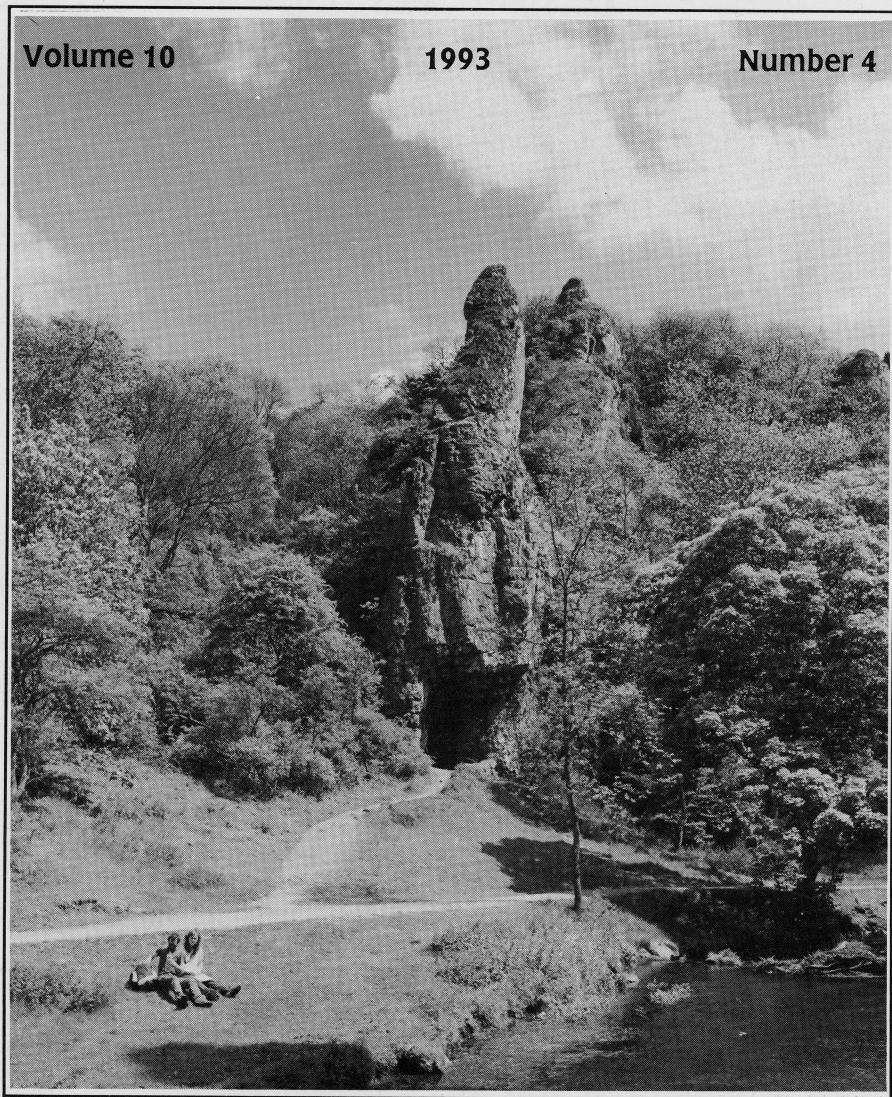


The George Wright
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General View of Dovedale, Peak National Park, England

Peak National Park Photo

The George Wright Society

Dedicated to the Protection, Preservation and Management
of Cultural and Natural Parks and Reserves
Through Research and Education

The George Wright Society

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The George Wright Forum

Volume 10

1993

Number 4

Letter from Gustavus: Leading the World to Sustainability <i>William E. Brown</i>	2
Call for Papers: "Sustainable Society and Protected Areas" <i>The 1995 George Wright Society Conference</i>	4
Society News, Notes & Mail	6

