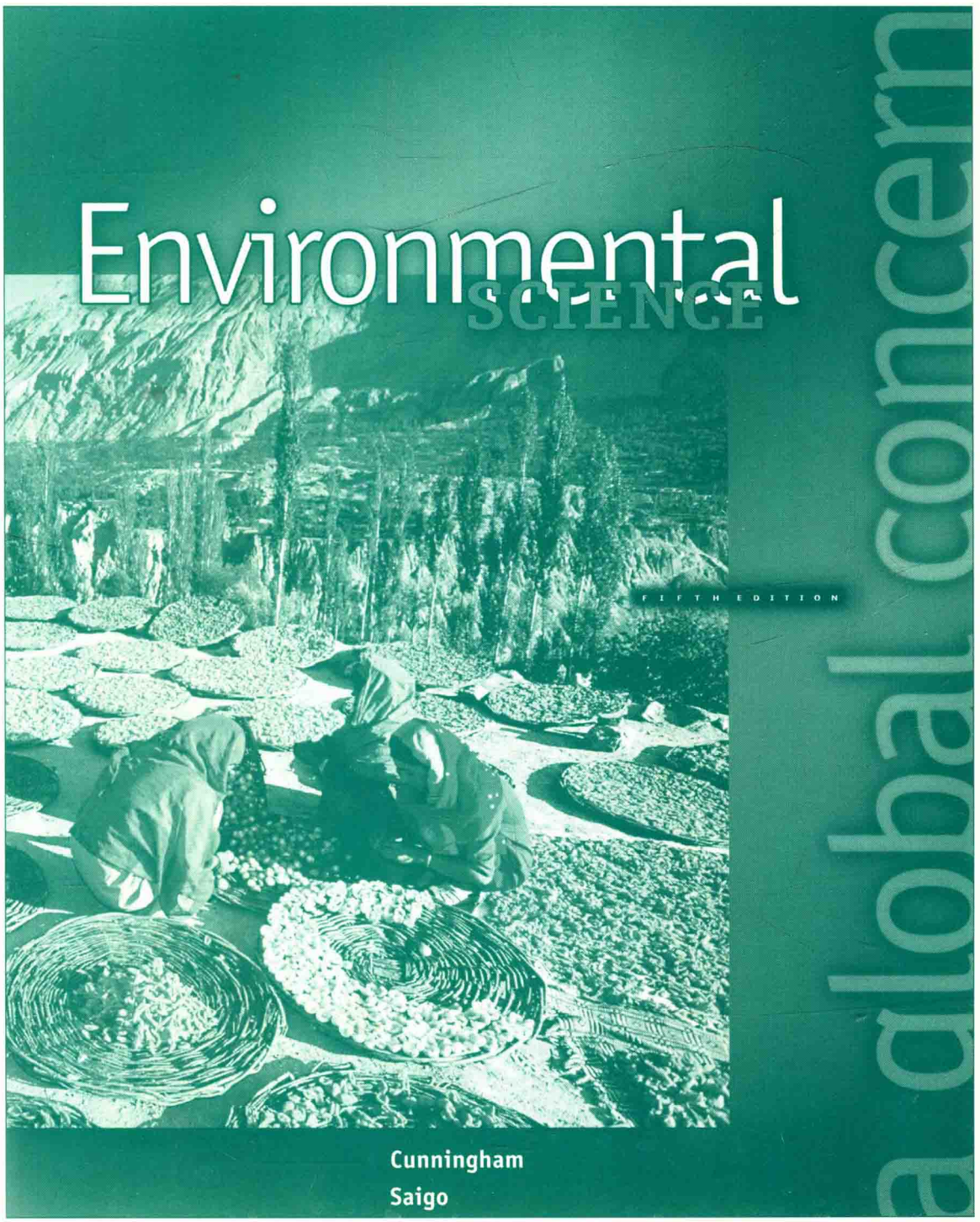
Instructor's Manual and Test Item File

to accompany



Prepared by
Amanda Woods McConney

Instructor's Manual and Test Item File

to accompany

Environmental Science

A Global Concern

Fifth Edition

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University of Minnesota

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Saiwood Biology Resources
Saiwood Publications

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Instructor's Manual and Test Item File to accompany
ENVIRONMENTAL SCIENCE: A GLOBAL CONCERN, FIFTH EDITION

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PREFACE

Note to Instructors by the authors of the text

Environmental Science: A Global Concern is designed for use in a one-semester or one-quarter length course in Environmental Science or Human Ecology. This text first covers principles of natural science and ecology, making them accessible to non-science majors as well as general science students (Part I). Questions of human populations and our interaction with our environment are addressed in Parts II and III. Part IV investigates our earth's resources and the ways we use and abuse them. Finally, Part V investigates ways we might build a society capable of living on earth with less harmful impacts. Throughout the text, examples, illustrations, and case studies apply science principles to both national and international topics of environmental importance, making clear the immediate connections between classroom learning and the world around us. While the material covered is scientifically thorough and up to date, presentation is clear and straightforward, so that students may get a solid grasp of concepts and their significance.

Throughout *Environmental Science: A Global Concern* a special effort has been made to guide students into patterns of independent thinking and evaluation of issues and problems. Chapter 2 includes an in-depth discussion of critical thinking skills. This discussion is designed to help students consciously develop an orderly method of evaluating and understanding the often conflicting information they will gather about science and the environment both in and out of the classroom. In order to reinforce this practice critical thinking is referred to in the chapters and students are asked to reflect on their worldviews in *What Do You Think* boxes. Lists of Questions for Critical Thinking at the end of each chapter as well as the customary Review Questions are also designed to reinforce meaningful learning and critical thinking. These questions are designed to expand independent reflection of topics discussed in the text, but they can also be useful tools in initiating in-class discussions or as starting points for paper topics. Chapter Objectives are presented so that students can clearly know from the outset which central lessons they should focus on as they read. In addition, alphabetized lists of key terms and additional resources on the Internet are presented with each chapter. Suggestions for Further Readings are provided at the end of the text, listed by chapter. This Instructor's Manual contains full lists of questions, outlines, objectives, and key term lists for each of the 25 chapters in the text.

