



Separating the signal from the noise

Signal™

The newsletter for Corporate Affiliates of the University Corporation for Atmospheric Research



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A Reader's Guide to Climate Change Literature

A fairly well educated layperson interested in the earth's environment might find himself or herself wondering, "What is out there that can help me understand the scientific principles and uncertainties surrounding global change?" If that layperson happens to be a businessperson, he or she will rightly want more: "What is out there that discusses global change research from political as well as scientific angles? Is there anything in-depth and reasonably objective that analyzes the importance of global change to industry?"

We at Signal found a few volumes that answer these questions. They're summarized below. The Corporate Affiliates Program will be happy to send copies of any of the below items to any interested affiliate. But we'd also like to ask a favor: Will you help us put together a second version of this resource guide? Please send us any nominations you may have for a second compilation, and we'll run it later this year. Thanks for your interest.

—Bob Henson, Signal editor

Guides to Global Change Issues

"Global Warming Debate," Research & Exploration (National Geographic Society, Spring 1993). Softcover, 264 pp., many color photos.

For an overview that's lovely to look at and scientifically sturdy, this volume is hard to top. It includes seven papers written by some of the best-known names from the global warming field: Robert Balling, James Hansen, Richard Lindzen, Patrick Michaels, Michael Schlesinger, Stephen Schneider, and others. At the end, Thomas Karl deftly summarizes the various arguments (some conflicting, of course) and puts forth a few modest assertions: the risk of

extreme climate change cannot be dismissed, global observation networks must be improved, better computer models are needed, energy efficiency makes sense. The articles include some complex arguments, but concepts are introduced with care and with ample, easy-to-follow diagrams. As one would expect from National Geographic, the photos are stunning.

Ozone Depletion: Frequently Asked Questions, Robert Parson. Available on the Internet, updated monthly. 66 pages, text only.

This document isn't a narrative, but it is a superlative one-stop reference source. Parson is an associate professor of chemistry at the University of Colorado in Boulder who compiled this volume and put it on the information superhighway out of personal interest and goodwill. He cautions readers that the document is not peer-reviewed and should be used mainly "as a pointer to the published literature," amply referenced throughout. The four sections cover the

"What is out there that can help me understand the scientific principles and uncertainties surrounding global change?"

stratosphere and ozone layer, stratospheric chlorine and bromine, the Antarctic ozone hole, and ultraviolet radiation and its effects. Questions are direct, ranging from "What is the stratosphere?" to "How far back do Antarctic ozone measurements go?" to "Are sheep going blind in Chile?" (the latter has been ascribed by some researchers to pink eye rather than ultraviolet rays). Answers range from one to three paragraphs in length. The document's four sections can be obtained and copied from the Internet via anonymous file transfer from the directory /pub/usenet/news.answers/ozone-depletion at rtfm.mit.edu. You may also obtain them by sending e-mail messages, one for each section,

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to mail-server@rtfm.mit.edu. Each message must contain the words *send usenet/news.answers/ozone-depletion/[section]*, where "section" is *intro*, *stratcl*, *antarctic*, or *uv*, depending on which one you want. (The Corporate Affiliates Program can provide hard copies for members on request.) Updates are made each month.

Climate Change: The IPCC Scientific Assessment (Cambridge University Press, 1990). Softcover, 403 pages, 13 photos, 200 line drawings.

This is the final report of the Intergovernmental Panel on Climate Change, a group of several hundred esteemed researchers from 25 countries convened by the World Meteorological Organization and the United Nations Environment Programme to review the state of scientific knowledge on climate change. The result is a massive, authoritative, but fairly dry reference book—a true committee product, for better and for worse. Though the narrative may not be incomprehensibly technical for those with a physical-science background, it could easily prove daunting to a layperson. Fortunately, there are concise executive summaries for each chapter. References are exhaustive, but I found it frustrating and inexplicable that virtually all first names are completely omitted. A more concise update, *Climate Change 1992*, is available from the same publisher.

The Changing Atmosphere: A Global Challenge,
John Firor (Yale University Press, 1990). 145 pages, 19 line drawings.

