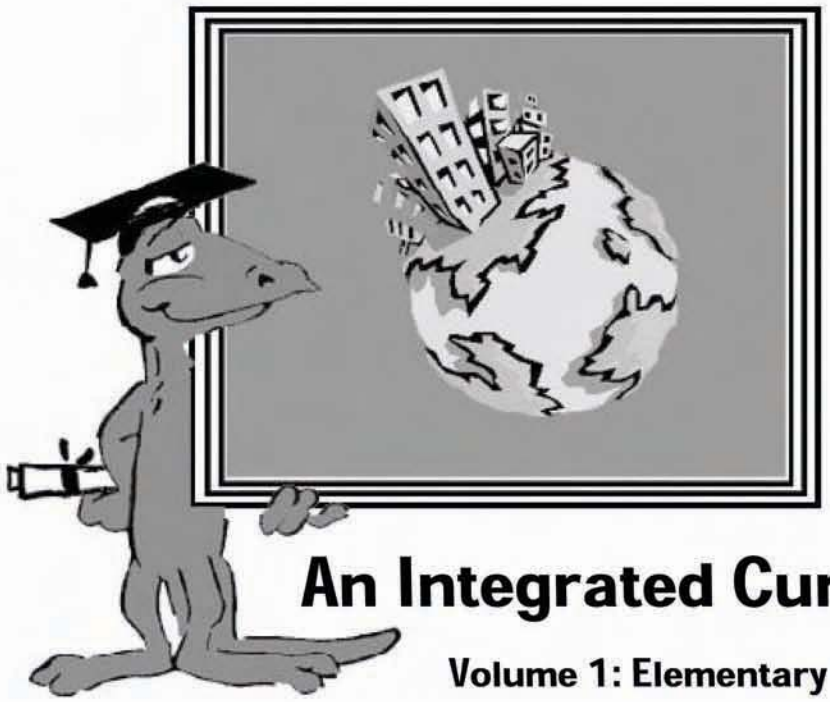
# Education for Sustainable Development



## An Integrated Curriculum

### Volume 1: Elementary School Edition

***Today's Youth = Tomorrow's Leaders***

Virginia Environmental Endowment

Virginia Tech

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# Preface

The Virginia Environmental Endowment is pleased to have initiated and supported this project to develop an integrated K-12 curriculum on Education for Sustainable Development. We hope, with its ready accessibility in print and on the Internet, that educators will find in these case studies and instructional activities valuable principles and ideas that will lead students to solutions that improve and sustain the quality of our environment. We appreciate working in partnership on such a multidisciplinary topic with the Virginia Council on Economic Education, Virginia Tech, and Virginia Cooperative Extension in this important and exciting endeavor.

Gerald P. McCarthy, Executive Director
Virginia Environmental Endowment

Virginia Environmental Endowment

Dedicated to helping students develop the decision-making skills needed to become responsible citizens and productive workers, the Virginia Council on Economic Education is committed to fostering economic literacy as a means of developing wise leaders and sustainable communities. The advancement of human quality of life and environmental quality are symbiotic goals. We are proud to have supported the work involved in development of this comprehensive curriculum, Education for Sustainable Development. We heartily endorse its unique contribution to the economic education of youth in the Commonwealth. Thank you.

Jeffrey M. Fitch, President
Virginia Council on Economic Education

VCEE

June 2002

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Department of Agricultural and Applied Economics
College of Agriculture and Life Sciences (0401)
Blacksburg, Virginia 24061
(540) 231-6301

# Acknowledgements

This work was funded in part by a grant, "Education for Sustainable Development," from the Virginia Environmental Endowment (VEE) to Virginia Tech (VT), M. J. Ellerbrock, principal investigator, with additional support from the Virginia Council on Economic Education (VCEE) and Virginia Cooperative Extension (VCE). Drafts of the curriculum were reviewed and field-tested by grade-level teachers. Staff members of the Virginia Association of Realtors (VAR) provided helpful comments and suggestions on the Green Buildings unit. Nevertheless, the content and any errors in this curriculum are the sole responsibility of the principal investigator. The ideas herein do not necessarily reflect the views of the VEE, VT, VCEE, VCE or VAR.

I wish to praise and thank our team of researchers, writers, designers, and editors who have worked so enthusiastically on this project of personal importance. Specifically:

- ✓ *Catherine Wheeler* – Technical Editor & Co-Author
- ✓ *Lisa Poley* – Primary Author
- ✓ *Kathy Sevebeck* – Primary Author
- ✓ *Tricia Crouse* – Co-Author
- ✓ *Laura Zepp* – Co-Author
- ✓ *Patty Fuller* – Graphic Design & Layout
- ✓ *George Wills* – Artist
- ✓ *George Santopietro, PhD* – Website Development
- ✓ *Anne Carter* – Research Assistant & Co-Author
- ✓ *Elizabeth DiSalvo* – Research Assistant
- ✓ *Suzanne Gerus* – Research Assistant
- ✓ *Laura Kirk* – Research Assistant
- ✓ *Ashlee Rudolph* – Research Assistant
- ✓ *Reed Shabman* – Research Assistant
- ✓ *Brian Wheeler* – Research Assistant
- ✓ *Graduate Class (EDCI 5594 F'99)* – Instructional Design Assistance

I wish to dedicate this curriculum to Dr. James C. Hite, my mentor, and all citizens who, like Jim, understand that each discipline has a vital role to play in achieving a sustainable future for all.

*Mike Ellerbrock, PhD*, Lead Author & Editor, July 2, 2002

# EDUCATION FOR SUSTAINABLE DEVELOPMENT

**K-12 Lessons Based on Virginia's Standards of Learning**



## Introduction:

Welcome to the world of sustainable development. We invite you to join us in an exploration of the educational dimensions of sustainable development. Specifically, please help us answer the question.

> *How can Virginia's schools better prepare youth to make wise environmental decisions as adults in order to enhance the quality of life for all?*

Anyone who cares about the answer recognizes the immediate challenge of properly framing the question. As a prelude to action, agreement on the meaning of words, concepts and ideas is important:

| | |
|---|---|
| *How* | All ideas are needed, for there is no single answer or set of prescribed solutions. |
| *Schools* | Our approach is through formal K-12 curriculum and instruction, though other sectors of society are also vital components, for youths' values are also shaped by parents, churches, hobby groups, media (art, music, literature, movies/TV, bumper stickers, T-shirts, billboards, etc.), peers, and other public and private role models. |
| *Virginia* | Our primary focus is on issues and actions in the Commonwealth of Virginia that have linkages to the rest of our nation and world. |
| *Better* | Many schools and teachers are already doing lots of good things that promote sustainable development, but seldom in a systematic manner across their curricula. |
| *Prepare* | Our immediate emphasis is on developing critical thinking skills, not on simplistic analysis, robotic training or ideological indoctrination. |
| *Wise* | Our ultimate goal is wisdom, not necessarily unanimity, popularity, political correctness, or even majority opinion, regarding the use or non-use of natural resources. |
| *Environmental* | Our concern is the integrity of the biosphere in all of its dimensions. |
| *Decisions* | Unavoidable realities of sustainable development are that decisions must be made, now or later, and that no decision is a decision. |
| *Adults* | Our aim is to help youth mature into holistic decision-makers as adults when they will have the greatest influence on public and private policies regarding sustainable development. |

| | |
|---|---|
| *Enhance* | We acknowledge that much progress has already been made by educators, scientists, engineers, doctors, lawyers, economists, ecologists, volunteers, philosophers, theologians, poets, politicians, inventors, entrepreneurs, designers, planners, entertainers, soldiers, et al., in building a better world. |
| *Quality* | We also acknowledge that much harm has been done, sometimes irreversibly, to the quality (and quantity) of our resource bases, both natural and human. |
| *Life* | Our domain includes both living creatures and inanimate objects, most without human voice. |
| *All* | In learning from the past, our concern is for both current and future generations. |

## The President's Council on Sustainable Development Education

In the United States in 1994, the President's Council on Sustainable Development outlined an approach for educating youth about sustainable development (President's Council). With a pedagogical approach similar to that developed in Wisconsin (Engleson and Yockers), the Council emphasized the need for: a) science-based content; b) critical thinking skills; c) systems analysis; d) multi-disciplinary paradigms; e) public/private partnerships; f) diverse cultural values; and, g) consensus-based local solutions.