SUSTAINABILITY, RESPECT, AND RESPONSIBILITY

Guest Editors: Joseph C. Dunstan, Katherine L. Jope & Geoffrey M. Swan

Why Sustainability? <i>Joseph C. Dunstan, Katherine L. Jope, and Geoffrey M. Swan</i>	9
Some Thoughts on Sustainability <i>Edwin P. Pister</i>	19
Sustainability in Historical-Philosophical Perspective <i>J. Baird Callicott</i>	26
A Sustainable Society: What Is It? How Do We Get There? <i>Stephen Viederman</i>	34
Sustainability, Natural Law, and the "Real World" <i>Gary K. Meffe</i>	48
What on Earth are We Doing? <i>USNPS Denver Service Center</i>	53
Integrated Bioclimatic Architecture <i>Javier Barba</i>	59
Strengthening the "Ability" of Sustainability: A Personal Perspective on Motivations and Sustainable Design <i>Joan Hirschman</i>	67
Balancing Management Goals for Ecological Systems on a Sustainable Basis: An Analysis of the Pacific Northwest Timber Dispute <i>David K. Cox, Val R. Beasley, and Paul W. Andrews</i>	76
Sustainable Design and the U.S. National Park Service <i>John J. Reynolds</i>	82
Sustainable Tourism in the Nature and National Parks of Europe <i>John Anfield</i>	87

A Science Agenda and Strategy for the U.S. National Biological Survey <i>Gary E. Davis</i>	95
Is the USNPS Ready for Science? <i>David A. Haskell</i>	99
About the George Wright Society / Membership Form	105

Letter from Gustavus

Leading the World to Sustainability

November 16, 1993

The issue of sustainability cuts both ways. From the viewpoint of those who would sustain the current human population, economic, and energy systems, it means steady increase of all three. For those who seek balance between our species and the biosphere's other forms of life and material resources, it means a decrease of human populations and demands to a level sustainable by harvest and husbandry. The one is the dynamo racing ever-faster to keep up. The other is the brake and the flywheel—RPMs in the green, not the red, of the dial.

Despite the obvious disparities between increasing populations and diminishing resources, current systems proceed apace. Periodically, technological fixes like the Green Revolution—always short-lived—sustain the myth that we can keep on doing what we have done in the past. It matters not that simple numbers and their changing ratios point to inexorable decline of calories, energy units, and quality of life for our children and their children, nor that the lower levels of that slope down which we now slide will be Dante-esque zones of mere survival for the fortunate and trampling by the Four Horsemen for the rest.

Why this blindness? Because denial is strong and present necessity determines. Because political leaders dare not propose the radical and politically lethal changes to meet long-term necessity. Thus do the politics and economics of binding scarcity spawn a worldwide Culture of Poverty that discounts the future in favor of desperate measures to sustain the current systems, even though they are destined to fail. We see the symptoms around the world and within our respective societies—elbow-swinging competition and inequity that breeds murders at home and wars abroad. We put on our blinders and dig

deeper in our mining of the earth for its remaining resources, which should be used for the transition to saner ways. Lacking alternatives, we are trapped where we live, where we work, and in what we do. I think of the peasant farmers of the Danube Basin, tilling their fields year after year as the Mongol Hordes advanced ever-closer, finally to overwhelm them. "But we must eat," they said, until almost the moment before the horsemen of the steppes charged.

What do *we* do in such a time? We convert our parks, these incredible treasures bequeathed by our ancestors, into beacons of enlightenment. There is no profit in and no time for despair. We park people in every nation hold in trust natural and cultural environments/laboratories/schools that can help our respective bodies politic to see the truth, the pragmatic truth of our predicament as a volatile, out-of-control species. We hold the remnant landscapes and gene pools that, as models and reservoirs, can help to replenish the battered earth.

In these places we can demonstrate truths that transcend destructive abstractions of belief, myth, and tribalism. In perilous times we have unparalleled opportunity to help create sustaining belief, myth, and community.

As the imperatives for reversing humankind's present collision course become ever-clearer, the parklands of the world can serve with other healing forces to provide alternatives, to show the limits upon us, to find intangible, non-consumptive forms of wealth and satisfaction.

All of this resides squarely in our respective park missions: Inspiration—yes. Education—yes. Environmental health—yes. Social inclusion and healing—yes. Scientific research, including global-change networking and forecasting—yes. These are some of the reasons for which natural and cultural parks have been set aside. There are many more—all of them contributory to reform.

We in fact violate our public trust if we default on these broad duties and obligations. We become mere facility managers—emptying the trash and clipping the grass. None of our parks came into being with such mundane functions (however necessary) as justification. All symbolize higher value systems.