In the introduction to this slender, admirable book, Firor—director of NCAR's Advanced Study Program and the lab's former director—discusses the mixed signals that go to the public when cautiously worded official assessments of climate change are followed by harder-hitting statements from some of the same scientists who served on those very assessments. Here and throughout

his book, Firor speaks directly to the lay reader with simple, clear prose and without condescension. The first chapters outline the basics of acid rain, global warming, and ozone depletion. Firor then looks at how our knowledge of human history, industrialization, and psychology can inform the political debate over global change. A nonscientist could finish this book in an evening with a far better understanding of the science and policy of climate change. Specialists will likely find the science familiar but the political and philosophical thoughts illuminating.

Climate System Modeling, Kevin Trenberth, editor (Cambridge University Press, 1992). 788 pages, many illustrations.

Easily the most technical of the books covered here, this is literally a textbook on climate modeling, originally produced for an NCAR-sponsored colloquium for graduate students. It remains the definitive volume in the field. Each of the 26 chapters is written by one or two specialists. The book moves from scientific groundwork to



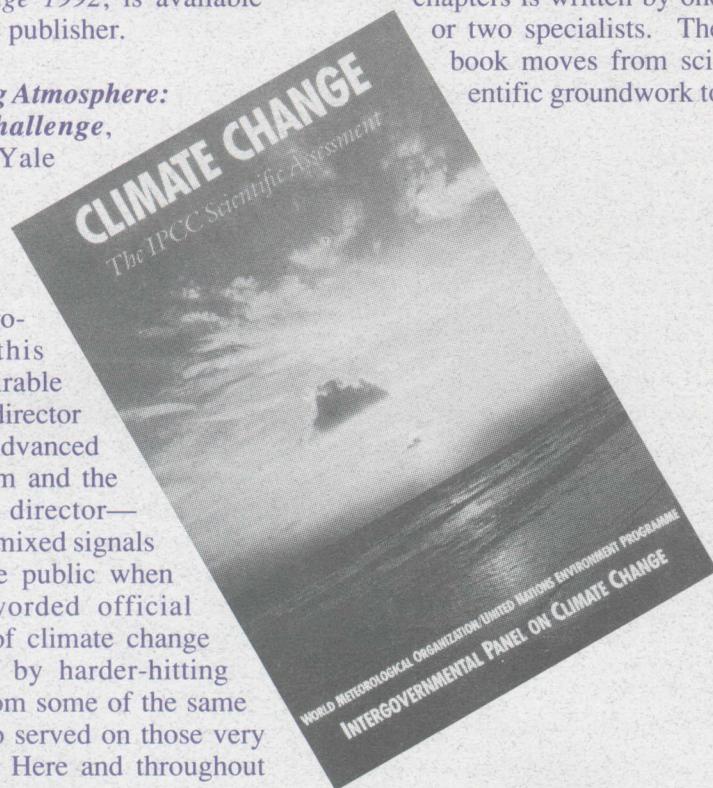
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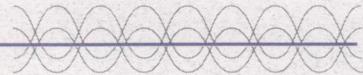
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Members are invited to submit news, opinion, and calendar items for *Signal* at the address below. Submissions will be used at the discretion of the Corporate Affiliates Program and cannot be acknowledged or returned.

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moves from scientific groundwork to modeling, interactions among climate components, model sensitivity experiments, and future prospects in modeling. Mathematics include partial differential equations. Diagrams in two colors, plus an insert with 16 full-color diagrams and photos, help ease the way for the uninitiated. There is a 48-page section of references.

Business-Oriented Guides

Costing the Earth: The Challenge for Governments, the Opportunities for Business, Frances Cairncross (Harvard Business School Press, 1992). 341 pages.

Cairncross, who became the first environmental editor of *The Economist* in 1989, here makes the case that government and industry can work together toward "green" goals. Her narrative ranges over various hot topics—energy efficiency, waste disposal, recycling—using anecdotes and case studies to show how policies that encourage industrial ingenuity can harness that energy for the good of the environment. Cairncross points out that government intervention in the form of agricultural and energy subsidies can do as much environmental damage as can inaction. She contends that government must begin by establishing ecological priorities, then lay a constructive framework for market forces to do the rest. While not really written from a businessperson's perspective, this book is still a worthy source of ideas.

