

Lecture #24: People Who Live in Glass Houses

Suggested Readings:

Spencer Weart, *The Discovery of Global Warming*, 2003; see also <http://www.aip.org/history/climate/>
Richard Elliot Benedick, *Ozone Diplomacy*, 1991 (insider's account of Montreal Protocol).
John Houghton, *Global Warming: The Complete Briefing*, 5th ed., 2015.
Intergovernmental Panel on Climate Change, *Climate Change 2014* (2014) <http://www.ipcc.ch/>
RealClimate website: www.realclimate.org (extensive web guide to current climate science discussions)
Bjorn Lomborg, *Cool It: The Skeptical Environmentalist's Guide to Global Warming*, 2007. (a leading skeptic)
Naomi Oreskes & Erik M. Conway, *Merchants of Doubt*, (2010). (critical history of climate change skeptics)
PBS Frontline, *Climate of Doubt*, <http://www.pbs.org/wgbh/pages/frontline/climate-of-doubt/>
Mike Hulme, *Why We Disagree About Climate Change*, 2009.
Richard Campanella, *Geographies of New Orleans: Urban Fabrics Before the Storm*, 2006.
Craig Colten, *An Unnatural Metropolis: Wrestling New Orleans from Nature*, 2004.
Douglas Brinkley, *The Great Deluge: Hurricane Katrina, New Orleans, and the Mississippi Gulf Coast*, 2006.
Joshua Howe, *Behind the Curve: Science and the Politics of Global Warming*, 2014.

Outline

I. The Limits to Growth

Malthusian demography as foundation for prophesying future environmental & social change
Limits to Growth, 1972, team led by Dennis and Donella Meadows (Donella chief author) most famous such prophesy of early 70s turned to MIT computer modeling as new more sophisticated version of Malthusian logic: plug complex economic, social, and ecological variables into elaborate set of equations, then run various "scenarios" to see likely future outcomes
"standard run" of computer: overpopulation, then falling resources, soaring pollution, collapsed society even "unlimited resources" run ultimately hit limits from pollution; only "stabilized model" held hope public read book as apocalyptic prophesy, perfectly timed (by accident) to coincide with Arab oil boycott, seemed fulfillment of worst environmental nightmare: missed message of future hope
Limits to Growth views achieved official govt approval when Jimmy Carter commissioned *Global 2000 Report*, authored by Gus Speth and published as Carter leaving office: 21st century worse in all ways conservative response: Julian Simon's, *Resourceful Earth* (1983) refuted point-for-point: better in all ways key insight: computer models now becoming indispensable tool for speculating about ways in which past and present environmental trends might be projected into future: environmental problems become virtual

II. A Hole in the Sky

1980s would see computer modeling of environmental problems turn to new realm: atmosphere
James Lovelock argues in *Gaia* (1979) that unusual unstable gases in oxidizing earth atmosphere impossible without life, atmosphere fundamentally a product of homeostatic biological processes
early 1980s: modeling to show effects of full-scale nuclear exchange in form of supposed "nuclear winter," darkening of atmosphere so complete as to yield long-term biological failure
early 1970s saw debate over supersonic passenger jet (SST) for potential damage to ozone layer; later, hypothetical argument that chlorinated fluorocarbons (CFCs) in aerosol sprays could also damage CFCs invented for GM's Frigidaire by Thomas Midgely in 1930 (he also invented tetraethyl lead in 1923) ideal refrigerants: non-toxic, highly efficient, non-explosive, extraordinarily stable: but very stability meant that they could be transported into upper atmosphere, broken down by sunlight, and chlorine ions could there serve as catalysts breaking down ozone molecules: unanticipated consequences
Sherwood Rowland and Mario Molina paper in *Nature* in 1974 first hypothesized CFC-ozone impacts striking example of how a solution to one environmental and health problem could cause other problems
1985, British scientists discovered ozone "hole" over Antarctica, with resulting fears about plankton and marine food supply, crop damage if found in mid-latitudes, potential increase in skin cancer from UV (note steady rise in melanoma and basal cell skin cancers since 1930s boom in tanning of bare skin)
1987: Montreal Protocol agreed to for phasing out of CFCs: technical fix to well-defined problem

III. Peering Skyward Into the Future

through 1970s, principal climate fear was of returning Ice Age from natural cooling and dust pollution (a leader in advocating for this view was UW-Madison's Reid Bryson, founder of Nelson Institute)
starting late 1970s, increasing interest in possible "greenhouse warming" from trace gases like CO₂, CH₄ (methane), CFCs (and water vapor, always most important)
earliest prediction: Svante Arrhenius, 1896: doubled CO₂ could yield 5° C global temperature increase; also predicted greater warming in winter than summer, land more than ocean, northern more than southern hemisphere, night more than day, poles more than mid-latitudes or equator; all plausible
Guy Stewart Callendar performed calculations by hand in 1938, and predicted world temperature rise
International Geophysical Year in 1957-58 created new institutional arrangements for climatic data collection: international scientific cooperation, permanent stations in Antarctica, climate monitoring