## The Need in Virginia:

According to its mission statement, the Virginia Environmental Endowment (VEE) has been committed for over 20 years to "improving the quality of the environment by educating and involving all sectors of the community to work together for the development of a sustainable society" (Virginia Environmental Endowment). Established in 1977 with court-ordered funds from a fine imposed on a corporation for polluting the James River with the pesticide Kepone, the VEE has closely monitored the health of Virginia's environmental and natural resources and worked with schools and other educational organizations to promote sustainable development. The VEE recognized the need for an holistic approach to education for sustainable development and in 1998 asked Virginia Tech's Center for Economic Education to design an integrated K-12 curriculum on sustainable development that would help our youth become wiser leaders and decision makers in the future. We hope this curriculum meets that goal.

## The Curriculum:

Arranged by grade level in two volumes, the curriculum is designed to engage teachers and students in a user-friendly exploration of Virginia case studies that illustrate general principles of sustainable development and address the K-12 science and social studies Standards of Learning (SOL's). The 12 topics include:

*Elementary Schools:*

Welcome to the Global Good Life...But Is It Sustainable?
A Habitat for All
Natural Resources
A Life History of "Stuff"... Production and Consumption

*Middle Schools:*

Sustainable Forestry: Urban or Wild?
Sustaining Our Water Resources
Sustainable Energy: Helping the "X" Family Meet Their Goals
Green Technologies: Sustainable "Stuff"

*High Schools:*

Sustainable Communities: A Way for Everyone to Win?
Home Sustainable Home: Green Buildings & Design Alternatives
Environmental Justice: Whose Resource Is It?
Sustainable Agriculture: Feeding People Feeding the Soil

## The Plan:

Each of the 12 units follows a similar format:

1. Overview of the Lesson
2. Unit Background
3. Unit Context
4. Objectives
5. Teacher Preparation
6. Student Activities
7. Assessment
8. References & Resources
9. Student Worksheets

Side Bar Information:
Grade Level
SOLs Addressed
Skills
Key Terms/Concepts

# Defining Sustainability

## Evolution of the Concept:

Discussing the future of our world is a huge challenge. Even at the local level, trying to plan sustainable communities is a complex task. Much disagreement exists among scholars and laypersons over defining what is meant by "sustainable development," even over who has the right to decide the definition, e.g., can anyone truly speak for animals, inanimate objects, and future generations of people (Holdgate)? A 1992 survey of the literature on sustainable development found over 70 working definitions (Holmberg & Sandbrook). On the positive side, the debate has forced planners, economists, ecologists, political scientists, philosophers, and many others to engage in an earnest, open and healthy dialogue on an unprecedented scale. The dialogue has generated an impressive array of critical thinking efforts and multidisciplinary analysis, including holistic books (Kirkby, *et al.*; Holdgate), eclectic journals, an International Society for Ecological Economics with 2,000 members, and a new discipline called the science and management of sustainability (Costanza).

The urgency and diversity of the debate led to two major international conferences convened by the United Nations and attended by nearly 30,000 people representing over 150 nations. The first gathering, the World Commission on Environment and Development (WCED) held in 1987, produced a major statement, *Our Common Future*, commonly called the Brundtland Report after its chairwoman (World Commission). The statement focused on seven major strategies for sustainable development, some of which were criticized as irreconcilable (Kirkby, *et al.*):

1. Reviving economic growth.
2. Changing the quality of growth.
3. Meeting essential human needs for jobs, food, energy, water and sanitation.
4. Ensuring a sustainable level of population.
5. Conserving and enhancing the resource base.
6. Reorienting technology and managing risk.
7. Merging environment and economics in decision-making.

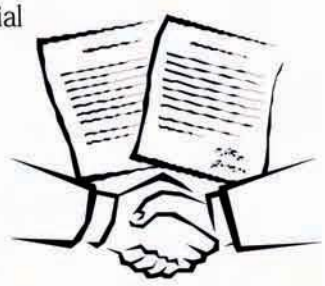
Despite the criticisms, the Brundtland Report's famous definition and its Ten Guiding Principles (Gilpin) served the world for several decades as the leading statement on sustainable development:

***"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."***

1. Decision-making processes addressing short, medium and long-term effects of an economic, social, equity, and environmental nature in a local, regional, national, international, and global context.

2. Development defined as all physical development and social activities with likely environmental effects resulting from domestic investment and foreign aid.

3. Consideration of the implications of development for the use and misuse of natural and human resources.



4. Arrangements for the involvement of the public, both individuals and groups, government at all levels, and stakeholders generally in the process leading to a development decision.

5. Avenues of appeal by all involved parties against development decisions, or conditions attached to those decisions.

6. Recognition that a strong, highly competitive economy, increases the capacity for responsible environmental management and enhances the real income of the community.

7. Sustainability of the resources supporting the enterprise, either through renewability or substitutability.

8. Intragenerational and intergenerational implications of the enterprise.

9. Implications of the enterprise for the greenhouse effect and ozone layer.

10. Transboundary implications of the enterprise.

The main criticism of the Brundtland definition is that it doesn't say much that is useful, i.e., it is too general and does not provide clear direction in its practical applications. The challenge is to identify any definition of sustainable development that is unambiguously clear, universally acceptable, straightforward in its implications, and free of value-laden terms.

The second gathering, the United Nations Conference on Environment and Development (UNCED) was held in 1992, and is commonly called the Rio Conference or Earth Summit. Though the Rio Conference was called to build on the Brundtland agreement, it took a surprisingly strong "green" and anti-development turn, led by the Northern nations who wanted environmental protection and overpowered the Southern countries who wanted economic growth. Within the North, an "unholy alliance" occurred between industrialists and environmentalists, both of whom feared the consequences of economic growth in the South. In the end, Rio produced several comprehensive agreements (Kirkby, *et al.*):

1. Convention on Biological Diversity.
2. Framework Convention on Climatic Change.
3. Principles of Forest Management.
4. Agenda 21 - Cross Sectoral Issues: The Earth Charter.
5. The Rio Declaration on Environment and Development.

The massive Rio Declaration is particularly important. It has 40 chapters and offers 27 principles for sustainable development, some of which were bitterly contested by attendees. Most significant is its anthropocentric assertion that, "human beings are at the centre of concerns for sustainable development. They are entitled to a happy and productive life in harmony with nature" (Kirkby, *et al.*).

The third gathering, the 2002 Earth Summit held in Johannesburg, South Africa yielded mixed reviews from government, environmental and humanitarian groups. From August 26th to September 4th, some 22,000 delegates, heads of state, representatives of major group organizations, and members

of the media gathered to try to implement the agreements made at the Rio Summit (United Nations 2002). Some heralded the gathering as a success while others said it was a waste of time and money (MSNBC, 2002). Key points agreed upon at the 2002 Summit include:

- *Energy*: Nations are committed to "urgently" increase the use of renewable energy sources, but the text also allows for the expanded use of modified hydroelectric dams and fossil fuels that pollute less.
- *Chemicals*: Chemicals will be produced and used in ways that minimize adverse effects on people and the environment by the year 2020.
- *Water & Sanitation*: Leaders aim to halve the number of people living without sanitation and potable drinking water by the year 2015.
- *Biodiversity*: Although no specific numbers or percentages are suggested, a goal was set to "significantly reduce" the loss of species by 2015.
- *Fisheries*: The text states that oceans are a vital part of ecosystems and an important source of food, in particular for people in poor countries. Nations pledged to maintain and restore diminished fish stocks to sustainable yileds by 2015.
- *Trade*: The declaration supports the phasing out of agricultural and other trade-distorting subsidies, but does not go as far to eliminate subsidies important to the U.S. and Europe.
- *Governance*: Nations recognized the need to promote democracy and eradicate corruption, but the text does not mandate good governance as a stipulation to receive foreign aid.