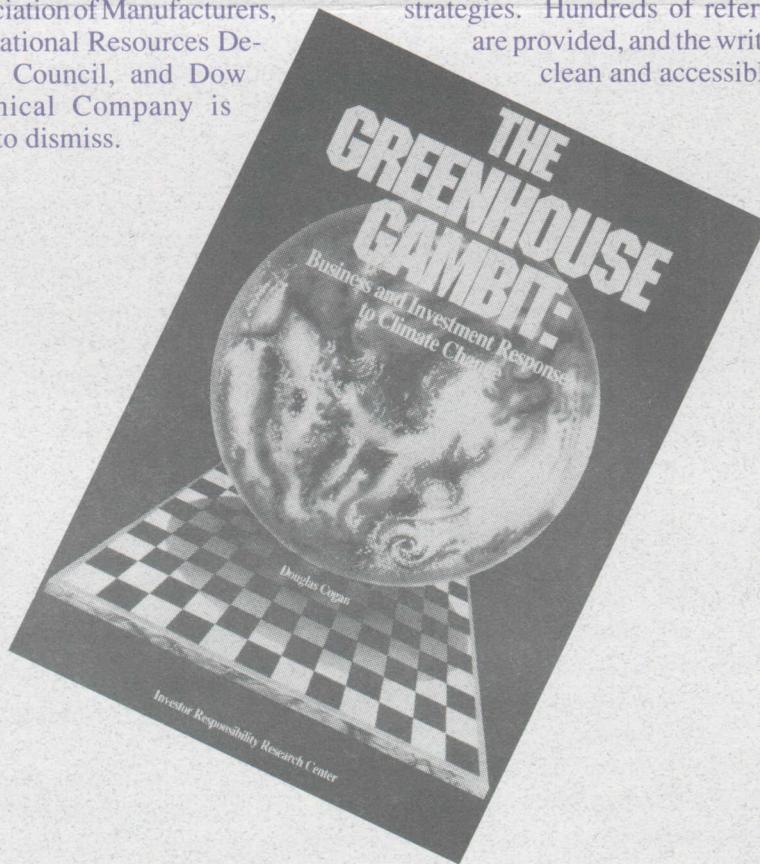
Beyond Compliance: A New Industry View of the Environment, Bruce Smart (World Resources Institute [WRI], April 1992). Softcover, 286 pages.

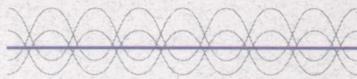
"These chapters are written primarily by, for, and about business." That line comes from the first

chapter of this rewarding guidebook, which traces the experience of about two dozen companies making real efforts to go green. Smart, who is a senior fellow at WRI, lets the corporations—Monsanto, Chevron, DuPont, Northern Telecom, Southern California Edison, and others—tell their own stories, which gives the book a first-person, authentic feel (though you may find yourself wondering what juicy tidbits the companies chose to leave out). The book follows corporate initiatives as they move from goals and accountability to recruitment of key players, communication with environmentalists and the public, regulatory and liability issues, and results assessment. For each topic, two or three companies' experiences are highlighted, so that each company is threaded in and out of the narrative. Any book that can earn favorable notice from the National Association of Manufacturers, the National Resources Defense Council, and Dow Chemical Company is hard to dismiss.

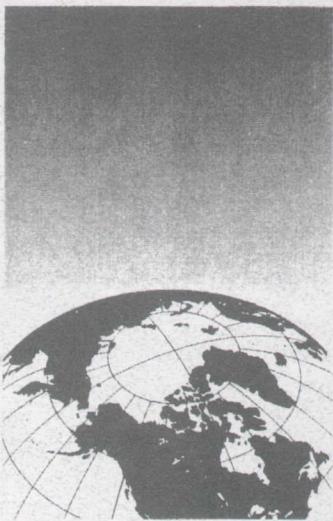
The Greenhouse Gambit: Business and Investment Responses to Climate Change, Douglas Cogan (Investor Responsibility Research Center, 1992). Softcover, 503 pages, about 50 line drawings.