Note to Instructors about the preparation of this manual

The organization and content of the instructor's manual is similar to previous editions and again I focused most of my energy on developing higher order questions for the test item file. Because assessment is such a critical aspect of student learning, I attempted to construct questions that are not based solely on knowledge, but instead require students to apply their knowledge. For this reason I did not use true/false questions. I believe that true/false questions make guessing too easy since students have a 50/50 chance of guessing correctly. Further, with the high level of guessing, you, the instructor cannot diagnose where students *are* in terms of their grasp of the content. Hopefully, some of the questions in this manual will help you diagnose student learning and will in turn facilitate student knowledge. As you well know, constructing good questions takes time, and I find, revisions after administering exams. I welcome your comments and suggestions so please provide feedback on the test questions. I can be contacted through Western Oregon University, Monmouth, OR 97361.

I am excited about the fifth edition of this text because I recognize the authors' commitment to critical thinking. Critical thinking is an integral component of the text and is not merely "tagged on" at the end in a chapter. This helps students develop their critical thinking skills–which are so very important in unraveling complex environmental issues. I urge you to use the list of Internet resources provided at the end of each chapter. These resources provide the most up-to-date information and can be an excellent tool for you in preparing class activities .

Have fun, good luck, and great teaching!! AWM

Further Information on Computer Network Resources:

Ecolinking: Everyone's Guide to On-line Environmental Information. Don Rittner, 1993. Berkeley, CA: Peachpit Press.

General References:

These sources were used extensively in preparation of the text *Environmental Science: A Global Concern.* They will serve as strong references and basic data sources for class discussion and student research or writing projects.

State of the World, 1997. The Worldwatch Institute (L. Starke, ed.). New York: W.W. Norton and Company. An annual publication containing well-documented essays on major environmental and population issues. Thorough discussions with examples and statistics.

World Development Report 1994: Development and the Environment. The World Bank, 1992. New York: Oxford University Press. An establishment view of human, environmental, and economic development issues. Each annual issue relates major themes to current approaches to development thought; the 1992 issue, for instance, focuses on sustainable development as discussed at the Rio world environmental conference. Excellent tables and graphs.

World Resources, 1996-97. The World Resources Institute (in collaboration with the United Nations Environment Programme and the United Nations Development Program). New York: Oxford University Press. A biennial report containing extensive original data on natural resources, environmental quality, and development progress. Each year's report focuses on a series of central issues such as land use, food supplies, and energy resources.

World Resources: Teacher's Guide. The World Resources Institute, 1997. New York: Oxford University Press. A handbook designed to facilitate classroom use of *World Resources.* Includes introductions to the issues, practical lesson plans, student handouts and enrichment activities, transparency masters, and more. Individual chapter reprints and sets of colored slides or transparencies of illustrations from *World Resources* are also available.

The World Environment, 1972-1992. United Nations Environment Programme. M. K. Tolba, O. A. El-Kholy, eds. London: Chapman & Hall. An international review of major environmental conditions, including discussions, data, maps, and graphs covering such topics as agriculture, mining, fresh water supplies, land and coastal degradation, air pollution, tourism, and population.

The 1993 Information Please Environmental Almanac. World Resources Institute. New York: Houghton Mifflin. A good source of instant environmental statistics, with good graphs and tables. Includes a listing of major environmental indices for each of the United States and each of the world's countries.

The Environmental Encyclopedia. William Cunningham et al., eds., 1994. Detroit, MI: Gale Research, Inc. About 1300 short articles on important environmental topics. A good starting point for students working on research papers. Longer articles fully referenced.

Thematic Atlases on Environmental Topics:

Atlas of United States Environmental Issues. Robert J. Mason and Mark T. Mattson, 1990. New York: MacMillan. ISBN # 0028972619. Excellent general reference covering lands, agriculture, natural resources, waste disposal, energy, wildlife, pollution, and other environmental topics.

US Mapbook: Environmental Atlas. 1992. Cambridge, Mass: Interarts. ISBN # 1879856018. Nearly 200 pages of mapped environmental data; comprehensive environmental source book including climate, relief, and natural resource use.

Atlas of the 1990 Census. Mark T. Mattson, 1992. New York: Macmillan. ISBN # 002897302x. Presents data from the first-ever mapped decadal US census, including most census data topics (population density, population changes, housing, economy, education, ethnicity, and more).

Third World Atlas. Ben Crow and Alan Thomas, 1983. Philadelphia: Open University Press. ISBN # 033510259x. Excellent source on demography, environment, politics, economy, and history, with overall attention to development issues.

California: An Environmental Atlas. Bern Kreissman, 1991. Davis, CA: Bear Klaw Press. ISBN # 0962748994. Good comprehensive source covering California's ecology, conservation of natural resources, and resource availability as well as relief maps. Includes bibliographic references.

California Water Atlas. 1979. North Highlands, CA: State of California. Available from General Services, Publications Section, Box 1015, North Highlands, CA 95660. ISBN # 0913232688. Outstanding and beautiful volume with detailed environmental information including extensive presentation of critical water issues: water resources, aqueduct and dam projects, aquifers, and more.

Water Atlas of the United States. James J. Geraghty, ed., 1973. Port Washington, NY: Water Information Center. ISBN # 091239403x. A dated but comprehensive source with outstanding maps focusing on water quality, resource availability and consumption, water laws, and other major topics.

The Last Rainforests: A World Conservation Atlas. Mark Collins, ed., 1990. New York: Oxford University Press. A lavishly illustrated and mapped presentation of the world's remaining tropical rainforests, grouped by world region and covering cultural ecology, botany, ecology, population, resource extraction, and other environmental problems. Extensive text discusses issues in detail.

The Great Lakes: An Environmental Atlas and Resource Book. Environment Canada and US EPA, 1987. Toronto: Environment Canada and Chicago: US Environmental Protection Agency. ISBN # 0662151985. A jointly produced atlas of water quality, settlement, industry, and other environmental issues surrounding these international waters.

Environmental Atlas of Alaska. Charles W. Hartman, 1978. Fairbanks: Institute of Water Resources, University of Alaska. Good sources of mapped climate, resource, and other environmental data.