Nevertheless, the debate continues in scientific, academic and political arenas. For example, the noted journal *Land Economics* recently published a Special Edition devoted entirely to the task of defining sustainability (Special Issue). Its 11 articles used principles of mathematics, economics, biology, and ethics to examine four aspects of sustainable development of particular interest to economists: a) how to maximize human welfare across generations; b) improving the calculations of the value of natural resources and environmental amenities in national income accounts; c) incorporating broader scientific, philosophic and institutional perspectives into economic analysis; and, d) formulating more effective and equitable public policies to promote sustainable development among regions and across generations. Also, whole books have been devoted to seeking a definition of sustainable development. For example, Atkinson *et al.* define it as, "non-declining human wellbeing over time." However, note that Atkinson *et al*. can be faulted for being impractically broad like the Brundtland definition.

The 2002 Earth Summit held in Johannesburg, South Africa yielded mixed reviews from government, environmental and humanitarian groups. From August 26$^{th}$ to September 4$^{th}$ 2002, some 22,000 delegates, heads of state, representatives of major group organizations, and members of the media gathered to put into action the agreements made at the 1992 Earth Summit in Rio De Janeiro, Brazil. Some heralded the gathering as a success while others said it was a waste of time and money. United States Secretary of State Colin Powell called the Summit a "successful effort" saying, "I think it shows that we have a shared vision of how to move forward. I think it shows that the world is committed to sustainable development" (United Nations: Johannesburg Summit 2002: www.johannesburgsummit.org/). Others did not see it that way: "The wealthy nat-ions have their heads in the sand," said Australian Sen. Bob Brown, a member of the Greens party. "The world's being let down. The interests of the next generation have been appallingly disenfranchised" (MSNBC: "Earth Summit ends in discord" http://stacks.msnbc.com/news/798955.asp). Key Points agreed upon at the summit include:

-*Energy*: Nations are committed to "urgently" increase the use of renewable energy sources, but the text also allows for the expanded use of modified hydroelectric dams and fossil fuels that pollute less.

-*Chemicals***:** Chemicals will be produced and used in ways that minimize adverse effects on people and the environment by the year 2020.

-*Water and sanitation:* Leaders aim to halve the number of people living without sanitation and potable drinking water by the year 2015.

-*Biodiversity:* Although no specific numbers or percentages are suggested, a goal was set to "significantly reduce" the loss of species by 2015

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-*Trade:* The declaration supports the phasing out of agricultural and other trade-distorting subsidies but does not go as far to eliminate subsidies important to the U.S. and Europe.

-*Good Governance:* Nations recognized the need to promote democracy and eradicate corruption but the text does not mandate good governance as a stipulation to receive foreign aid. References and Websites of Interest:

Earth Summit 2002, Building Partnerships for Sustainable Development - An overview of what Earth Summit 2002 is, where it came from and what it will try to do. www.earthsummit2002.org/

"Earth Summit approves final deal" CNN
http://europe.cnn.com/2002/WORLD/africa/09/03/earth.resolve.glb/index.html

"Earth Summit ends in discord" MSNBC staff and wire reporters
http://stacks.msnbc.com/news/798955.asp

Johannesburg World Summit 2002 - United Nations World Summit on Sustainable Development Host Country Official Site
www.joburgsummit2002.co.za/

The official United Nations website for the Johannesburg Summit 2002 – the World Summit on Sustainable Development
www.johannesburgsummit.org/

World Summit on Sustainable Development Plan of Implementation
http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm

## What We Have Learned - Core Dimensions of Sustainability:

It seems clear that human and environmental history, particularly in recent centuries, has taught us that discussion of the future of our world must include the following dimensions:

**Quality of Life & H:uman Development**

Though we have generally progressed quite dramatically in meeting humanity's essential needs, 80% of our global population lives in conditions of poverty (Ruckelshaus) and 20% of the earth's people remain desperately poor without basic health services, the "global underclass" suffering without hope.

**Gender & Racial Equity**

Most of the global underclass are indigenous peoples restricted to degrading reservations, undereducated women and children.

**Understanding Nature**

Biodiversity (rain forests, endangered species), carrying capacity (fisheries management), resource depletion (deserts, forests, ozone, soil fertility, clean air & water), changes in the natural order

(benignly static or violently dynamic?).



### Economic Equity

Rich Northern temperate vs poor Southern tropical countries.

### Political Stability & Peace

Vital for protecting private property rights within nations and insuring incentives for conservation; huge opportunity costs of wars ($1 trillion annually is spent on armies); international agreements promoting sustainable development are now a regular dimension of U.S. foreign policy (Wirth).

### Intergenerational Transfers

Burdening the unborn with debt vs enhancing their capital and natural assets.

### Population

Controlling population while respecting cultural values and religious traditions.

### Hierarchy of Values

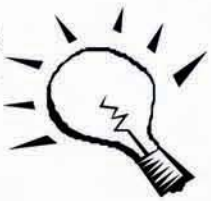
Anthropocentric (humans) vs biocentric (nature) vs ecocentric (dual primacy) (Colby).

### Agriculture

All people (current and future) need a food supply that is dependable, nutritious, safe and affordable, which means that: production practices must balance the multiple goals of large-scale output, cost-effectiveness, farming profitability, secure land tenure, long-term soil fertility, environmental protection, and cultural acceptance; processing methods must be sanitary, standardized, and customer oriented; and distribution systems must be efficient and equitable.

### Energy

Research, exploration, discovery, development, distribution and management of renewable and finite energy resources in an efficient system that rewards innovative risk-taking and entrepreneurship, meets the needs of various industries, and promotes economic growth, political stability, and social equity.



### Linkages

Political stability, ethical fairness, economic dependence, and ecological systems have no geographic boundaries.

### Science & Technology

Green entrepreneurship is a synergistic force for growth and conservation; biotechnology such as genetically-modified foods can boost agricultural production, yet pose environmental risks; sharing technology can help developing countries "leapfrog" forward to the quality of life in developed countries (Editors).

### Visionary Design

Designing new and renovated office buildings, factories, stores, homes and schools to utilize natural sources of energy, lighting, cooling, heating, fresh air, colors, and sounds to stimulate worker productivity, with ecologically effective methods for drainage and waste recycling, and creative ideas for parking and pedestrian usage (McDonough).

### Economic Growth

The real issue is *how*, not *whether*, to grow; concern for the environment ironically tends to follow economic growth because citizens, businesses and governments in affluent countries usually have the most time, interest and resources (scientific, financial, educational) to devote to environmental protection and enhancement.

### Subsidiarity

This principle of social ethics asserts that local stakeholders who have to live with the consequences should make decisions affecting their communities, which requires grassroots empowerment (Gilpin).

### Regional Planning

Dense urbanization, suburban sprawl, and rural development each pose some unique and some interrelated problems for humans, animals and the environment.

### Policy Formulation

Wise public policies with appropriate economic incentives (market prices, clear property rights, government regulations, subsidies, fees, fines, taxes, *et al.*) are crucial for guiding human behavior toward actions that engender sustainable development.

### Institutional Infrastructure

Nations must have accessible and honest institutions that provide financial, legal, medical, educational, and technical service to all citizens. Also, the media play a key role shaping citizens' perceptions about sustainable development.

### Communication

Too many misunderstandings and conflicts arise in discussions about sustainable development because people from varied backgrounds apply different meanings to key words (e.g., health, fairness, freedom), concepts (e.g., optimality, efficiency, renewability) and images (e.g., labor, poverty, nature).