This book manages the difficult feat of being a global-change primer and a business-strategy adviser at the same time. Cogan examines four industries with the greatest to lose (or gain) in the greenhouse debate: agriculture, forest products, automobiles, and electric power. The "gambit" of the book's title is the trade-off between waiting for more concrete climate predictions and acting now to forestall greater adaptational pain in the future—a choice Cogan calls "the essence of risk, the stuff of investing." That spirit infuses the book's chapters, which lay out the possible global-change impact on each of the four industries and then take a close look at the viability of response strategies. Hundreds of references are provided, and the writing is clean and accessible.





Technology Corner



NCAR GRAPHICS

UCAR's Technology Commercialization Program markets technologies that have been created in the course of scientific research and development within UCAR. Each month in this column, we outline one or more technologies now available for licensing.

NCAR Graphics, version 3.2

The NCAR Graphics package offers a wide range of capabilities for the display of numerical data. Its versatility has helped researchers at some 1,500 sites throughout the world make sense of massive quantities of data—whether the task be visualizing solar convection fields, particle accelerator magnetics, the Antarctic ozone hole, water movement in the ocean, or some other observed or calculated data. Version 3.2 includes a substantial amount of new capabilities, and version 4.0 (expected to be released near the end of this year) will further strengthen NCAR Graphics as a professional data analysis and visualization package.

At the heart of version 3.2 of NCAR Graphics lie over two dozen utilities for contours, maps, field flows, histograms, x-y plots, wire frame surfaces, and stroked characters. The package is based on ANSI C, FORTRAN 77, ANSI/ISO Graphical Kernel System (GKS) and Computer Graphic Metafile (CGM) standards, X Window System, Motif, Network Common Data Form (netCDF), Hierarchical Data Format (HDF), and PostScript. Full C bindings for supported systems are now available for all user entry points in every utility and in the supplied NCAR GKS-0A package.

Capabilities include

- *Graphs, grids, and dashed lines.* Several utilities let you draw and annotate curves or families of curves and draw bar charts, grids, perimeters, or dashed lines. A range of labeling and smoothing capabilities is provided.

- *Contouring.* Conpack draws black-and-white or color contour plots from regularly spaced (gridded) data. Irregularly spaced (random) data can be interpolated and contoured using provided Bivar routines. The new version of Conpack includes inverse map transformations, raster contouring using cell-array output, and hachuring capabilities.

- *Maps, area fill, and field flows.* Ezmap plots continental, U.S. state, and world political outlines using one of ten projections. Softfill fills polygons in solid fill, parallel solid lines, or rows of dots, polymarkers, or characters; you may use color. Areas creates an area map from a set of edges that divide a two-dimensional plane into areas; it may be used with utilities like Ezmap and Conpack to create solid-colored maps and contour plots. Vectors

creates a two-dimensional vector field display using arrows whose length represents magnitude and whose color can represent another scalar field. Streamlines plots flow lines with arrowheads indicating flow direction. Both Vectors and Streamlines support coordinate-system mapping and have a new masking capability to enhance support for overlays.

- *Text, labels, and legends.* Plotchar uses new, high-quality filled fonts and optional outlining and shading to plot publication-quality characters. Text characters may be transformed onto arbitrary surfaces.

- *Color conversion.* Colconv converts color specifications from any one of the following color spaces to any other:

- hue, lightness, and saturation (HLS)
- red, green, and blue (RGB)
- hue, saturation, and value (HSV)
- YIQ (the color space used by broadcast television)

- *Three-dimensional displays and movies.* Isosurface creates iso-surfaces (with hidden lines removed) from a three-dimensional array; it now has the ability to interpolate surfaces to a higher resolution. Surface provides a three-dimensional display of a two-variable function. Threed provides three-dimensional line-drawing capabilities. Gflash supports a limited picture segmentation capability, while Scrolled_title produces scrolled or stationary movie titles; both utilities allow for color, fade in, and fade out.

User Support

The Scientific Computing Division (SCD) of the National Center for Atmospheric Research (NCAR) provides users with various support services. Experienced staff can be



contacted during installation, if needed. Along with ready-to-install binaries for supported systems, you will receive, under license, the package source, which lets you make modifications as you see fit. Your appointed site representative(s) can inquire at the SCD Consulting Office about such areas as utility interfaces, functionality, applications to specific problems, and the combined use of utilities. On a contract basis, UCAR can arrange on-site installation of the NCAR Graphics package, user-defined package modifications or enhancements, and device-driver modification or creation.