Atlas of Environment and Natural Resources in Appalachia. HRB Singer, Inc., 1977. Washington, DC: Appalachian Regional Commission. A dated but excellent source covering economic development, forest, mineral, and water resources of this economically important region. Also covers mine disasters, mine reclamation, solid waste conditions, and demographic data.

Additional Innovative Course and Classroom Resources:

Fast Plants & Bottle Biology. A source of insect eggs and plant seeds developed by the University of Wisconsin for in-class experiments, ecosystem simulations, and other hands-on projects. Plants and insects selected for fast germination and breeding in plastic soft drink bottles in less than five weeks. Venus fly traps, fruit flies, praying mantises, and a variety of flowering plants are available for simple demonstrations of predator-prey relationships, pollination, niches, and other ecological concepts. Seeds, instructions, and ideas provided. Write or call Fast Plants/Bottle Biology, University of Wisconsin-Madison, Department of Plant Pathology, 1630 Linden Dr., Madison, WI 53706, (608) 263-5645.

Cooperation and Competition: Theory and Research. David W. Johnson and Roger T. Johnson, 1989. (Interaction Book Company, 7208 Cornelia Dr., Edina, MN 55435, (612) 831-9500). Cooperative learning techniques. Intriguing research results and practical techniques in cooperative learning strategies and structured interactive projects. Included in this discussion are methods of recognizing and managing attitudes toward science, motivation, social skills, and self-esteem. Useful in developing effective learning methods.

How to Study Science. Fred Drews, 1992. Dubuque, IA: William C. Brown. Designed to supplement any introductory science text, this student workbook includes discussions and exercises concerning ways to learn and study concepts, organize note taking and set priorities in remembering ideas, and interpret lectures. Also contains discussions of overcoming science anxiety.

General Environmental Science Resources

Games and Simulations

Balance of the Planet. Students manipulate production of and investments in natural resources, health, technology, population control, and other variables in an effort to gain points by establishing a healthy, stable planet. Manual includes glossary, brief discussion of environmental hazards and benefits, and an annotated bibliography.

Global Recall. Lets players use a real-world environmental database, including over 300 maps, 600 data indicators for all countries of the world, graphing capabilities, and essays on development issues to direct a world development strategy. Macintosh. Source: World Game Institute.

CD and On-line Databases

Dictionary of the Living World. CD-ROM dictionary with text and graphics covering environmental topics and systems. Macintosh. Source: Educorp, #1566.

World Resources Database 1992-93. A tabular database and graphing program from World Resources Institute. Demographic and environmental data worldwide. 3.5 and 5.25 inch disks formatted for PC. Source: World Resources Institute.

Focus on Global Change. An on-line database covering more than 200 publications on subjects including agriculture, demography, earth sciences, ecology, economics, forestry, geography, natural resources, planning, and other topics. On-line databases, updated bi-weekly, are accessed with a program installed on either IBM compatible, Macintosh, or NEC computers. Source: Institute for Scientific Information, 3501 Market Street, Philadelphia, PA 19104.

Small Blue Planet. A CD-ROM full-color satellite atlas of the world. Allows students to zoom in and out, scan, use insert windows with political, physiographic, and other map themes. Macintosh. Source: Educorp, #2090.

Videotapes and Video Disks

Race to Save the Planet. WGBH Educational Foundation, 1991. A 12-inch interactive laserdisc with 7 excerpts from the public television series of the same name. Six-minute segments cover topics including the Colorado River, the Rhine River, wilderness and species diversity, garbage, pesticides, air pollution, and Chico Mendez and the Brazilian rubber tappers. Includes a Macintosh-formatted environmental database, user's manual, teacher's guide, and student worksheets. Scholastic Software.

Race to Save the Planet. The complete series of 10 hour-long video tapes of the public television series *Race to Save the Planet*. A dated, but useful resource. The tapes need to be reviewed before showing them. Topics include historical human relationships with the environment, atmospheric change, solid and toxic waste disposal, biodiversity, and more. Produced by WGBH Educational Foundation. VHS #UM-3007, Films for the Humanities.

Individual titles in the Race to Save the Planet Series:

Environmental Revolution (historical human-environment relations, ideas about nature)
Only One Atmosphere (potential climatic crises associated with human activities)
Do We Really Want to Live This Way? (advantages and disadvantages of modern consumer culture)
In the Name of Progress (reviews well-intentioned development efforts gone bad, asks if environmental preservation and economic development need to be opposing interests)
Remnants of Eden (looks at mass extinctions, our possible role in them)
More for Less (considers ways we might plan our future with less environmental exploitation)
Save the Earth-Feed the World (questions modern farming practices, reviews alternatives)
Waste Not, Want Not (chilling accounts of waste disposal problems, explores reduction and recycling options)
It Needs Political Decisions (explores the power of politics in environmental protection-in developed and developing countries)
Now or Never (introduces individuals actively working for environmental change, encourages others to take action)

The Greenpeace Years. A look at the early innovations and recent accomplishments of this highly visible, controversial, and committed environmental activist organization. Interviews founders, members, and participants in a Greenpeace training camp. 54 min. VHS, National Film Board of Canada.

Danger Ahead: Is There No Way Out? Is global warming available? Can we reverse it technologically? This film presents various projections of climate change. 26 min. VHS, Beta or U-matic #PD-2406, Films for the Humanities.

Preserving Our Global Environment. 1993. An hour-long focus on three major issues, population growth, biodiversity loss, and global warming, and their interrelations and implications. Presented through real examples of communities in Zimbabwe, Panama, and the United States. 53 min. VHS #EDPGV, World Resources Institute.

Part I: Environmental Science and Ecological Principles (Chapters 1 - 5)

Games and Computer Simulations

LIFEmap. A CD-ROM simulation with high-quality graphics and special effects demonstrating the process of evolution. Three volumes: 1. Organic Diversity (#1992); 2. Animals with Backbones (#1993); 3. Animals (#1994). Macintosh. Source: Educorp.

SimEarth: The Living Planet. Students direct the development of a planet, from the first emergence of land to the development of sentient cultures among different types of creatures or plants. Macintosh. Source: MacWarehouse Catalog, ENT 0356.