## Boiling It Down: The 5P's

When we apply the educational principles espoused by the President's Council to the Brundtland Report, Rio Declaration, related literature, and core dimensions identified from their analyses, we can synthesize the study of sustainable development into five overarching themes. These themes will be evident throughout this curriculum:

- People - Human values, individually and collectively, shape our perceptions as to what is sustainable development. Both objective and subjective information influence our ideas about what ought to happen in our communities. Different folks have a variety of values, knowledge, prejudices, and priorities for their communities. Getting people to truly listen and learn from one another is crucial to the ownership of progress that is sustainable.

- Place - Location is a significant factor in assessing what is sustainable development. Whereas one community might reject a mining or landfill operation, nuclear power plant, or whaling or fur-trapping industry, another might welcome such activities, each for valid reasons. The environmental pros and cons of such activities are discussed in more detail in Chapter 2's presentation of the Hard and

Soft Green schools of thought about sustainability and under Question #5: *What About Landfills … Or Can We Still Allow Deer To Poop In The Woods?*



- Prices - When prices include all of the costs (direct + indirect + opportunity) of production, economic market forces can be effective triggers to send signals from producers to consumers and vice versa as to society's preferences about environmental amenities and resources. Using prices may also be more efficient than direct government regulation in providing incentives that reward corporations and citizens for acting toward the common good as environmental stewards. Full-cost accounting is critical. For an example of how a market-based pricing system for promoting environmental protection has been implemented, see the case of $SO_2$ permits established by the 1990 Clean Air Act Amendments in Chapter 2's discussion under Question #3: *Does Sustainability Mean Perfection?*

- Politics - People need a process for discussing and deciding the current and future use of environmental resources. Establishing a fair and open process (deciding how to decide) is critical to eliciting buy-in and involvement by all stakeholders in the search for consensus. Public credibility in the process is crucial. Accurate and timely information is essential.
- Period - What is considered sustainable can and does vary across generations (e.g., we're doing fine without the dinosaurs), hence time is a key aspect, as well as technology. Nature itself is characterized by evolutionary and geologic change, cosmic novelty, creative randomness, and magnificent surprises (Haught). Advancements in technology have dramatically shifted our ability to use resources efficiently and wisely (e.g., food production, indoor air quality, mass transportation). For a broader discussion, please see Chapter 2's discussion under Question #1: *Does Sustainability Mean Forever?*

## Looking Ahead: Adopting an Educational Framework

Oftentimes the pedagogical enterprise is invigorated by debate. Teaching and learning can be enhanced by competition in the marketplace of ideas and values. In Section II, we will frame the current debate about sustainable development within two leading schools of thought – Hard vs Soft Green.

## Setting Sail: One Caution

As you begin exploring the future of our world, please note the limitations of this curriculum: it does not and cannot cover everything students need to know about sustainable development. The topics and issues examined in this curriculum are meant to illustrate some of the key principles and main schools of thought involved. The teaching activities are designed to engage students in critical thought about these complex issues. Thank you and best wishes!

**Author:** Michael J. Ellerbrock, Director, Center for Economic Education, Virginia Tech.

## References

Atkinson, G., et al., Measuring Sustainable Development: Macroeconomics and the Environment (Cheltenham, UK: Edward Elgar), 1997, 16.

Colby, M.E., The Evolution of Paradigms of Environmental Management in Development, (Washington: The World Bank, Strategic Planning and Review Discussion Paper No. 1), October 1989.

Costanza, R.C., Ecological Economics: The Science and Management of Sustainability (New York: Columbia University Press), 1991.

Editors, "Development and the Environment Survey," The Economist 346:8060, 3-21-98, 1-16.

Engleson, D.C., and D.H. Yockers, A Guide to Curriculum Planning in Environmental Education (Madison: Wisconsin Department of Public Instruction), 1994.

Gilpin, A., The Dictionary of Environment and Sustainable Development (New York: John Wiley & Sons, 1996), 206.Holmberg, J., and R. Sandbrook, "Sustainable Development: What is to be Done?" Policies for a Small Planet (J. Holberg, ed., London: Earthscan Publications Limited, 1992), 19-38.

Haught, J.F., Science & Religion: From Conflict to Conversation (New York: Paulist Press, 1995).

Holdgate, M., From Care to Action: Making a Sustainable World (Washington: Taylor & Francis), 1996, 45.

Kirkby, J., et al., "Sustainable Development: An Introduction," The Earthscan Reader in Sustainable Development (London: Earthscan Publications Limited), 1995, 1-13.

McDonough, W., "Design, Ecology, Ethics and the Making of Things," A Centennial Sermon given in New York at The Cathedral of St. John the Divine, 2-7-93; published in Environmentally Intelligent Textiles (Charlottesville, VA: Designtex, 1995), 9-25.

President's Council on Sustainable Development, Education for Sustainability: An Agenda for Action (Washington: U.S. Government Printing Office, ISBN 0-16-048783-8, http://whitehouse.gov/WH/EOP/pcsd/), 1994.

Ruckelshaus, W.D., "Toward a Sustainable World," Scientific American 261:3, Sept. 1989, 166(8).

Special Issue, "Defining Sustainability," Land Economics (Madison: University of Wisconsin Press), 73:4, November 1997.

Virginia Environmental Endowment, 1997 Annual Report, Three James Center, 1051 East Cary Street, Suite 1400, P.O. Box 790, Richmond, VA 23218-0790.

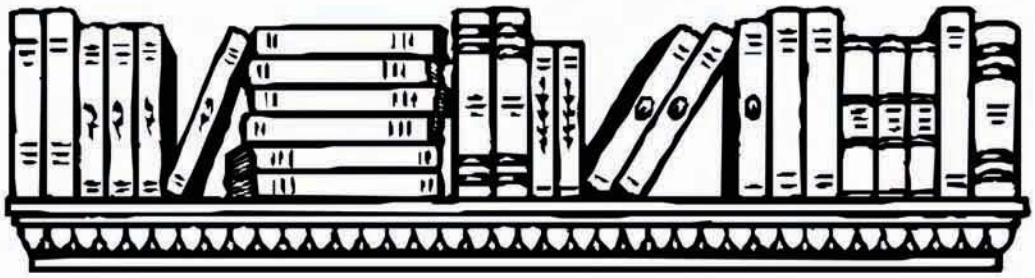
Wirth, T.E., "Sustainable Development: A U.S. Foreign Policy Priority" Economic Perspectives (USIA Electronic Journals, http://www.usis-israel.org.il/publish/journals/economic/august96/ 1:11), August 1996.

**Additional Resources**

1. Facing the Future, Facing the Future: People and the Planet (http://www.facingthefuture.org/), 1999.

2. "Green Development" @ www.rmi.org.

3. "What 'Wood' You Do: Cook Food or Build Houses?" Why Are Some Nations Rich and Others Poor? M.J. Ellerbrock and J. R. Alwang, New York: National Council on Economic Education, @ www.economicsamerica.org/econedlink/newsline/income/index.html.



## Today's Two Main Schools of Thought

It is perhaps fair and helpful to frame the current state of the debate using the metaphors soft and hard green, passionately articulated by the popular books *Natural Capitalism* (Hawken, Lovins & Lovins) and *Hard Green* (Huber), respectively. Representing two ends of the spectrum, these scholars vigorously and directly debate each other's assessment of the problem - *defining and achieving sustainable development* - and offer seemingly opposite solutions. Following is a summary of the two movements drawing principally, though not exclusively, on *Natural Capitalism* and *Hard Green*:

### The Soft Green Movement

A. Reliance on "soft" technology and natural design of communities, buildings and vehicles to passively decrease energy consumption.

B. Adoption of ascetic values, simpler lifestyles, and reduced population.

C. Focus on fully valuing nature's many services that make human life possible, sustainable and enjoyable.

D. Distrust of industrial business-as-usual, merely tweaking the complacent system, without "thinking outside of the box."

E. Utilization of principles of "natural capitalism", e.g., biomimicry – designing materials like windows and roofs with some organic compounds that are resilient to heat and stress, yet water and sunlight permeable where helpful.

