizers: Sara Curran, Assistant Professor of Sociology, Department of Sociology and Office of Population Research, Princeton University and Alex de Sherbinin, Coordinator of the Population-Environment Research Network and Senior Staff Associate at CIESIN, Columbia University
Notetaker: Susan Cassels

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Background and Rationale

This workshop was organized by the Population-Environment Research Network with funding from the John D. and Catherine T. MacArthur Foundation's Population, Consumption and Environment (PCE) initiative through a grant to the Office of Population Research at Princeton University. The purpose of this workshop was to explore a research agenda and methodological approaches for studying the linkages between population, consumption and environment in both developed and developing countries. It built upon earlier research agendas set by the National Research Council's *Environmentally Significant Consumption: Research Directions* (Stern *et al.* 1997), and the Organization for Economic Cooperation and Development's (OECD) sustainable consumption initiative (OECD 2002).

In the 1980s and 1990s, there was widespread belief among environmentalists and lay people that uncontrolled population growth was responsible for environmental degradation of all types. Scientific research, however, has not shown a definitive link between population growth or size and environmental decline. Critics have pointed out that consumption of resources by citizens of the global North is at least as important in explaining environmental degradation as population growth. On the other hand, growing consumer demand in developing countries also portends threats to the environment (e.g. the growing middle class in China and India), and does not contradict statements about how high population growth is a cause of environmental degradation. The sheer number of people does not on its own explain the dire state that many ecosystems are in – how people and institutions use those resources, the technologies used to extract them, and policies influencing consumer behavior are as important. The organization of consumption then becomes a key mediating factor.

The issue of consumption, how to measure it, and its relationship to resource use is poorly understood and has many different definitions, some of which are culturally subjective and depend on the social and economic aspirations of the consumer. Theory and research also demand consideration of rates of consumption versus the regenerative rate of the resource being consumed or the linkage between population change, consumption change, and environmental change. The dearth of good research can be explained by the fact that the topic spans at least six major disciplines (demography, economics, political science, sociology/anthropology, industrial engineering, and ecology) and requires an integrated approach to theory, data collection, and analysis. Stern *et al*. (1997) bring some of these questions to bear upon consumption research in developed countries. A next step in this research agenda is to assess what has been done to empirically evaluate the research questions posed by Stern et al. (1997) and to consider the consumption-environment linkages between developed and developing countries, and within developing countries themselves. One example of this linkage would be the ways in which "developed country consumption" is impacting upon developing countries.

Since much of the interest has concerned the loss of tropical forest ecosystems and depletion of marine resources in the South, the knowledge generated needs to be useful for governments and citizens there. Yet, the consumption of those resources is often for markets in the North, making it necessary for northern institutions and citizens to be aware of the consequences of their actions and for policy solutions that overcome free-rider costs. Finally, there must be a strong connection to policy in order to make the research useful for conserving the environment and improving the quality of life of the people who depend on ecosystem services for their livelihoods.

Agenda

Time Slot	Speakers / Topics
9:00-9:05	Welcome
9:05-10:05 Session 1	Presenter: Vaclav Smil, University of Manitoba (Canada), **Energy Consumption and the Environment** Presenter: Daniela Zlatunova, University of Sofia (Bulgaria), **Energy and Sustainable Development in Eastern Europe** Presenter: Evans Kituyi, African Centre for Technology Studies (Kenya), **Charcoal Production and Consumption in East Africa**
10:05-10:30	Question & Answer and Discussion
10:30-10:45	Coffee Break
10:45-11:45 Session 2	Presenter: Faye Duchin, Rensselaer Polytechnic Institute (USA), **Household Lifestyles: Ideas for a Research Program** Discussant: Barbara Entwistle, Carolina Population Center and the University of North Carolina (USA) Presenters: Fritz Reusswig & Herman Lotze-Campen, Potsdam Institute for Climate Impact Research (Germany), **Changing Global Lifestyles and Consumption Patterns: The Case of Energy and Food** Discussant: Daniel Hogan, Population Studies Unit, University of Campinas (Brazil)
11:45-12:15	Question & Answer and Discussion
12:15-12:45	Closing Panel Po Garden, Unit for Social and Environmental Research (USER), Chiang Mai University (Thailand) Paul Stern, National Research Council (USA) Sara Curran, Office of Population Research, Princeton University (USA) Alex de Sherbinin, Population-Environment Research Network and CIESIN, Columbia University (USA)
12:45-1:00	Brainstorming session on future PCE research agenda

Note: Selected individual presentations are available from the "workshops" web page on the PERN website, http://www.populationenvironmentresearch.org.