Ecology. Ecological simulations and games exploring relationships and dynamics in ecological systems such as the Amazon rainforest. Macintosh. Source: MacWarehouse Catalog, EDU 0298.

Predation Equilibria. A package that allows students to explore the effects of varying sizes of predator populations and to model the effect of hunting pressure in a stable predator-prey system. William. C. Brown.

Niche: An Ecological Game. Students use this program to explore the concept of an ecological niche. Cambridge Development Laboratory.

CD and On-line Databases

Discovery Environmental Data. Worldwide data on food, population, and agriculture, including general environmental data from *World Resources.* Source: PEMD Education Group, Ltd., 220 Hyde Street, San Francisco, CA 94109.

Environmental Bibliography: GeoRef. Journal abstracts on CD ROM from the American Geological Institute's GeoRef database. Source: SilverPlatter Information, Inc.

Science Citation Index. CD ROM version of printed index to 3300 major journals in 100 scientific disciplines. Search by title, author, cited author, cited work or patent. Updated quarterly. Available at many libraries.

The National Directory. A national listing of over 100,000 organizations, with phone and fax numbers. Source: Xiphias.

Videotapes and Video Disks

Diversity Endangered. A good, ten minute introduction to biodiversity. Smithsonian Institution Traveling Exhibition Service, Washington, DC 20560; (202) 357-3168.

Only One Earth. A series of tapes from the public television series. Each segment investigates one major aspect of living with our environment, such as efforts to provide organic foods, biodiversity and medicines, or the fate of the earth's forests. Each show 30 to 60 minutes. VHS (catalog numbers vary), University of Minnesota Film and Video.

Significant Hazards? The Sommerville DNA Debate. Documents the political and public debate surrounding the proposed building of a recombinant DNA lab in a densely populated suburb of Boston. Makes clear the importance of effective communication between scientists and the public, examines benefits and risks of technological development. 24 min. 16mm #7N1715, University of Minnesota Film and Video.

The Blue Planet. This video examines the development of life on earth and the ways the earth's environment shaped the way in which life-forms evolved. 26 min. VHS, Films for the Humanities.

Ecological Biology. This film describes the distribution of living organisms in space and time, why they live where they do, and how their populations interact. 16 min. 16 mm #10271, University of Wisconsin.

What Is Ecology? A film defining what an ecosystem is, with examples. 21 min. 16 mm, #05274. University of Wisconsin.

Matter and Energy. Describes the properties and states of matter and energy, and the law of the conservation of matter and energy. 14 min. #03250, University of Wisconsin.

Goddess of the Earth. This Nova show explores the controversial theory that the earth functions as a living organism, modifying conditions to create an optimal environment for life. 58 min. VHS #4937C, Coronet/MTI Film and Video.

How To Make a Difference Video: Wetlands. Audubon Productions 1992. Outlines the rapid loss of wetlands in the United States, the costs of this loss, and ways that individuals can take action to help preserve our remaining wetlands. 30 min. VHS. Source: Audubon Activist.

The Living Reef. Explores the composition and communities of the Great Barrier Reef in Australia. Looks at the many types of marine life that depend upon the coral reef. Laserdisc. Emerging Technology Consultants.

The Temperate Rain Forest. Examines the characteristics and ecology of the beautiful British Columbian coastal rainforest, looks at factors that make its balance delicate, and presents a case for its preservation. 16 min. 16mm #5N1714, University of Minnesota Film and Video.

The Everglades: Conserving a Balanced Community. Documents the political and public debate surrounding the Everglades, featuring aerial views of the swamps, forests, and prairies and close-ups of birds, plants, and alligators. The unique environment exists nowhere else but is threatened by population and industrial growth. 12 min. 16mm #5N1746, University of Minnesota Film and Video.

Antarctica. Still largely uncharted, Antarctica is already used as a garbage dump. Introduces the geography, beauty, and vulnerability of this remote region. VHS, Beta, or U-matic #PD2200, Films for the Humanities.

The Water Crisis. Although most Americans take water for granted, this segment of the Nova series shows that water scarcity could become the next national issue. Looks at supplies, pollution, and policies of water. 57 min. 16mm #1N14543, University of Minnesota Film and Video.

Water and Life: A Delicate Balance. This video shows the role of water in the human body, the cycles of water, and industrial water consumption and pollution. 13 min. VHS, Films for the Humanities.

Jungle. A segment of the *Living Planet* series, this video describes the complex ecological relationships in a tropical rainforest. 14 min. VHS or 16mm #1N1587, University of Minnesota Film and Video.

Part II: Population, Economics, and Environmental Health (Chapters 6-9)

CD and On-line Databases

Agricola. The National Agricultural Library's on-line database, covering worldwide journals and monographs on agriculture, soils, livestock, forestry, and other related topics. Source: Knowledge Index Databases.

Agrochemicals Handbook. Provides information on agrochemical products used worldwide, on-line via Dialog. Source: Knowledge Index Databases.

Economic Literature Index. On-line database run by Dialog. Covers book reviews and articles from 260 economics journals as far back as 1969. Source: Knowledge Index Databases.

The Chemical Referral Center. A public service providing health and safety information about chemicals and chemical production. An on-line database: to use it call (800) CMA-8200 between 9 am and 6 pm M - F. Free.

Food Science and Technology Abstracts. Provides access to research and innovations in food science, agriculture, chemistry, and other related subjects since 1969. Source: Knowledge Index Databases.

Pollution Abstracts. References to literature on pollution of all sorts, as well as sources and control methods. Source: Knowledge Index Databases.

Toxic Chemical Release Inventory. CD database of reports to US EPA of toxic emissions from manufacturing, processing, or use facilities. Available at larger libraries or through the EPA.

Films and Videos

World Population. A graphic display of the history of human population growth. 6.5 minutes. ZPG Population Education Program, 1400 16th Street, NW, Suite 320, Washington, DC 20036. (202) 332-2200.

Will the World Survive? Increasing populations need accelerated agricultural production, but rapid-growth, high-yield crops take their toll on soil resources. Considers the Green Revolution and other efforts to improve food production. 58 min. VHS #5136C, Coronet/MTI Film and Video.