F. Reliance on decentralized energy production to reduce loss of efficiency in long distance transmission systems and disperse pollution.

G. Reliance on consensus-based public planning processes to elicit stakeholders' commitments and proactively generate grassroots solutions to local environmental problems.

H. Distrust of "free" markets as sources of perfect information and mechanisms for fostering competition.

I. Need for government to avoid formulating policies with perverse environmental incentives and subsidies, e.g., mandating graduated Corporate Average Fuel Efficiency (CAFÉ) standards that increase the cost of *owning* a car with higher mpg, but actually decrease the cost of *driving* it, thereby increasing the *social costs* from having more drivers on the road.

J. Reliance on "first dimensional environmental income" from renewable energy sources at the earth's surface: solar, wind, water, biomass, hydrogen, etc.

K. Complete elimination of "waste" via *cradle-to-cradle* design of consumer goods.

L. Significant reduction in all pollutants, with the burden of proof of safety on the producer.

M. Focus on the financial profitability of energy-saving appliances and small-scale technologies for homes, offices, transportation, and shopping centers that have quick payback periods.

N. Focus on the multiplier effect (also called "trickle-up theory") of reducing energy demand at the point of final consumption in order to generate "ten-fold, one hundred-fold and thousand-fold" decreases in the mining and burning of fossil fuels at the power plant due to the high loss of BTU's in generation (typically 50-70%) and transmission (typically 10-20%) (Hawken, Lovins & Lovins).

O. Use of scientific modeling to forecast long-term megatrends, e.g., global climate change, population, natural resource exhaustion/limits to economic growth.

P. Advocate a cautious approach to the development of agricultural biotechnology guided by the Precautionary Principle – unless the severity of potential impacts (human and environmental, not just financial) of a new technology is known in advance with some high degree of certainty, do not adopt the technology, especially if the decision would be irreversible.

Q. Where the Tragedy of the Commons occurs (e.g., international fisheries, public grazing lands, wildlife refuges) access should be more tightly controlled, not necessarily privatized.

R. Assert that, without "radical resource productivity" (in particular enormous strides in energy efficiency) and major paradigm shifts in human values, the earth cannot sustain the quality of life for all inhabitants currently enjoyed by most people in the Western developed world.

## The Hard Green Movement

A. Reliance on "hard" technology, research and development, and industrial innovation to actively increase energy production.

B. Enhancement of individual wealth and quality of life, which lead to stable or reduced population, concern for environmental protection, and aesthetic appreciation of wilderness.

C. Focus on human capital development as the most potent force for maintaining and advancing human existence.

D. Distrust of government mandates, environmental regulations on private property, and bureaucratic motives.

E. Expression of the anthropocentric philosophy of humans having "dominion over nature", e.g., conservation – wise use of natural resources to meet a hierarchy of needs, beginning with humanity's.

F. Reliance on large centralized power generation facilities that have greater engineering efficiency than decentralized energy sources and more manageable pollution abatement/disposal strategies.

G. Reliance on markets, property rights, and financial incentives to stimulate private investments in green technology and ration tolerable amounts of pollutants, e.g., $SO_2$ emissions permits.

H. Trust in free markets to dispense technological information and disperse economic power.

I. Need for government to not distort markets via subsidies and tax incentives.

J. Reliance on "third dimensional environmental capital" from nonrenewable energy sources that lie deep underground: fossil fuels, uranium.

K. Reliance on land fills as carbon sequestration repositories.

L. Rejection of policy obsession with eliminating human exposure to micro-pollutants, with the burden of proof of danger on consumers and/or environmental activists.

M. Rejection of adopting small-scale energy-saving technologies as the social equivalent of regularly "having a brownie with your diet coke" (Huber); in other words, "efficiency is not the same thing as frugality" (Huber).

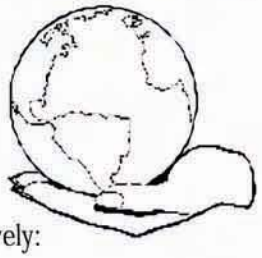
N. Rejection of the trickle-up theory as technically simplistic, overly optimistic, and economically naïve due to the "diet coke/brownie" behavior of consumers and producers.

O. Use of scientific modeling to objectively assess the relative ecological footprints of current environmental policies and technologies, e.g., Huber argues that nuclear power is the greenest path to the future.

P. Rejection of the Precautionary Principle as biased – in the absence of solid information about the future impacts of a new technology, "trust high technology first … [rather than] the political enterprise" (Huber).

Q. Where the alleged Tragedy of the Commons occurs, privatize – government is the problem, not the solution.

R. Assert that terms like "sustainable development," "carrying capacity," "urban sprawl" and "smart growth" are meaningless words that are not empirically testable (verifiable or falsifiable) – temporally contextual buzzwords.



## Capturing the Debate

In essence, the Hard vs Soft Green Debate centers on whether one tends or prefers to see the path to sustainable development as a fundamental choice between economic policies that increase supply vs decrease demand, respectively:

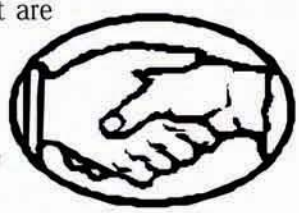
- ✓ Specifically, Hard Green advocates assert that history has shown that education, human ingenuity and technological advances have consistently enabled humanity to discover, invent and de-

velop new and improved ways to produce increasing amounts of food, clothing, shelter, transportation, energy, usable raw materials, higher quality products and services, more efficient means of transmission and delivery, and systems for recycling and disposal, with an emphasis on nature's capacity for resiliency and fruitfulness. In rejecting Malthus' (1976) dire predictions about the future based on his famous analysis in 1798 that population grows at a geometric rate while food production increases at only an arithmetic rate, this worldview asserts that we are not doomed to inevitable famine and starvation. In most countries, technological advancement (especially in agriculture) has outpaced population growth. There is some truth in this optimistic assessment and perspective.

- ✓ Conversely, Soft Green enthusiasts argue that the problem of sustainability is caused by overpopulation, consumption outpacing production, personal materialism and national greed, exploitation and pollution of natural resources, short term planning horizons in the use of renewable resources, under-valuation of environmental assets and the true costs of waste disposal, lack of appreciation for biodiversity, and an overly utilitarian view of nature by arrogant humanity. In support of Malthus, this worldview considers the Hard Green worldview that nature is a boundless frontier for pioneers to conquer as disastrously naive. In most countries, there are limits to growth. There is some truth in this pessimistic assessment and perspective.

The bottom line of the argument is that both sides are partly correct. In explaining how the real world works, economists integrate both perspectives in terms of supply and demand, powerful forces that interact on a daily basis and usually approach or bring about what is called a socially optimal point of "equilibrium" – achieving balance between producers (including nature) and consumers, if and when the market price reflects the true (total long term) costs of providing each good and service, including recycling and disposal.

To a certain extent, the Hard Green and Soft Green schools of thought are complementary movements that can work together toward a sustainable future. Policies that enhance the supply of essential items and/or decrease the demand for non-essential items can simultaneously increase the quality of human life while safeguarding environmental quality. The worldviews are neither mutually exclusive paths to sustainability, nor complete philosophical enemies.



## Operationalizing Sustainable Development

Now that we have adopted a framework for evaluating sustainable development, a practical question arises: What does this mean, in real everyday terms? This section of our curriculum on **Education for Sustainable Development** explores the policy implications of this broad framework and tries to operationalize its meaning in concrete language for teachers and students to use. First, we describe a sustainable community. Then we focus on 12 common questions. Lastly, to personalize the discussion, we resurrect an old metaphor – *nature as household.*

## Picturing A Sustainable Community

It is impossible for us to give an entirely accurate vision of the future. Who would have anticipated the full impacts of the information/technology revolution only a few decades, much less generations,

ago? However, we know that our future must possess certain characteristics if human survival and a high quality of life for coming generations are to be assured.