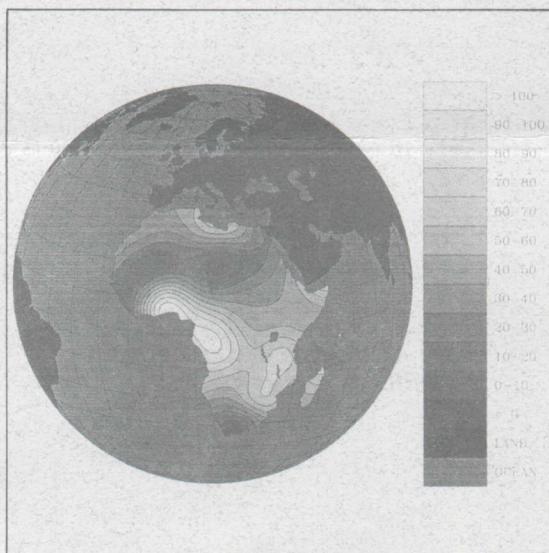
SCD currently offers support for NCAR Graphics when correctly installed on the UNIX-based computers and operating systems shown below. It cannot consult on installation questions for other computer/system combinations, but source code is distributed with each package, and user-supplied hints on ports to other systems may be available.

CRAY Y-MP (UNICOS 6.1)
DEC DECstation (ULTRIX 4.3)
HP 9000, series 7000 (HP-UX 9.01)
IBM RISC/6000 (AIX 3.2)
Silicon Graphics R4 Systems
(IRIX 4.0.5C)
Sun-4 series or Sun SPARCstation
(SUN OS 4.1, 5.1, and 5.2
[Solaris 2.1 and 2.2])

Each purchase of NCAR Graphics comes with complete user and installer documentation. On-line reference manual pages are updated with each software release. Users also receive a complete set of hard-copy documentation, including over 270 FORTRAN and C examples that can be compiled and executed to give you a quick start on producing results.

How to Order

The NCAR Graphics package is available in various media, including popular CD-ROM or eight-millimeter cassette formats. For technical and ordering information about the NCAR Graphics package, please contact NCAR Graphics Information. You may send e-mail to scdinfo@ncar.ucar.edu, send a fax to 303-497-1814, or call 303-497-1201. For sublicensing and redistribution information, please contact Wayne Moore, marketing manager for the Technology Commercialization Program, 303-497-8563, e-mail wmoore@ncar.ucar.edu.



This plot shows how color-filled contours can be partially overlaid on a map projection, while at the same time masking the remaining land-mass boundaries and drawing latitude and longitude lines only over the ocean. A label bar has been added to relate colors to values. The data for the contour plot were randomly generated.

Calendar/Announcements

April 10–13

University of Montreal
International Symposium:
When Science Becomes Culture
Montreal, Quebec, Canada
Information: 514-285-1450

April 12–13

Earth Resources Association
U.S. Global Change Policy Symposium
Washington, D.C.
Information: 612-822-3702

April 25–26

Walter Orr Roberts Institute/
UCAR Office of Interdisciplinary Earth Studies
*Workshop on Industrial Interests and
Concerns in Climate and Severe Weather*
Boulder, Colorado
Information: 303-497-2109

June 19–24

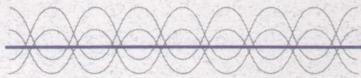
Air and Waste Management Association
AWMA 87th Annual Meeting and Exhibition
Cincinnati, Ohio
Information: 412-232-3444

June 20–24

*International Conference on
Ecology and Environment*
Drake Bay
Peninsula de Osa, Costa Rica
Information: 506-515-348 (fax)

September 5–13

United Nations
*International Conference on
Population and Development*
Cairo, Egypt
Information: 212-297-5250 (fax)



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timely reports issued by UCAR and other organizations. Members are acknowledged with listings in UCAR reports and receive a certificate of membership that can be used in public relations. (Of course, membership does not imply any UCAR endorsement of a company or its products.)

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Research into: global climate

atmospheric chemistry

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instrumentation

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What did you most like about this issue of *Signal*? _____

Other comments: _____

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