Then let us employ these places and the value systems they represent to help humanity save itself, and the world, and indeed the parklands themselves—which can survive only in context. And let us start, each of us, right where we are. Don't wait for the thunderbolt from on high. Create your own direction, then form alliances with people of like mind. Your own park story—human and natural—is where you begin.

This issue of THE GEORGE WRIGHT FORUM will give you some clues.

Keep the faith,

Bill Brown

Call for Papers

Sustainable Society and Protected Areas Challenges and Issues for the Perpetuation of Cultural and Natural Resources

The 8th Conference on Research and Resource Management
in Parks and on Public Lands
April 17-21, 1995 ❖ Portland, Oregon

Sponsored by The George Wright Society

The 1995 George Wright Society Conference is dedicated to the exploration of sustainability as it relates to parks and other protected areas. Emphasis will be placed on the value of natural and cultural resources as the objects of sustainable management and as reference points for the larger society. The program will also include a variety of contributed papers and posters organized around topics of major interest in protected area management and research. Subjects may address any discipline involved with protected areas—from prehistoric archeology to marine zoology—or resource type. Papers are needed on research, interpretation, and management.

The George Wright Society Conference on Research and Resource Management in Parks and on Public Lands is the USA's premier interdisciplinary conference on protected areas. Our most recent conference brought over 500 people together to share problems and information, hear new perspectives, and contemplate critical questions about the future of protected areas. Aside from the presentation of papers and posters, the conference will include keynote addresses from major figures in conservation, as well as several plenary sessions, each focusing on the relationship between "sustainability" and protected areas.

Portland, widely recognized as one of North America's most attractive cities, is a short drive from some of the Pacific Northwest's finest natural areas, such as Mount Hood, Mount St. Helens, the Columbia River Gorge, and the Oregon coastal state parks. Nearby cultural sites include Fort Vancouver, Fort Clatsop, and the Warm Springs Tribal Museum. The conference will take advantage of Portland's proximity to these protected areas by offering mid-week field trips to participants. Several special events are planned for the conference week, including an opening reception and the GWS Awards Banquet.

ABSTRACTS & REGISTRATION

To adequately plan and organize the conference, authors are requested to submit abstracts of their proposed sessions, papers, and posters. **Session proposals** should indicate how the session might relate to the rest of the conference, given its theme and the suggested topics below, as well as who will chair the session, what format it will take, and who will be invited to participate. Proposals for debates, round-table discussions, and other interactive formats are welcome. Preference will be given to **paper proposals** having broad applicability, although case studies or reviews of programs may be used as illustrative or support material. Generally, **posters** are devoted to presenting case studies or other work in progress. Poster presenters may also, if they wish, prepare a paper based on their poster to be included in the conference publication.

While no explicit format for abstracts is required, **do** include a title for the session, paper, or poster; **do** include the name, affiliation, address, telephone number, and fax number of **each** author or presenter; and **don't** exceed 150 words. **Abstracts should be faxed or postmarked by May 15, 1994, to the GWS office (address below).** If you would like the complete Call for Papers brochure, which contains a suggested list of topics and more detailed information on the conference, call the GWS office (GWS members will automatically receive this information).

The basic registration fee will include attendance at all conference sessions, the opening reception and keynote address, information materials, and refreshments during breaks between sessions. Meals, field trips, transportation, and lodging are not included. Conferees may choose to sign up for field trips and additional special events "à la carte" at an added cost. Details will be included in the registration package, which will be ready in September 1994. The package will contain a registration form with selection guide to field trips and other special events, a preliminary program, a complete fee schedule, hotel registration information, and information on Portland attractions. **Only those who contact us will automatically receive the registration package.**

Please note that George Wright Society members will be able to register at a substantially lower cost than non-members. Anyone who joins the GWS or renews their membership during 1994 will be considered a member in good standing for conference registration purposes. Membership may be obtained by filling out the form in this issue.

INTERESTED?

If you would like to receive a registration package, or simply more information, **contact the GWS office.** We will be happy to answer any questions you might have—call us!