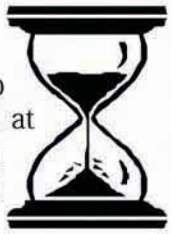
A sustainable society of the future will provide reasonably high material standards of living for the majority of its inhabitants, but will do so without excessive consumption of finite natural resources or production of high volumes of waste. In the future, the "waste" from one system of production will become the "food" for another. Human populations will stabilize or grow at a rate that allows improving the quality of life for all. We will rely primarily on perpetual sources of energy (solar, wind, wave, fuel cell, nuclear fusion, geothermal, *et al.*). The ethical principle of subsidiarity - *that the local people most impacted by development decisions should be the main policymakers* - will be universally recognized and respected. Social justice, rather than charity, will be used to redress poverty. Education will be promoted as a right, not a privilege. And our plurality of values will be seen as a strength, not a weakness.



In an operational sense, sustainable development seeks win/win approaches to life that use our best ideas in design, promote economic efficiency and ecological effectiveness, meet the needs of the poor, challenge our social and moral paradigms, and give full consideration to future generations. In sum, we are called to do the best we can, with our current resources, for all concerned. And to always work for a better future.

## A Dozen Common Questions

### 1. Does Sustainability Mean Forever?



Yes and No. Some schools of thought about sustainable development, e.g., "deep ecology," assert that our decisions regarding nature must be sustainable forever, at least in terms of what we as humans can control. A goal of all human activity must be to try to design buildings, fuel vehicles, grow food, make clothes, steward nature, manage waste, conduct genetic experiments, etc., with the constant aim of achieving renewability in perpetuity in each of these systems. In other words, design all activities and structures to last long enough for nature to replenish the resources used in the process. Let no human activity take more from nature than it returns, neither qualitatively nor quantitatively. Whether or not we always achieve perfectly self-sustaining systems, this must be our goal from the beginning of the design process, during research and development, and throughout construction, use, renovation and disposal.

However, it also appears true that nothing is forever, with the possible exception of a God or gods. In geologic time, the earth and cosmos have changed dramatically, generating life, sustaining life and eradicating life in various forms in different eras and places. Galaxies come and go. Change is inevitable, part of nature's intrinsic design. Is it biologically or morally wrong that the dinosaurs are no longer with us? Is it feasible to build buildings today that will last one million years? Is it fair to hold today's designers to such an unrealistic standard? Can we be expected to visualize what life will be like four, five or six generations down the road? Can we know "their needs," as our definition requires or assumes? Probably not, yet we must try.

The key is for humans to work with the natural law. In an engineering sense, we must physically do the best we can to design all human activities to honor, respect and complement the laws of nature, as we know them. In a moral sense, we must treat all creatures and inanimate resources with the dignity, compassion and justice they inherently deserve.

## 2. What About All Of Those Old Tires?

For example, should Henry Ford have been allowed to invent and develop the automobile, which has left us with zillions of ugly and dangerous (spontaneously combustible) mounds of tires lying along our landscapes? Ideally, Ford should have incorporated into his research and development processes a sustainable solution(s) to the problem of waste disposal of used cars and auto parts. Realistically, he should have been expected/required to use the existing knowledge and best available technology (BAT) to foresee and address the problem. Perhaps Ford tried.

Similarly, today's designers, engineers, miners, farmers and foresters must be expected to use the BAT and best management practices (BMP) in their work. Governmentally, we have already legislatively mandated the use of BAT's and BMP's in many manufacturing, mining, agricultural and silvicultural operations as requirements for participating in federal grants and subsidy programs. These environmental requirements are called the "compliance provisions" of many programs of the U.S. Departments of Agriculture, Defense, Interior, Environmental Protection Agency, and other federal, state and local government agencies.

Also, we must collectively promote an economic system with financial incentives that reward clever people for figuring out sustainable solutions to environmental problems. This is called "green entrepreneurship" and "natural capitalism" (Hawken). However, for businesses and entrepreneurs to make money off of their environmentally sensitive ideas, products and services, we as a society must be willing to pay as consumers and taxpayers for their efforts, which means that we must truly value nature. We must be willing to "put our money where our mouth is." Moral suasion by the public is a necessary, but seldom sufficient, motivator of business behavior.

## 3. Does Sustainability Mean Perfection?

Can/should we allow any environmental pollution to occur? At one extreme, deep ecologists assert a rigid, "No, it's wrong!" At the other extreme, "frontier economists" assert with confidence, "No problem, we'll figure out solutions in the future, because humanity is smart!" In the middle, more balanced analysts think that a goal wiser and more reasonable than perfection is "optimality." Why? Because achieving perfection can be very expensive and inefficient.

Many economists argue that there is an optimal level of pollution, as well as crime and other social ills. They do not mean to sanction pollution and crime as morally acceptable behavior. By "optimality" they mean that, in a world of scarcity – where the resources (time, expertise, money, natural assets) available to prevent or solve a problem are limited – we should allocate those resources to their highest and best uses, i.e., where their marginal benefits equal their marginal costs. We should not spend *more* money to *further* reduce pollution or crime than the benefits derived from the *added* reduction. We follow this principle of optimality countless times in our personal lives: when we clean up our bedroom to a certain degree, order a meal with or without a fancy dessert in a restaurant, select a car to buy, and decide how many years to attend college.

For example, if we want electricity today generated by the burning of coal, which contains sulphur, we must be willing to accept some degree of air pollution from sulphur dioxide ($SO_2$), which can cause acid rain. The economic question is, how much? If we desire less air pollution and acid rain, we must be willing to pay more for cleaner, greener electricity. However, if we demand zero air

pollution from $SO_2$, the cost of achieving such perfection will be extremely high – no electricity from coal, a relatively plentiful source of energy.

In the 1990 Clean Air Act Amendments, Congress established a mandatory nation-wide system of $SO_2$ permits for coal-burning utility plants. Every year each plant must purchase from the EPA through the Chicago Board of Trade (or from each other during the year) at least as many permits as the number of tons of $SO_2$ it emits that year. Violators are subject to fines and prosecution. The permits are annual and transferable to other firms or any other buyers. The cost of the permits is an incentive for dirty plants to invest in pollution control technology (baghouses, scrubbers, precipitators, etc) and/or purchase the more expensive higher grade (lower sulphur content) coal. Anyone (environmental groups, citizens, etc.) interested in reducing air pollution can purchase and "retire" permits. In each locality, a scientific/medical board sets an annual limit on the total number of permits that the utility plants in the aggregate are allowed to purchase. The firms compete for permits through the Board of Trade's daily price bidding system or by negotiating prices with other firms that have surplus permits for sale.



If, after the first few years of the policy, the local scientific/medical board and affected citizens believe that there is still too much $SO_2$ air pollution causing eye, skin and respiratory health problems, does that mean that the economic approach has failed? No. It means that there are too many permits being allowed.

In that case, the message is to reduce the number of permits. When that happens, the following chain of events will likely occur: fewer permits … higher permit prices … higher costs of electrical energy production … higher fuel bills charged to consumers … increased energy conservation measures voluntarily adopted by entrepreneurial consumers … less energy consumed by the public – the original source of the problem! Watt's more fair?

Here we see a major virtue of the system: pollution permits are a powerful mechanism by which society can express with dollar votes its desire for clean air and clean electricity! Not an immoral idea, selling pollution permits is a transitional device for moving us toward zero emissions, if we are willing and able to pay for perfectly clean electricity. And, as a compassionate society, when electricity prices rise beyond the financial means of our poorer citizens, we can and have subsidized them with tax rebates and other forms of income enhancement.

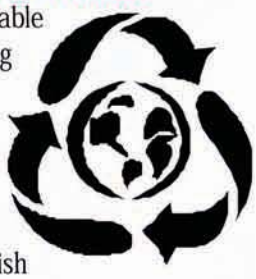
### 4. Is There A Different Way Of Thinking About All Of This?