Roger Revelle, 1957: "Human beings are now carrying out a large-scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future...." (Revelle taught Al Gore) Cold War military interest in long-distance missiles, navigation, growing computational power, radiation: all contributed to the technologies and instrumentation that made it possible to study climate change key experiment: Charles David Keeling's Mauna Loa monitoring found rising CO₂ (famous graph) computer models key here too: indeed, began to be relied on even more than actual climatological data records of past temperature and gases: tree rings, Greenland and Antarctica ice cores, pollen, carbon 14 severe midwestern drought of spring 1988 was context for James Hansen (NASA climate modeler) testimony before Senate that local weather crisis resulted from greenhouse effect; highly controversial Intergovernmental Panel on Climate Change (IPCC) founded under UN auspices in 1988, began preparation of series of synthetic reports designed to identify consensus understanding among climate scientists (most recent of these published in 2007, available at <http://www.ipcc.ch/>) January 1989 *Time Magazine* replaced "man of the year" cover with "planet of year": "Endangered Earth" Bill McKibben published *The End of Nature* in 1989, serialized in *New Yorker*, first popular book on climate change, national bestseller, declared that human influence on climate and earth was now everywhere by mid-1990s, "hockey stick" graph seemed show clear signal of global warming caused by anthropogenic increases in greenhouse gases; computer models now better at mimicking historical data CO₂ not remotely as easy to regulate as CFCs, given its central role in all agricultural, industrial, and physiological activity: tied to the very metabolism of modernity mounting evidence and growing concerns: fear of flooding in coastal areas from sea level rise; shrinking mountain glaciers worldwide; shorter period of ice on Lake Mendota; spread of insect-borne diseases

IV. Katrina

Al Gore's *An Inconvenient Truth* in 2006 played crucial role in focusing public attention on climate change, an issue that had been of concern to Gore for many years, earning him (and IPCC) Nobel Prize in 2007 film led to large investments by oil companies and conservative groups to cast doubt on climate science, with Heartland Institute (<https://www.heartland.org>) playing a lead role in organizing such efforts after 2008 promotional posters for film showed ominous hurricane vortex emanating from industrial smokestacks clear implication was that greenhouse gases were contributing to hurricane frequency and/or severity use of image no accident: Hurricane Katrina a year earlier, on August 29, 2005, as symbol of severe weather after extended period of relatively infrequent hurricanes in second half of twentieth century, frequency seemed to be on the rise by 1990s, with some climatologists hypothesizing that warmer ocean temperatures would increase the number of severe hurricanes; property damage rose as people built expensive vacation houses on exposed shorelines during decades of relative calm although Katrina and New Orleans became symbols of global warming, we know from this course that they in fact reflect much deeper environmental historical phenomena that we've been studying all semester city's location at mouth of Mississippi River meant that the interior drainage of nation all flowed by here people had been constructing levees along the river for centuries to prevent flooding, with large-scale levee building promoted by the Army Corps of Engineers from second half of nineteenth century forward theory was that levees would not only protect property adjacent to the river, but would speed flow of water and scour and deepen river bed; but floods kept getting higher, requiring levees to be raised repeatedly New Orleans had suffered from flooding from the beginning when "crevasses" opened in its levees oldest part of city, the French Quarter, was on the highest ground adjacent to the Mississippi, with relatively little construction in the low marshy ground between the Mississippi and Lake Ponchartrain until 20th c 1927 Mississippi River flood widely blamed on bad levee design, producing strong commitment afterwards to higher levees, pumping facilities, and spillways where excess water could be directed effectiveness of new flood control accelerated urban settlement onto lower ground, while at same time drying and compressing soil so that city began to subside, making low ground even lower: by early 21st century, 49% of city was below sea level: New Orleans as "bowl" between Mississippi & L. Ponchartrain containment of river between levees meant that marshes in Louisiana delta were no longer replenished with silt, so that they too began to sink and disappear, thereby reducing buffer against storms Hurricane Katrina made landfall east of New Orleans as Category 3 storm (had been Category 5) on August 29, 2005; after initial elation that direct hit had been avoided, realization that levees had been breached in several locations, resulting in 80% of the city being under water at height of flooding more than 1800 people lost their lives in storm and floods; \$81 billion in property damage; 90,000 sq mi (size of United Kingdom) declared disaster area; 3 million people left without electricity differential impact on poor people and the linkage of poverty with race made storm's aftermath a scandal: nation ashamed at what was revealed by Katrina, and angry that leaders so ineffective in responding although Katrina became a symbol of global warming for many, it was a tragedy with much deeper and more complicated historical roots Hurricane Sandy makes landfall in New Jersey on 10/29/2012, 131 fatalities in U.S. (253 total), more than \$60 billion in damages, deadliest storm to hit NE since 1955, 4.8 million left without power (including in lower Manhattan), 2nd costliest hurricane after Katrina