Summary of Presentations

By Susie Cassels and Alex de Sherbinin

Session 1

Vaclav Smil began his presentation with a basic introduction on energy-related issues. First he compared the relative energy derived from different types of fuel. For instance, straw only yields around 15 megajoules per kilogram (MJ/kg), wood yields 20 MJ/kg, coal yields 20-25 MJ/kg, while fossil fuels (oil, gasoline, jet fuel) yield around 42 MJ/kg. The corresponding energy densities are 1 watt per square meter for wood, 5,000 watts per square meter for coal, and 40,000-50,000 watts per square meter for fossil fuels. The energy density of fossil fuels is unparalleled, and it is the reason industrial societies have become so dependent on them.

Dr. Smil claims that we will never run out of fossil fuels; rather, we will run out of the cheapest and most easily accessible fuel. Soon, it will not be economical to continue to rely on fossil fuels. However, alternative energy sources are not without their own short comings. For instance, renewable sources require huge areas to gather the energy. To heat a city the size of Montreal with fuel wood would require hundreds of thousands of hectares of forest lands. Wind farms would require massive areas under turbines and a forthcoming article in *Nature* argues that such wind farms may cause considerable change to wind and atmospheric dynamics, upsetting ecological systems. Furthermore, were it not for massive subsidies, wind power would not be competitive with other energy sources. Hydropower can only capture about 30-40% of the total potential energy in a given basin, and most basins in Europe and North America are saturated. And the ability to build new dams for hydro power in developed countries. For example, hydro-power has been almost entirely captured in Europe and North America.

Next, Dr. Smil compared energy consumption between regions. The developed world consumes about 4 tonnes of crude oil per year per capita. Within the developed world, North Americans annually consume about 340 Gigajoules per person (GJ/person), whereas Europeans consume 150 GJ/person of commercial energy. Most of the rest of the world consumes about 60 GJ/person, and India and China consume 10 and 30 GJ/person, respectively. However, the figures for India and China probably represent an under estimate because they rely heavily on non-commercial sources of energy – thus their figures should be multiplied by 1.5 and 1.3 respectively. Similarly, Brazil's level of consumption nearly doubles when accounting for non-commercial energy sources.

These figures say relatively little about *efficiency*. Most energy from a wood stove is wasted or lost (they are about 30-40% efficient), but the massive amount of energy consumed in the developed world is consumed very efficiently (furnaces in developed countries are 70-97% efficient). Even though developed country houses are oversized, they use energy efficiently. Therefore, it is important to normalize energy consumption with efficiency rates. Unfortunately, over the past 40 years almost all gains in energy efficiency have been more than offset by increases in the size of homes or in the size and number of cars per household. This points to attitudes and behaviors being fundamental drivers of environmentally significant consumption.

Dr. Smil ended his presentation with the associations between energy consumption and two important measurements of well-being: infant mortality (a physical measurement) and access to education. Beyond 60 gigajoules per capita, which was about the energy consumption level of Lyon, France, in 1960, one sees very few gains in either measure of wellbeing. If everyone on earth had access to energy at the current global average level of consumption, and if the same association held true, then everyone would also have low levels of infant mortality and adequate access to education.

Daniela Zlatunova then presented a case-study on Bulgaria and the change in consumption patterns over the last 10 years. Bulgaria has produced and consumed about 1.5% less than it did in 1990. They rely more on nuclear and hydropower than they did 10 years ago; however, these alternative sources only account for 6% of power. She went on to present a typology of European countries based on three types of efficiency: financial (measured by GNP per area), ecological (measured by population per area), and social (measured by air pollutant emissions per area). The countries of Europe were then presented according to a typology, which is described more in her paper (downloadable from the workshop website).