Yes, sort of. Whereas economists place a lot of emphasis on using human and natural resources in the most efficient manner possible, some critics of economics assert that the principle of optimality ignores the fundamental point of reexamining "the box we're in" and searching for new paradigms of sustainable development. Some thinkers like McDonough (1993) challenge us to "think outside the box" and search for win/win solutions to economic/environmental problems.

For example, McDonough argues that we should strive for commercial, industrial and residential systems that are "eco-effective," rather than "eco-efficient." Whereas eco-efficient processes achieve the optimal level of polluting by-products, given the current set of inputs and technology, eco-effective processes aim to eliminate pollution altogether by re-designing the entire system. In response, most economists would say, "Amen!"

Actually, the two schools of thought are neither contradictory, nor mutually exclusive. The economic efficiency argument is a static view in light of the given situation and known alternatives. It involves rational trade-offs and compromises. It is wise. The effectiveness criterion is a dynamic argument that stresses creativity and major shifts in our values and priorities. It involves personal courage and soul-searching. It is also wise.

## 5. What About Landfills ... Or Can We Still Allow Deer To Poop In The Woods?



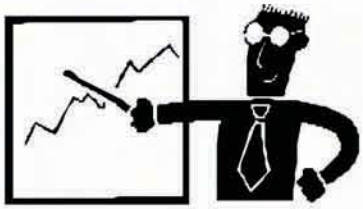
Designing "cradle to cradle" systems of human activity that are truly sustainable means getting beyond "cradle to grave" systems that end up with using the earth as a waste sink for our garbage. In this sense, one can argue that we should never have landfills, that all of our trash should be recyclable, that all commodities should therefore be designed up-front for recycling.

This is wise thinking, with one qualification. It is important to distinguish between "pollution" versus "waste." Pollution hurts the long-term health of the environment and thus imposes costs on the ecological and economic systems in which we live. Waste, on the other hand, is that normal by-product of human and natural activity that is easily assimilable by the biosphere. In a technical economic sense, waste does not become pollution until it is of such consequence that it imposes costs on humans. Obviously, this is an anthropocentric perspective.

For example, when deer poop in the woods, such waste will be handled by nature's carrying capacity, unless there are too many deer. The same is true for most human trash over time, unless there is too much of it.

On the other hand, Huber (p. 115), an MIT engineer and Harvard attorney, argues that properly constructed landfills complete the carbon cycle by returning carbon deep into the earth from whence it came in the form of fossil fuels, offering a virtually complete solution to global warming. He says that, "the notion that 'there is no room' down there is absurd." Recycling is oftentimes the worst thing we can do environmentally, e.g., composting food wastes and recycling newspapers backfire by returning carbon to the atmosphere. Hence, Huber believes that, "with rare exceptions, recycling is the worst possible option."

## 6. Is There A Maximum Sustainable Global Population?



The answer to this question has puzzled analysts for centuries. Today it remains an intensely debated issue. Perhaps the answer is a moving target, dependent on technology. For example, in his alarming prognosis, the Rev. Thomas Malthus predicted inevitable mass starvation because, in Malthus' time (late 18th Century), the human birth rate expanded at a geometric rate, whereas food production increased at only an arithmetic rate (Malthus). This pessimistic view became known as the Malthusian Doctrine. Malthus' famous doomsday forecast has so far not occurred on a global scale because he dramatically underestimated the growth in food production due to technological advancement in modern agriculture and because a lot of countries have achieved near stable populations. However, Malthus has been correct on a limited scale - some nations, e.g., Ethiopia, have indeed suffered famine and starvation.
The point is that targeting a sustainable global population depends on a variety of social factors and resource constraints, including changes in technology and one's own view of what constitutes

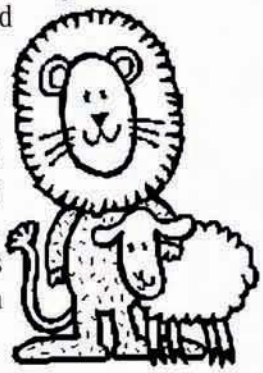
an acceptable quality of life. For another example, during the early 19th Century some analysts believed that the most limiting constraint on U.S. human population growth was the availability of pastureland for horses, since horses were essential for farm work and everyday transportation. Obviously, times and technology have changed!

Today, a vigorous debate continues over whether "the population problem" is caused by too many people and too little food *production*, or by an inadequate *distribution* of the food produced. The latter group asserts that we can and do produce enough food to feed everyone on earth, but that poor planning by farmers, inadequate processing and transportation systems, human greed, government bureaucracy and/or corruption prohibit a timely delivery and equitable distribution of food to all people. Both camps cite persuasive statistics to build their case and indeed there is probably some truth in both schools of thought.

Also today, many analysts assert that "the population problem" causes excessive pressures on all natural resources, not just agricultural, due to the finite ability of ecological systems to support all human activities. Environmental pollution, excessive hunting and fishing, depletion of forests, monocultural farming (growing the same crops year after year) and urban sprawl, etc., are all linked in that they reduce biodiversity, which in turn has serious implications for long term ecological integrity. And indeed, there is some truth in these arguments.

### 7. Can The Poor Afford Sustainabililty?

A particularly difficult issue in sustainable development involves meeting the needs of poorer citizens. Does the goal of eco-effectiveness mean that we must build homes for everyone that will last forever and be perfectly in harmony with nature's land, air, water, and waste disposal systems? How expensive would such dwellings be? Perhaps the fairest and wisest solution is to build *affordable* homes using the BAT and BMP's currently available for that price range of structures. And continue to design ever greener structures and building processes.



### 8. Animal Futures: Extinction, Zoos, Refuges?

To most people, the extinction of any species of flora or fauna seems sad and scary due to loss of biodiversity, potential medicinal benefits, and pure human love of nature. Conversely, is extinction inevitable – a necessary part of the natural cycle? For example, by some estimates (www.pbs.org/evolution) 99.9% of all species that have ever existed on earth are now extinct, opening the door for new life to emerge.

Captive animals also evoke a myriad of human responses. Some argue that zoos are immoral forms of cruelty and slavery. Others argue that zoos are our last chance to see endangered creatures. Others rebut that you cannot fully appreciate the majesty of an elephant or eagle in an artificial enclosure. Ideally, we should not need zoos, but we do.

Regarding this curriculum, are zoos consistent or inconsistent with sustainable development? We suggest that, in light of Question 6 above and 9 below, zoos represent an affordable middle path to a better future, as long as the aim is work with nature rather than against it. Beyond serving as educational and research institutions, zoos should be in the business of going out of business – returning species to their native habitat.

Some nations achieve multiple objectives by protecting species in refuges and sanctuaries open to eco-tourism. Such enterprises generate jobs for former poachers and revenues for local businesses and government programs.

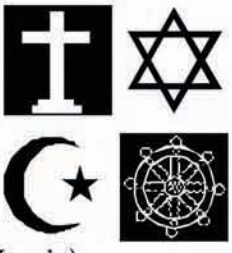
## 9. Should We Tamper With Nature?

Another perplexing issue in sustainable development involves the wisdom of tampering with nature, e.g., genetic engineering of plants, animals, and even humans. Startling developments have occurred in various fields of biotechnology in recent decades, e.g., cloning and patenting new life forms. Yet, some critics vigorously assert that we "must not play God!" Others respond that we "play God" all the time whenever we take an aspirin or warn of a hurricane.

Perhaps a key to resolving the debate is to distinguish between working with God/nature versus against God/nature. When we use science to understand, utilize and complement the forces of nature, we are on solid ethical ground, but not when we seek to circumvent or redesign nature. For example, using zoos to learn about and propagate animals in order to reintroduce them into the wild is more defensible than to use them as mere human toys and sources of entertainment. And zoos with natural habitats are more justifiable than prison-like facilities.