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Erratum: Correct version of paper on GIS at Colonial National Historical Park is available

We must apologize for an error we made in composing the last issue of THE GEORGE WRIGHT FORUM (Vol. 10, No. 3). We mistakenly published a not-quite-final version of "What We've Learned About GIS: One Park's Experience in the World of Geographic Information Systems," by Chuck Rafkind, Hugh Devine, John Karish, and Patti Dienna. The article explored in very useful detail the

application of GIS at Colonial National Historic Park. We erroneously typeset the copy from an earlier diskette, and for this we apologize to our readers and the authors. If you would like a free copy of the correct version, please send a note to The George Wright Society, P.O. Box 65, Hancock, MI 49930-0065 USA, or you may call us at (906) 487-9722 or fax us at (906) 487-9405.

Toothman, Veirs re-elected to Board; Minnucci reappointed

Two incumbent Directors of the Society's Board, Stephanie Toothman and Stephen D. Veirs, Jr., were re-elected to three-year terms in the annual fall Board balloting. They were challenged by Ann Hitchcock and John Donahue. The results were announced at the Society's Annual Membership Meeting on November 13 in San Francisco. At the Board meeting on that date, George J. Minnucci, Jr., was reappointed to a second three-year term on the Board.

Toothman and Veirs were first elected to the Board in 1989. Stephanie is regional historian and

chief of the cultural resources division of the USNPS Pacific Northwest Region in Seattle. Until recently, Steve was unit leader at the USNPS Cooperative Studies Unit at the University of California at Davis; he has now been transferred to the National Biological Survey. George, who was first appointed to the Board in 1991, is the president of the Eastern National Park and Monument Association.

Nominations for the 1994 Board election will be accepted through June 1, 1994. For details, contact the Society office at the address or phone numbers above.

Assessment of New York State Park System published

In June 1993 the New York State Office of Parks, Recreation and Historic Preservation finished a statewide analysis of problems and threats fac-

ing one of the USA's largest and most diverse state park systems. Entitled *Fostering Environmental Stewardship: A First Report on Managing and Protecting*

the Natural and Cultural Resources of the New York State Park System, the study made a first-cut evaluation of the condition of the state's parks, which include not only recreational areas and historic sites but the vast Adirondack Park.

One of principal findings of the study was that there are strong parallels between the challenges facing New York's parks and those in the other states that have carried out similar studies: California, Pennsylvania, and Missouri. Moreover, state parks appear to share many of the same problems as the U.S. National Park System and parks outside the USA.

The study listed seven areas of environmental concern, ranked according to significance. The most acute was

encroachment of residential and commercial development on park boundaries, followed by high levels of visitation and overuse, degradation of water quality, deficiencies in staff development and training in natural and cultural resources management, impairment of visual qualities, incomplete survey data on biological resources, and loss of critical wildlife habitat areas. The study issued fifty recommendations for dealing with the situation.

To obtain more information about the study, contact Thomas L. Cobb, New York State Office of Parks, Recreation and Historic Preservation, Building 1, Nelson A. Rockefeller Empire State Plaza, Albany, NY 12238.

Travel grants for study at Forest History Archives

The Forest History Society, a non-profit educational organization affiliated with Duke University, has announced the availability of its Alfred D. Bell, Jr., travel grants for 1994. Those wishing to study at the Society's library and archives may receive up to \$750 in support of travel and lodging expenses. Eight Bell grants were

awarded during 1993. There is no deadline for applications, which are currently being accepted. For information on the Society's holdings and application procedures, write" Bell Travel Grants, Forest History Society, 701 Vickers Ave., Durham, NC 27701; 919-682-9319.

GWS helps fund human ecology / climate change workshop

The Society helped underwrite a recent workshop on "Human Ecology and Climate Change: The Role of Parks and Protected Areas." The workshop, which was organized and primarily sponsored by the USNPS, was held at Pack Forest, LaGrande, Washington, October 17-21, 1993. The workshop addressed the topic of human interactions with climate change and the societal and cultural implica-

tions of global change. The meeting brought together researchers from the Pacific Northwest, Alaska, Canada, and elsewhere. The key papers from the workshop, which will be published as a book, will provide a basis for a series of work groups that will develop management-issue statements and research agendas for the USNPS to use in addressing the questions surrounding human ecology and climate

change. For more information on the workshop and the follow-up book, contact Darryll R. Johnson or David L. Peterson at the USNPS Cooperative

Park Studies Unit, College of Forest Resources—AR-10, University of Washington, Seattle, WA 98195.