Evans Kituyi discussed an interesting problem of energy and the environment in sub-Saharan Africa. Because many Africans are not able to use cleaner energy options, biomass is the main energy source; this leads to many problems with the environment, human health and conflict with governmental institutions.

Charcoal is used in many African countries for more than 40% of household energy needs, and in urban areas the proportion is even greater. It is made from wood, which is then compacted and burned in traditional kilns which are only 10-15% efficient (meaning 85-90% of the energy content is lost in the conversion from wood to charcoal). In Kenya it is not legal to produce charcoal, but paradoxically it is legal to buy it in the market. This means that most charcoal production is produced from forests on government lands, and bribes are given to forest wardens in order to fell trees and produce the charcoal. Charcoal production is contributing to extensive land clearing, and generates methane when burned. But, since it is illegal, there is no way for environmental agencies to improve the efficiency of production or change towards cleaner production. Furthermore, there is no incentive for forest stewardship. In Sudan, where charcoal production is legal, individuals plant forests and wait for 15 years in order to harvest the wood for charcoal production. Dr. Kituyi indicated that he is optimistic that Kenya will change its laws so that charcoal production can be regulated. Dr. Kituyi's paper is available from the workshop website.

Group discussion

- Why is energy use per capita in North America so much greater than in Europe?
- Smil: We also need to make energy-estimate adjustments for *distances traveled* and *climate*. Distances between settlements in the US are on average greater than in Europe (ex: New York to Los Angeles). And, heating and usage of energy intensive materials differ from place to place.
- Smil: Photo-voltaic cells are a good idea, but the problem is scaling: the price is still very high and in order to fuel a city we need many gigawatts (the order of magnitude of PV cells now are only in megawatts). We need to make sure that different sources of energy pass the "engineering test." For example, hydro-power is a good idea, but it displaces many people and is a huge source of greenhouses gases.
- Are we being pessimistic? Can we improve efficiency even more? What about factor 4 or factor 20?
- Smil: Efficiency is improving at about 1% a year in North America**,** while China is making *much larger* gains in efficiency (16% a year). But, efficiency is not the answer, especially when rates of use are still increasing. We can not "engineer" our way out of the problem—the answer is constricting energy use.
- There are always unforeseen consequences when looking at alternative sources of energy for the Earth as a whole. According to Smil, the devil you know may be better than the one you don't know.
- Is water a limiting resource? In Bulgaria, water is extremely important—and they have decreased water usage since 1990, but the quantity available has also decreased because of climate change.
- For energy consumption, should settlements be used as the unit of analysis?
- Kituyi: With charcoal production, land ownership is a big issue. Most of the land for charcoal production is owned by the government, and people sneak onto it and use it. In the urban areas, settlement patterns are based on economic status. In between the very rich and very poor are three formal classes—those are the ones he uses in his study (clustered together).

Session 2

Faye Duchin presented new research directions on studying households and lifestyles. She began by framing her presentation in terms of one of the major global environmental change issues – climate change. The success of the Intergovernmental Panel on Climate Change (IPCC) was that it put climate change on the agenda. But there are still many big questions that have to be answered. How much will it cost to adapt? Who's at fault? Who needs to do what? Dr. Duchin says technology and lifestyles are the answer. There has been some work on technology, but less systematic work on households and lifestyles.

The IPCC used economic models of the world economy, and we should start there also. Economic models have some important strengths: 1) theories on consumption, material inputs, and generational exchange, and 2) lots of data! But, weaknesses include assumptions about growth, and lifestyle is entirely undefined. Quantification and formalism can help define lifestyle, but we need to couple these with qualitative data and narrative assessment.

There are three ways to define households: 1) by social class (employment characteristics, access to resources), 2) by income categories (income and prices determine how people act), and 3) by clusters of consumption (factor analysis—who is more likely to buy what). The first two categories are top-down classifications, while the third is bottom-up. *Market research* should be more important in how we think and collect data.