Using science to promote human health is qualitatively different as an ethical matter than to engage in merely cosmetic alterations of our physical appearance or self-centered attempts to improve our social status or temporal pleasure. Some of these issues involve personal and collective assessments of ethical and spiritual values. For example, is there a moral difference between re-routing a flood-prone stream versus building one more fishing pond for anglers? Is there a moral difference between raising cattle and poultry for food under "natural conditions" versus suspending young calves in harnesses for veal production? Similarly, medical ethicists examine the distinction between curing human diseases through genetic manipulation or surgery versus using our limited resources for strictly cosmetic surgery?

## 10. Are Religious Beliefs Relevant To Sustainable Development?



Yes and No. Religious ideas and value systems help shape humanity's view of nature. For example, much effort has been employed by theologians and environmentalists over the centuries in discerning what it means for people to be "stewards" and "have dominion" over nature (Gen1:28) and where is God's kingdom located - strictly in heaven, or in heaven and on earth (1Chr 28:5; Mt 4:23)? One of the main movements in theology in recent decades has been the development of "environmental theology" (Haught).

Yes, theology is relevant to sustainable development in terms of helping people understand and evaluate their views (explicit and implicit) of nature. In this sense, the religious traditions must be brought into the process of developing sustainable communities as legitimate stakeholders. For a lot of people, their attitude toward nature had spiritual roots (Associated Press). Sustainable development requires education about basic religious beliefs in order to foster mutual understanding and respect.

No, faith-based perspectives become irrelevant to sustainable development whenever we try to force our beliefs on one another. The difference is between *preaching* versus *teaching* about religious insights. The diverse dialogue necessary for sustainable development must include

calm and open discussion of religious and philosophical values, without attacking others' spiritual experiences and perspectives.

## 11. Can We Protect The Chesapeake Bay?

An aggressive agreement from the Chesapeake Bay Commission was signed into effect in 2000. The agreement called for the signed states (Pennsylvania, Maryland, Virginia, and the District of Columbia) to "strengthen programs for land acquisition... that are supported by funding and target most valued lands for protection" (Chesapeake 2000 Bay Agreement). They plan to permanently preserve 20% of the land area in the watershed from development by 2010. With an overall goal of preserving 7.8 million acres, 6.7 million acres had been preserved as of July 2000. An even loftier goal pertains directly to urban sprawl. By 2012, the states are to reduce the rate of "harmful sprawl development of forest and agricultural land in the Chesapeake Bay watershed by 30%..." (Chesapeake 200 Bay Agreement).

One of the main reasons these will be difficult (but not impossible) to achieve is that an estimated additional 3 million people are expected to settle in the watershed by the year 2020. Therefore, it is vitally important to have these goals to prevent uncontrolled and irresponsible growth such that it does not undo all that has been done in the means of nutrient reduction and habitat protection, and to strive to remove the Bay and its tributaries from the list of impaired waters.

## 12. What are TMDL's – Total Maximum Daily Loads?

In 1972, Congress passed the Clean Water Act, requiring all states territories and authorized tribes to develop lists of impaired waters and develop TMDLs for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a body of water can receive but still meet the water quality standards set for it by the governing body. It allocates pollutant loads (or the amount of a pollutant) to pollution contributors. This is a large and daunting, yet necessary task. Currently, over 40% of assessed waters do not meet the water quality standards set forth by their governing bodies (EPA website). Around 300,000 miles of rivers and shorelines are classified as impaired, along with a staggering 5 million acres of lakes (EPA website). The majority of this pollution comes from excess amounts of sediment, nutrients and harmful microorganisms; however, what is more pressing is that the majority of the US population, about 218 million people, live within 10 miles of these sub-standard waters.

Until recently, not much had been done in the way of developing these lists and TMDLs. However, a string of lawsuits has brought them to the forefront and forced action by the states and EPA. The system works as follows: A state, territory or authorized tribe sets the specific water quality standards, then is required to test all of its bodies of water. If a water body does not meet its standard, it is placed on the list of impaired waters and a TMDL is calculated such that a comprehensive plan for achieving good water quality is developed. The impaired waters are then ranked according to severity of pollution and submitted along with the associated TMDLs to the EPA. The EPA then reviews the list and may change it as they deem necessary (adding waters, adjusting TDMLs, etc.) This process is repeated every two years.

In 1999, the EPA signed a consent decree after the American Canoe Association and the American Littoral Society filed a complaint against them for failure to comply with the Clean Water Act in Virginia. This decree brought about a schedule for the

development of impaired water lists and TMDLs in Virginia (DEQ website). The DEQ estimates that it will develop and submit 648 TMDLs to the EPA for the approximately 600 impaired waters in Virginia.



## An Old Metaphor We Shall Use: *Nature As Household*

Is there a symbol or image that captures all that we have said? Yes indeed, and it's not a new idea. Early Greek philosophers saw nature as a house on stilts, whose care and balance rested on three legs: *eco*nomics, *eco*logy and *ecu*menism. Note the etymological roots of these disciplines derive from and reflect today the ancient notion of a "household" [Gr. *Oikos*] (Meeks; Young):

- *Eco*nomics – study of the management of a household's financial resources;
- *Eco*logy – study of the management of a household's physical resources;
- *Ecu*menism – study of the management of a household's social, moral, ethical, philosophical, and spiritual resources, amidst a plurality of values.

Sustainable development rests on this three-legged stool. For communities to survive and thrive, each of the legs must be strong, managed wisely, and integrated with each other. If any leg collapses, the structure collapses. We must build just economic systems that respect the ecological resource base and reflect the diversity of our social values. For growth, peace, and justice to be sustainable and harmonious, we must build just economic systems that respect the ecological resource base and reflect the diversity of our social values. For growth, peace, and justice to be sustainable and harmonious, we must integrate everyone as stakeholders into the picture.

Today, the term "ecumenism" is most frequently used in the context of inter-religious dialogue, but it actually refers to any effort to foster understanding and respect among people with different values, customs, and traditions. Ecumenism seeks to answer the question: How can we all get along, given our cultural values, social norms, religious beliefs, and personal values? In a political context, ecumenical approaches are key to resolving conflicts (and conflict in life is inevitable) in a democratic manner: How can we peacefully coexist, without sacrificing our differences? For our purposes here, ecumenism is the social dimension of sustainable development, the third leg of our stool.

Throughout this curriculum, we shall use this metaphor of *nature as household.* It might help youth conceptualize the dimensions of sustainable development by focusing on their image of a house or home. Each house has a variety of systems: land, building, air, water, food, waste disposal/recycling, energy, communication, transportation, money, authority, rules, responsibilities, and personal values. For the home to be sustainable, each of these systems must be managed in a sustainable manner. This is true for individual homes, neighborhoods, communities, states, nations, and our global village.

**Author:** Michael J. Ellerbrock, Director, Center for Economic Education, Virginia Tech

## References


Associated Press, "Loggers Say Forest Service Bends to Religion," *The Roanoke Times*, 12-25-99, A16.

DEQ website on TMDLs: http://www.deq.state.va.us/tmdl/

EPA website on TMDLs: http://www.epa.gov/owow/tmdl/

Haught, J.F., *The Promise of Nature: Ecology and Cosmic Purpose* (New York: Paulist Press), 1993.

Hawken, P., A. Lovins and L.H. Lovins, *Natural Capitalism: Creating the Next Industrial Revolution* (Boston: Little, Brown & Co.), 1999.

Huber, P., *Hard Green* (New York: Basic Books), 1999.

McDonough, W., "Design, Ecology, Ethics and the Making of Things," A Centennial Sermon given in New York at The Cathedral of St. John the Divine, 2-7-93; published in *Environmentally Intelligent Textiles* (Charlottesville, VA: Designtex, 1995), 9-25.

Malthus, T.R., "An Essay on the Principle of Population," (Toronto: W.W. Norton, Inc.), 1976.

Meeks, M.D., "God and Land," *Agriculture and Human Values* 2(4): 16-27, 1985.

Young, M.D., *Sustainable Investment and Resource Use: Equity, Environmental Integrity, and Economic Efficiency* (Park Ridge: Parthenon Publishing Group), 9, 34, 54, 1992.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