Upcoming Conferences:
National Symposium on Urban Wildlife,
North American Wildlife and Natural Resources Conference

A National Symposium on Urban Wildlife is planned for October 22-26, 1994, in Bellevue, Washington (a suburb of Seattle). It is being convened by the National Institute for Urban Wildlife. The symposium will cover all aspects of wildlife conservation in metropolitan areas. Among the topics: urban ecology, the social need for wildlife in cities, urban greenways, habitat restoration, and legal considerations. For more information, contact Dr. Lowell W. Adams, National Symposium on Urban Wildlife, National Institute for Urban Wildlife,

10921 Trotting Ridge Way, Columbia, Maryland 21044 USA; phone (301) 596-3311.

The theme of the 59th North American Wildlife and Natural Resources Conference will be "International Partnerships for Fish and Wildlife." The conference will be in Anchorage, Alaska, from March 18th through the 23rd, 1994. A wide variety of special events is planned in addition to the conference sessions. Contact: Wildlife Management Institute, 1101 14th Street NW, Suite 801, Washington, DC 20005.



Why Sustainability?

Joseph C. Dunstan, Katherine L. Jope, and Geoffrey M. Swan

*U.S. National Park Service, Pacific Northwest Region, 909 First Avenue, Seattle, Washington
98104*

An unexamined life is not worth living.

—Socrates

Introduction

We are in the midst of a *sustainability revolution*. Every day environmentalists, members of the “wise use” movement, and government officials from the United Nations and the industrialized and third world countries are embracing the concept of “sustainable development.” How is this apparent consensus possible when so many diverse groups and individuals have such different value systems and goals?

Conservation biologist Reed Noss believes that sustainability as a notion is popular because it represents the perfect middle ground in human and natural resource conflicts. To protect wilderness and biodiversity would demand radical changes in the way we do business as a society. On the other hand, embracing sustainability is safe and non-threatening. “How on earth could anyone be opposed to sustainability?” asks Noss (1991:120).

In the speak-easy world of politics, sustainability is popular precisely because of its lack of meaning. This often gives the illusion that everyone is in agreement; that an activity must be good because it is “sustainable”; that things are fine just the way they are;

and that, while minor changes may be required, major societal changes which are inevitably painful are unnecessary.

While we all may agree on the word, we would not all agree with a particular definition of sustainability. Thus we are still faced with reconciling the conflicting goals of diverse groups, agencies, and governments with regard to land and resource management.

The purpose, then, of this winter issue of THE GEORGE WRIGHT FORUM is to bring together an array of individuals who have thought a great deal about sustainability, sustainable design, and our role in the universe around us.

Sustainable development

The term "sustainability" first became popular with Lester Brown's book *Building a Sustainable Society*, and with the IUCN's *World Conservation Strategy*, both of which appeared in 1980. Since then, several other groups have called for sustainable initiatives of one form or another:

- The World Commission on Environment and Development (WCED), chaired by Gro Harlem Brundtland, published a report calling for sustainable development worldwide (WCED 1987).
- The Ecological Society of America launched a Sustainable Biosphere Initiative (Lubchenco et al. 1991).
- The U.S. government, under the direction of Vice President Al Gore, is currently pursuing a national strategy for sustainable development and has established a Presidential Council on Sustainable Development.
- The U.S. National Park Service, through its 75th-anniversary "Vail Agenda," is now integrating sustainable design principles into park planning and facility design.

Building on these initiatives, the next George Wright Society conference, scheduled for April 1995 in Portland, Oregon, will have "Sustainable Society and Protected Areas" as its theme.

There are many who define sustainability as "that which can be sustained." According to this definition, there is no difference between "sustainability" and traditional concepts of sustained-yield harvest using single-species or single-resource management. Such "sustainable harvest"

focuses on the relationship of rates of harvest to reproductive rates of a given resource. The resource is considered in virtual isolation from its environment, with no consideration given to ecological linkages except simple correlations with its food base and other features that have clear and direct repercussions for reproductive and mortality rates (Schemnitz 1980, McEvoy 1988).