Lifestyle is an abstract notion, but we can measure it by what people buy. Duchin suggests that we develop a third level between consumption and lifestyle, which is *household activities*, like 1) the food and diet complex, 2) housing, 3) transportation, and 4) fertility or the number of people in a household. The paper by Dr. Duchin is available for download from the workshop website.

Barbara Entwisle began her discussion of Duchin's proposed research agenda by first clarifying the definition of a household unit, and suggested that households are in fact made up of individuals, and that they do not always make decisions monolithically. In a traditional nuclear family household, parents may have disproportionate deciscion-making authority, but in other kinds of households decision-making may be more diffuse. But this amendment can easily be incorporated into Duchin's framework.

Second, it is important to note that households change over time, thus it is important in data collection to follow the individuals. Households grow, shrink, and multiply. The fact that households are not stable has two important implications: 1) It is important to understand the proliferation of households in a population, and not simply population growth, and 2) decisions regarding important household changes happen at points of transition (ex: marriage, moving). Thus, when looking for points of intervention, look for the moments when households transition and transform.

Group questions and discussion

- We must look at all levels of analysis: individual, household, community and so on, and understand how each is *embedded*. Then, we can define linkages.
- Entwisle: If one elaborates on embeddedness, they might not lose track of time.
- How can this type of work influence other research? We must ask and then answer questions about household lifestyle and changes, and carry out research that demonstrates the importance of these scenarios, which can not be ignored.
- Household conceptualization still needs a lot of work. We need to give up concepts like "head of household" and move on to see households as decision makers. Also, we should have more categories to define households, like market research has for businesses.

- Economists have theorized that the only healthy economy is a *growing* economy. Is this necessarily so? In theory, could there be a healthy economy that does not grow?

Fritz Reusswig and Herman Lotze-Campen presented their work on lifestyle, energy and food. They suggest that lifestyle should be regarded in more of a social context, and needs a double perspective to measure (observer and participant). Regarding the first point, we need to understand behavior in context: Why consume less? What are the motives? Generally, lifestyle is more than mere consumption—we need to include market preferences and reflexive and political preference.

Drs. Reusswig and Lotze-Campen continued by discussing ways to measure energy food consumption, and then presented their preliminary results of categorizing 40 countries on types of lifestyle, food and energy consumption. They included variables like economic growth, GDP, CO_2 emissions (industrial only), carbon intensity and energy intensity to measure energy consumption. They found, for instance, North America to be "rich emitters" and Africa to be "poor, involuntary climate protectors." Variables for food consumption included income, food consumption, consumption structure (% meat products), and environmental impact. The paper by Drs. Reusswig and Lotze-Campen is available from the workshop website.

Daniel Hogan began his discussion of Reusswig and Lotze-Campen with a historical perspective. Dr. Hogan explained that it wasn't until the Cairo meetings that the research community realized that we need to look at consumption and population growth at the same time. He suggested that we need to make a demographic analysis of consumption. Cluster analysis has been especially beneficial because it allows us to move on from simple dichotomies like rich/poor, north/south or consume/populate. But he added that we still need to include demographic information like rapid fertility decline, age structure (especially the "youth bubble"), population distribution including movement, mobility between cities, tourism, settlement patterns and sprawl, and lifestyle changes when looking at consumption patterns. He concluded by reiterating that market research data are an under-used resource. We can learn a lot from them.

Group discussion and questions

- We must remember that the audience for our research agenda that focuses upon consumption, especially consumption behavior of families or households, is very different from the past. No longer is it the State or policy makers, but individuals. This will mean that research needs to be *organized, funded and disseminated* differently to the community.
- Follow-up comment: Future research may be more problematic. It is fundamentally *subversive* to multi-national corporations.
- How do we connect divergent thoughts on consumption and the environment—like self-interest vs. altruism, or the war on cholesterol?
- We should connect consumption of a product with the different possible uses of that product in out research.
- Lotze-Campen response: Heterogeneity of preference is under-researched.