The Silent Emergency Preventable diseases kill 15 million children yearly, a problem that could be largely prevented with monitoring and simple technology. English, French, or Spanish. 21 min. (3/4 inch U-matic videotape #193, UNICEF.

Nova: Child Survival-The Silent Emergency A full-length presentation of the "child survival and development revolution," a worldwide UN effort to prevent childhood mortality due to diarrhea and other common illnesses. English only. 58 min. 3/4 inch U-matic videotape #197, UNICEF.

A Population Story: Collision with the Future. Shows a frightening futuristic scenario in which life on a dangerously overpopulated earth finally becomes insupportable. 23 min. 16 mm #10025, University of Wisconsin.

Tragedy of the Commons. Portrays the problems associated with overpopulation; based on the essay by Garret Hardin. 30 min. 16 mm #08657, University of Wisconsin.

Scientific Eye: Earth LTD. Journal Films. Discusses the earth's non-renewable resources (metals, stones, fuels) and ways that we can use them more carefully and wisely. Laserdisc. Emerging Technology Consultants.

Forestry: the Science and the Art. Gives an overview of the forest products industry and its current controversies, especially the clearcut method of harvesting trees. 20 min. VHS #5N1753, University of Minnesota Film and Video.

Pollution: How Much Is a Clean Environment Worth? Defines the concept of "external diseconomy," shows the ways in which externalities can be calculated, and uses a cost-benefit analysis to determine the "optimum" level of pollution. 30 min. VHS #7A1027, University of Minnesota Film and Video.

The Toxic Goldrush. Cleaning up the environment has become a fast growth industry. But will companies hired to clean up air, water, and land really use appropriate technology and contain the poisons, or will sloppy methods merely transform and spread toxic substances? 26 min. VHS #NN-1871, Films for the Humanities.

Dioxin. Exactly what is dioxin? Where does it come from? What is its effect on humans? Working from the example of Agent Orange, this film looks at how links are scientifically established between a chemical and disease. 26 min. VHS #NN-1832, Films for the Humanities.

Environmental Illness: Bad Chemistry. This program examines the health effects of common chemicals from perfumes and aerosols to plastics. Environmental Illness (EI) has become an increasingly common and recognized result. 60 min. VHS #NN-3058, Films for the Humanities.

Environmental Toxins and Community Response. Includes 17 lectures on 6 videocassettes, taped at the Harvard School of Public Health. Accompanied by a 149-page study guide. VHS, Umbrella Films.

A Plague on Our Children. Two hour-long segments covering the debates and dangers surrounding dioxins and herbicides (part 1) and PCBs (part 2). Looks at regions where serious health problems have arisen and at EPA responses. VHS, Richter Productions.

Environmental Health: Are You Swimming in a Sewer? Waterways and oceans are receiving billions of gallons of waste daily. What sort of toxic chemicals are fouling our waters, and what threats do they pose? 58 min. VHS #5127C, Coronet/MTI Film and Video.

Introduction to Ecological Economics. Gaylord Nelson, Herman Daly, and John Cobb, Jr., present an introduction to the issues and ideas of environmental approaches to economics. 45 min. Griesinger Films. ISBN # 0961676256. 1991.

Investing in Natural Capital. Herman Daly and others investigate ways of altering our current ways of economic thinking to include the natural world as a viable priority. 45 min. Griesinger Films. ISBN # 0961676264. 1993.

Conversation for a Sustainable Society. Amory and Hunter Lovins, Dennis Meadows, and others explore the possibilities for building a sustainable society. 45 min. Griesinger Films. ISBN # 0961676272. 1993.

Good Books

Steady-State Economics, 2nd Edition. Herman E. Daly, 1991. San Francisco: Island Press. ISBN # 155963071x. Daly's classic 1977 argument for an economic paradigm in which, rather than "more is better," we can consider that "enough is best." A keystone in sustainable development theory, compiled with new essays.

The Green Economy. Michael Jacobs, 1991. San Francisco: Island Press. ISBN # 0745304125. Explores what it would mean to integrate an environmental perspective into economic theory, both in theory and in practice. Investigates the ideas of "sustainability" and "environmental protection."

Part III: Food, Land, and Biological Resources (Chapters 10 - 15)

Computer Games and Simulations

EcoDisc. CD-ROM simulation of a developing and working nature reserve; demonstrates principles and dynamics of maintaining a nature reserve (available in 9 languages). Macintosh. Source: Educorp, #1355.

Darwin's Dilemma. Students manipulate evolutionary dynamics to cause life-forms to evolve. Macintosh. Source: MacWarehouse Catalog, ENT 0338.

SimLife: The Genetic Playground. An advanced genetic simulation that allows students to design plants and animals, test adaptive abilities by altering the environment, and experiment with food webs, mutations, and natural disasters. Macintosh. Source: MacWarehouse Catalog, ENT 0457.

On-line and CD Databases

Standard Pesticide File. Lists approximately 3900 pesticides, with chemical structure, trade names, and classifications. On-line database from BRS/After Dark.

Tropical Agriculture. Worldwide literature since 1975 on methods and developments in tropical and subtropical agriculture. On-line database from BRS/After Dark.

Videotapes, Video Disks, and Films

Diversity Endangered. A good, ten minute introduction to biodiversity. Smithsonian Institution Traveling Exhibition Service, Washington, DC 20560; (202) 357-3168.

Pesticides: For Export Only. Documents production and export of agricultural chemicals that are banned in producing countries of North America and Western Europe. Ironically, continued use of these chemicals in Third World agricultural production leads to a "circle of poison" when wealthier nations import coffee, bananas, and other agricultural products. English or Spanish. 57 min. VHS, Richter Productions.

Will the World Survive? Increasing populations need accelerated agricultural production, but rapid-growth, high-yield crops take their toll on soil resources. Considers the Green Revolution and other efforts to improve food production. 58 min. VHS #5136C, Coronet/MTI Film and Video.

Fragile Harvest. New genetic engineering tools promise solution to world hunger, but they are increasingly in the hands of multinational chemical companies that have taken over seed companies and are breeding and marketing seeds to suit their agro-chemical interests. Filmed in Ethiopia, Peru, Turkey, and North America, this film records "development" programs that have driven farmers from the land, increased agrochemical dependencies, and eliminated indigenous crop varieties. 49 min. 16mm #1S2387, University of Minnesota Film and Video.

The Muck and the Mystery Man. Part of the *Only One Earth* series, this film documents the resurgent demand for natural, chemical-free foods in industrialized countries, and some of the difficulties of reverting to organic agriculture. 20 min. VHS #7G1011, University of Minnesota Film and Video.

The Law of Nature: Park Rangers in Yosemite Valley. Looks at the dilemma of park rangers, trained as naturalists, who must act almost exclusively as law enforcement agents. 28 min. VHS, Umbrella Films.

Can Tropical Forests Be Saved? A global examination of tropical rainforests from Indonesia to West Africa to Amazonia. Inspects global effects of deforestation, economic and cultural values of rainforests, and efforts to save both the trees and the people of these areas. Three segments, 35 to 45 min. each. VHS, Richter Productions.

Equilibrium in a Mountain Habitat. After millennia of human habitation and overtaxing of resources in India's jungle region and in the mountains of central France, government protection and regulation in each place is developing model examples of how humans can live in equilibrium with their environment. 28 min. VHS, #VJ-2337, Richter Productions.

Treasures of the Greenbelt. The nine counties surrounding San Francisco Bay contain some four million acres of parks and watersheds, farms and ranches, forests, and vineyards, making a "greenbelt" around urban San Francisco. Looks at lifestyles, land uses, and endangered species here. 28 min. (all standard video formats) #37989, University of California Extension Media Center.

STV: Rain Forest. National Geographic. Portrays the richness of a fragile ecosystem. Based on the National Geographic television series. Laserdisc. Source: Emerging Technology Consultants.

Genetics: Patterns of Evolution. Coronet/MTI. Illustrates modern evolutionary biology, including field studies of species adaptations in dynamic, interactive systems in habitats ranging from volcanic islands to temperate woodlands. Laserdisc. Source: Emerging Technology Consultants.

Eco-Insights. Interactive videodisk covering basic principles of ecology in the Kananaskis Region of the Canadian Rockies, including biological diversity, adaptations to winter, and forces of landscape change.

Baikal: Blue Eye of Siberia. Looks at environmental damage done to Lake Baikal, which contains one-fifth of the world's fresh water and is home to 2600 species. An international campaign-fraught with politics-is under way to save the lake after decades of toxic contamination. 107 min. VHS #NN-2791, Films for the Humanities, Inc.

Sea of Slaughter. In this film author Farley Mowatt chronicles five hundred years of European exploitation of marine life on the northwestern Atlantic coast. The decimation of walrus, seals, seabirds, fish, and whales is documented and discussed. Produced by the Canadian Broadcasting Corporation. 96 min. VHS, Bullfrog Films.

Part IV: Physical Resources (Chapters 16 - 22)

On-line News Sources and Databases

Power. A catalog record of books, journals, proceedings and other sources collected by the Department of Energy since the 1950s. On-line databases from BRS/After Dark.

Videotapes, Video Disks, and Films

Riches from the Earth. Our modern technological society depends as never before on the earth's resources, from precious metals to commercial ores and groundwater. A story of discovery, depletion, technology, and conservation. 20 min. 16mm #5N1485, University of Minnesota Film and Video.

Do We Really Need the Rockies? This segment of the Nova series investigates the pros and cons of a new industry, shale oil production, in the Rocky Mountains. There is more oil in the Rockies than in the entire Middle East, but every attempt to extract the fuel thus far has proven too costly and environmentally unsound, and processing produces enormous volumes of highly toxic wastewater. 57 min. 16mm #1G0933, University of Minnesota Film and Video.

Alterations in the Atmosphere. Discusses widespread effects of pollution in the troposphere, the lowest layer of the atmosphere. Examines evidence for the "greenhouse effect" and the roles of various "greenhouse" gases. 18 min. VHS #NN-2321, Films for the Humanities.

Assault on the Ozone Layer. CFCs spread in the atmosphere with great speed, reaching from the equator to the poles in weeks. Ozone losses around the globe are the subject of this film, which also shows the effects on living things of these events. 18 min. VHS #NN-2320, Films for the Humanities.

Emissions and Emotions: Challenges to the European Forest. Political revolutions have exposed ecological crises of astonishing proportion in eastern Europe. Subjects include the "Death Triangle" between Poland, Chechnya, and East Germany, where industrial pollution has decimated forests, resulting in soil erosion. 30 min. VHS, Bullfrog Films.

Rampaging Carbons. Since the industrial revolution we have been burning fuels at an unprecedented rate, and the result is high levels of carbon dioxide in the air. Looks at a group of scientists monitoring all aspects of carbon release and absorption. 20 min. 16mm #7N1632, University of Minnesota Film and Video.

The Climate Factor. Analyzes how climate affects populations and how past climate changes have caused whole populations to move or disappear. 25 min. 16mm #7N1724, University of Minnesota Film and Video.

The River in the Desert. Looks at how the Colorado River became "one of the most highly dammed, diverted, and regulated rivers in the world," and examines the consequences of this aggressive manipulation of nature from early settlement to modern speculative land development. 29 min. VHS or 16 mm, Umbrella Films.

The Ocean Planet: Death of the Mississippi. Although the Mississippi was declared a wild and scenic river less than two decades ago, much of its reach, especially its southern bayous, are heavily contaminated with oil, chromium, mercury, lead, and other toxic substances. 23 min. VHS #NN-2295, Films for the Humanities.

The Great Lakes: Troubled Waters. Examines the nature of the threat to water quality of the lakes, and the bi-national failure of the United States and Canada to fully address the problem. 48 min. VHS, Umbrella Films.

The Underlying Threat. Offers a penetrating look at groundwater pollution: how it happens, what contaminants are involved, why groundwater pollution is especially difficult to measure or manage, and what we can do about it. Produced by the National Film Board of Canada. 48 min. VHS or 16mm, Bullfrog Films.