Closing Panel

Paul Stern sees our research as two-pronged, regarding both land-use and industrial metabolism. Tying human activity to land points is sufficiently difficult, but it is even harder to pin down the links between human activity and industrial metabolism. Part of the complexity lies in the embeddedness; how far should we look? We can look at level of geography, politics, building and transportation for example. Additionally, we must not ignore who is behaving, from where, which corporations, and what

organizations are intervening. There are a lot of actors and relations between them, but very little research.

Po Garden urged us to consider what kind of consumption patterns can help people out of poverty. The main problems, he believes, are consumption and income gaps.

Sara Curran focused her comments on trade: Trade is an understudied mechanism in population, consumption and environment research. To incorporate trade, we must map commodity chains (production, processing, shipping and movement, and consumption) and understand how the political economy shapes patterns of consumption. Therefore, we may understand one commodity at one point in time, but there are many actors that affect the changes over time.

Alex de Sherbinin highlighted the importance of households in population, consumption, and environment relationships. In developed countries, population growth does not impact the environment as much as affluence or technology when using the standard I=PAT model. But, when households are the unit of analysis, population becomes more important. He also mentioned that our research needs to influence political decision makers, and that it is not sufficient to simply try to encourage individuals to change their consumption patterns. Mr. de Sherbinin's presentation is available from the workshop website.

Proposed Future Research Questions and Approaches

The workshop ended with a brainstorming session focused on major research approaches, interesting research questions, and potential data sources. The following are the major points raised in bulleted form:

- Focus on households as dynamic consumption units.
- Researchers may wish to tap into the wide array of market research data.
- We should make the most of data from developing country censuses and surveys that approximate the market research type of data.
- Examine leverage points in household consumption that have greatest bang for buck.
- Research attitudes and behavior vis-à-vis "green" products and willingness to pay (eco-labeling)
- The Knowledge-Attitudes-Practice (KAP) "gap": conflicting values, how do people want to live, who wants to live that way, and why?
- What apart from cost of energy (lower costs in N. America), distance (greater distances between settlements and more "urban sprawl" in N. America), and greater personal transportation use accounts for differences in consumption between Europe and North America? Can it be ascribed solely to the black box of "culture"? What insights might be gained by looking at this more closely?
- Identifying paths to sustainable consumption in developing countries.
- Are there potential strategies for development that don't depend so much on demand from developed countries.
- If we reduce consumption, how will those working in the industrial sector be impacted? Will unemployment result?
- Can we forecast consumption efficiency? Then can we change product production with those forecasts?
- Create a forum for sharing data (IHDP? PERN?).
- The peak of oil production is important: when will we reach diminishing returns?

- Production-distribution-consumption chains and trade. Trade is one of the best means to increase efficiency and wealth. Policies that lead to environmentally damaging production do not reflect comparative advantage.
- Political scientists need to be engaged in this research, especially on the political obstacles to moving towards more sustainable consumption.
- Our research needs to look more at *values*, social processes, how they influence organizations, and how that will influence behaviors.
- The World Trade Organization and its influence on sustainable consumption; trade is one of the best means to increase efficiency and wealth; policies that lead to environmentally damaging production that does not reflect comparative advantages (e.g., subsidizing beet sugar production in N. America when sugar can be produced much more efficiently in the tropics).
- How do issues of governance, transparency, and corruption relate to environmentally significant consumption, especially in the primary or "extractive" sector (e.g., resource extraction in mining, oil, logging, etc.)?
- Move beyond analysis of current levels or trends in consumption, and move toward an analysis of options for change (e.g., future scenarios or directions).

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References

Organization for Economic Cooperation and Development (OECD). 2002. *Towards Sustainable Household Consumption? Trends and Policies in OECD Countries.* Paris: OECD.

Stern, P.C., T. Dietz, V.W. Ruttan, R.H. Socolow, and J.L. Sweeney (eds.). 1997. *Environmentally Significant Consumption: Research Directions*. Washington, DC: National Academy Press. (Available online at http://books.nap.edu/books/0309055989/html/index.html)