Whose Sea Is This? How do nations divide rights to the oceans? Do they belong to all of us? If property ownership is unclear, environmental protection is difficult to develop. This program looks at the Law of the Sea and at the ways we are treating our seas. 26 min. VHS or Beta #ND-2293, Films for the Humanities.

Down to the Last Drop. Only during droughts do we think about water conservation; once the rain falls all is forgotten. But better planning may be necessary if we are to have reliable, usable water supplies. 26 min. VHS or Beta #ND-1831, Films for the Humanities.

Green Energy. This program examines some renewable alternatives to petroleum products and explains how biological and organic products like wood chips, corn, and garbage can become major sources of energy. 26 min. VHS #NN-1870, Films for the Humanities.

Chernobyl: A Taste of Wormwood. Provides on-site photography of the blast site and of the areas and people affected. Interviews with victims, physicists, and politicians. 52 min. VHS #NN-1264, Films for the Humanities.

The Energy Bank. Examines the potential of energy conservation to meet our energy needs and reduce both global warming and air pollution. Takes case studies from the Pacific Northwest and the Northeast, where pioneering energy programs have been developed. 38 min. VHS, Umbrella Films.

Energy: Less Is More. An energy conservation film that shows how energy can be saved in transportation, in building construction, and in industrial applications, including cogeneration. Presents the case study of a community that has effected remarkable savings through building codes and community involvement. 21 min. 16mm #5N1430, University of Minnesota Film and Video.

Part V: Society and the Environment (Chapters 23 - 25)

Computer Games and Simulations

SimCity. Students direct the development of a city, balancing investments in technology, pollution control, building, and human resources, in an effort to create a stable, livable urban environment. Macintosh. Source: MacWarehouse Catalog.

Videos and Films

Affluenza A humorous, thought-provoking look at what happens when a society becomes infected with Affluenza. Originally produced for public television. 60 min., Bullfrog Films.

Conservation for a Sustainable Society. Amory and Hunter Lovins, Dennis Meadows, and others explore the possibilities for building a sustainable society. 45 min. Griesinger Films. ISBN # 0961676272. 1993.

Baabu Banza: Nothing Goes to Waste. In Niger's capital city of Niamey, inventive and industrious citizens glean useful materials from garbage dumps, refashioning them into useful, marketable materials. 16 min. VHS #NN-3081, Films for the Humanities.

Garbage: The Movie. Churchill Media. Presents current solid waste problems and some solutions. Shows working landfills, incinerators, recycling plants, and composting yards. Laserdisc. Source: Emerging Technology Consultants.

Protecting Our Environment: Recycle. Outlines the process of recycling, discusses what materials are recyclable, and shows some of the process of breaking down and re-using materials. Also in this series: *Protecting Our Environment: Reduce*, and *Protecting Our Environment: Reuse.* Laserdisc. Source: Emerging Technology Consultants.

The Disposable Society. Americans generate 400,000 tons of garbage daily. The simplest solution to disposal for all this waste is to reduce our consumption of disposable materials. 26 min. VHS #NN-1709, Films for the Humanities.

Hazardous Waste: Who Bears the Cost?. Looks at Woburn, Massachusetts, with America's oldest toxic waste dumpsite, as a case study of a community affected by the presence of hazardous waste. 28 min. VHS, Umbrella Films.

The Growth of Towns and Cities. Considers urban landscapes as layers of development, and looks at the ways peoples' lives have been changed by technology. Discusses how industrialization led to urbanization, transportation and the development of suburbs, problems of urban living, and solutions to problems. 20 min. VHS #NN-3318, Films for the Humanities.

Urban Ecology. Inspects some of the problems of rapid urbanization in Abidjan, the Ivory Coast's capital city. Between its colonial legacy and its modern growth rate of 10% per year, increasingly serious conditions face residents. 24 min. VHS #NN-2344, Films for the Humanities.

Toward a Livable City. Looks at the development of Barcelona, Spain, from pre-Christian times through the Industrial Revolution, World War II, and modern growth. Effective planning and regulation have transformed Barcelona into a livable, even scenic, urban area. 28 min. VHS #VJ-2345, Richter Productions.

Conservation of the Southern Rainforest. Focuses on the development of controlled ecotourism as an economic alternative to existing, unsustainable forms of development in rainforest areas of developing nations. 58 min. VHS, Umbrella Films.

Restoring the Environment. Looks at ways technology is being used to correct the environmental problems it has created, including a mobile incinerator for destroying PCBs and environmental safeguards developed by an electroplating firm. 26 min. VHS #NN-1868, Films for the Humanities.

Wetlands and Pinelands. Looks at the New Jersey Pine Barrens and wetland ecosystems in Mexico and Belize, where environmental planning and recognizing the long-standing role of humans in the environment is demonstrating that it is possible to save both people and indigenous species. 28 min. VHS #VJ-2343, Richter Productions.

The Desert as Laboratory. Examines two desert ecosystems being used as research models to find ways to understand the human role in an arid environment and to control desertification. 28 min. VHS #VJ-2236, Richter Productions.

The Rebirth of Whitewood Creek. An award-winning documentary about reviving a stream once made barren by mine effluents, from mercury to raw sewage. Community, EPA, and the mining industry find a way to cooperate in bringing life back to this South Dakota Black Hills creek. 28 min. 16 mm, Cottonwood Productions.

Good Books

Forging International Agreements: The Role of Institutions in Environment and Development. Lee Kimbal, 1992. Washington, DC: World Resources Institute. ISBN # 0915825821. Highlights accomplishments of and challenges for international institutions, especially the UN, in forging environmental agreements and policies.

Material World. Peter Menzel, 1994. Sierra Club Books. A portrait of humanity at the end of the century. Average families from thirty countries share their lives.

Stuff: The secret lives of everyday things. John C. Ryan and Alan T. Durning, 1997, Northwest Environmental Watch (NEW), 1402 Third Avenue, Suite 1127, Seattle, WA 98101, (888) 643-9820, e-mail: nwwatch@igc.apc.org. The things we buy, consume, and use everyday are traced from their origins to the market, into our homes, and beyond.

Valuing the Earth: Economics, Ecology, and Ethics. Herman E. Daly and Kenneth N. Townsend, eds., 1993. Cambridge, Mass: MIT Press. ISBN # 0262540681. A collection of classic and recent essays approaching holistic thought about our ethical and intellectual approaches toward the environment.

Sources of Films, Computers Programs, Databases, and Networks

Film and Video Sources

Audubon Activist, the Audubon Society, 950 Third Avenue, New York, NY 10022, (212) 979-3000.
Bullfrog Films, Box 149, Oley, PA 19547, (800) 543-3764.
Coronet/MTI Film and Video, 108 Wilmot Road, Deerfield, IL 60015.
Films for the Humanities, Inc., P.O. Box 2053, Princeton, NJ 08543-2053.
Griesinger Films, 7300 Old Mill Road, Dept. IP, Gates Mills, OH 44040, (216) 423-1601.
National Film Board of Canada, 1251 Avenue of the Americas, 16th Floor, New York, NY 10020. (800) 542-2164 to preview videos.
Richter Productions, 330 West 42nd Street, New York, NY 10036, (212) 947-1395.
Scholastic Software, 730 Broadway, New York, NY 10003.
Emerging Technology Consultants, P.O. Box 120444, St. Paul, MN 55112, (612) 639-3973.

Umbrella Films, 60 Blake Road, Brookline, MA 02146, (617) 277-6639.
UNICEF, 331 East 38th Street, New York, NY 10016, (212) 686-5522.
University of California Extension Media Center, 2176 Shattuck Avenue, Berkeley, CA 94704.
University of Minnesota Film and Video, 1313 5th Street, S.E., Suite 108, Minneapolis, MN 55414.
University of Wisconsin, Bureau of Audiovisual Instruction, Box 2093, Madison WI 53701-2093, (608) 262-3902.
World Resources Institute, 1709 New York Avenue, NW, Washington, DC, 20006.

Sources of Computer Games and Simulations

Cambridge Development Laboratory, Inc., 214 Third Avenue, Waltham, MA 02514, (800) 637-0047.
Educorp, 7434 Trade Street, San Diego, CA 92121-2410, (800) 843-9497.
MacWarehouse Catalog, P.O. Box 3013, 1720 Oak Street, Lakewood, NH 08701-3013, (800) 225-6227.
World Game Institute, 3215 Race Street, Philadelphia, PA 19104, (215) 387-0220.
William C. Brown Publishers, 2460 Kerper Boulevard, Dubuque, IA 52001, (800) 336-5578.
ZPG Population Education Program, 1400 16th Street, NW, Suite 320, Washington, DC 20036. (202) 332-2200.

CD and On-line Databases

Educorp, 7434 Trade Street, San Diego, CA 92121-2410, (800) 843-9497.
World Resources Institute, 1709 New York Avenue, NW, Washington, DC 20006
Xiphias, 8758 Venice Boulevard, Los Angeles, CA 90343.
SilverPlatter Information, Inc., 1 Newton Executive Park, Newton Lower Falls, MA 02162.
Institute for Scientific Information, 3501 Market Street, Philadelphia, PA 19104.

How to Subscribe to Networks and Mailing Lists

BITNET: Subscribe through a BITNET account if it is available at your institution, or contact the BITNET Network Information Center, EDUCOM, 112 16th Street, NW, Suite 600, Washington, DC 20036, (202) 872-4200. Usually available free or for a small hourly fee.

Bulletin Boards: These are usually accessed by communications software and a modem or through an institutional network. Your software will determine the method of linking. For further information see *Ecolinking: Everyone's Guide to On-line Environmental Information,* by Don Rittner (Berkeley, CA: Peachpit Press 1993), chapter 7.

Internet: Because Internet is an international network designed and funded in the US for academic research, most users access it by establishing an account with an educational or research institution that is connected to the Internet (to subscribe contact the address given in list description). If you do not have access to such an institution, you can get on-line via DIAL n'CERF, a "gateway" network service based in California. Contact CERFnet, San Diego Supercomputer Center, P.O. Box 85608, San Diego, CA 92186; (800) 876-CERF; electronic mail address: help@cerf.net Costs vary with access method: network accounts usually free, external accounts usually charged only for telephone time.

Knowledge Index. Part of Dialog Information Services, the largest on-line bibliographic company in the United States. To subscribe call (800) 334-02564.

CONTENTS

PART I
ENVIRONMENTAL SCIENCE AND ECOLOGICAL PRINCIPLES

1
UNDERSTANDING OUR ENVIRONMENT

Special Note to Instructors

The authors would greatly appreciate your comments about the text. Is the presentation suitable for your students? Are there materials that the authors could add or delete or corrections they should make? If you have suggestions for how they could improve the text they would be very grateful. Please send comments to William P. Cunningham, College of Biology, University of Minnesota, St. Paul, MN 55108.

Note to Instructors about Critical Thinking in the Classroom

Since critical thinking involves questioning experts and the sources of information, these and subsequent activities can help students start thinking more critically. However, as instructors it is important for us to be open to, and supportive of, students' questions and not intimidated by student thinking. Similarly, it is important to *explicitly* model critical thinking in the classroom. One way to do this is by thinking out loud when students ask questions.

Study Aids

Most of the questions in the *Questions for Review* require recall of the chapter material and can help students remember details of the chapter through reinforcement of key ideas. If you emphasize that students are required to explain their reasoning, the questions can help students practice supporting their thoughts with evidence. The *Questions for Critical Thinking* ask for more application, comparison, and prediction and can be useful for the students to synthesize the information in the chapter and make meaningful connections. Again, the students need to support their reasoning for practice in providing evidence and facilitating the development of logical thinking.

Chapter Outline

Objectives
Deformed Frogs
What Is Environmental Science?
A Brief History of Conservation and Environmentalism
    Historic Roots of Nature Protection
    Pragmatic Resource Conservation
    Moral and Aesthetic Nature Preservation
    Modern Environmentalism
    Global Concerns
Current Conditions
    A Marvelous Planet
    Environmental Dilemmas
    Signs of Hope
North/South: A Divided World
    Rich and Poor Countries
    A Fair Share of Resources?
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    Political Economies
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    Developmental Discrepancies