This use of the term "sustainability" parallels the approach of the Brundtland Commission in adopting sustainable development as the pivotal concept of its report *Our Common Future*. The Commission defined development as sustainable if it "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987:8). They expanded on this human-centered approach by further defining sustainable development as economic growth. "If needs are to be met on a sustainable basis," they stated, "the Earth's natural resource base must be conserved and enhanced.... It will be necessary to turn to methods that produce more fish, fuelwood, and forest products under controlled conditions" such as aquaculture and tree farms (WCED 1987:57-58). In the view of the Brundtland Commission and others (such as Norgaard 1988), sustainable ecosystem management implies more sophisticated manipulation of the biosphere, with multi-national planning and cooperation to raise worldwide living standards while protecting critical life-support systems and the ability of resources to renew themselves.

The Brundtland Commission urged us to see human populations

not just in terms of numbers, but also as a "creative resource." Yet Vitousek et al. (1986:368-373; cited by Orr 1992a:7) estimated that humans now use, directly and indirectly, 40% of the net primary productivity of terrestrial ecosystems on the planet, thus changing climate, exterminating species, and toxifying ecosystems (Orr 1992a:7). Increasing economic productivity and enhancing lifestyles worldwide will inevitably mean diverting increasing amounts of energy and resources to human purposes, leaving less to support the complex ecosystems of which we are a part.

Therefore, an approach to sustainability based on human-centered utilitarian values cannot be succeed in the long-run.

Sustainability and ecological thinking

There is a growing sense of apprehension about society's efforts to manipulate ecosystems. Eckersley (1992: 52) stated that "nature is not only more complex than we presently know but also quite possibly more complex ... than we *can* know."

With the power we wield, the consequences of a mistake are greater than ever before. In the U.S., just one aspect of the consequences of our traditional approach to the environment is evident in the endangered species dilemma. For a time, the debate over the spotted owl in the Pacific Northwest was reduced to arguments over how many jobs would be lost to save a few owls. Following the Forest Summit, led by President Clinton in April 1993, a Forest Ecosystem Management Assessment Team was assigned to evaluate alternative options for forest management and their ef-

fects on the entire spectrum of species associated with old-growth forest ecosystems. In carrying out its charge, the team found that owls were just the smallest tip of the forest-ecosystem iceberg. They found that their assignment involved assessing the effects of forest management options on 524 species of mushrooms and other fungi; 106 of mosses and other bryophytes; 142 of lichens; 127 of vascular plants; 102 of slugs, snails, and other molluscs; 18 of amphibians; 38 of birds; 27 of mammals; and more than 7,000 of insects and other arthropods (Thomas 1993).

Taken individually, conserving each of these species seems like an insurmountable task. Falk (1990) stated that government acquisition and preservation of habitat for every geographic variant of every rare species would require an impossibly large investment of capital. Instead, he proposed investment in off-site genetic conservation such as germplasm banks and cultivated populations.

However, Thomas (1993) seemed to come to the realization that more important than the species themselves are the functional linkages among them. This situation is similar to that faced by quantum physicists when they began to look at scales smaller than the smallest known particles. Instead of finding still more minute particles, they found only "probabilities of existence." They realized that it is not the particles themselves that are important, but rather their interactions and interrelationships. The same holds true as we examine ecosystems more closely. While it might be possible to conserve species in zoos or conserve their genetic materials frozen in test

tubes, this misses the essence of their existence. What's important is not the species themselves, but their interrelationships. As physicist Fritjof Capra put it, "It's not the dancers, but the dance" (Capra 1978).

When we degrade the environment, it's not the loss of species that is of ultimate importance, but rather the loss of connections and dynamic interrelationships. As we raze forests, or drain wetlands, as toxic pollutants seep from dumps or are released into waterways and the sea, what does this do to the connections? Humans are woven into this web of connections as well. What are the consequences of each decision we make?

Sustainability and ethical thinking

There is an illusion that sustainability can be achieved through technological and scientific processes. Inherent in our scientific studies and the development of technology is the use of models to simplify complex systems with the intent of enhancing our understanding. The result is an illusion that we have sufficient understanding to manipulate these systems. The consequence of maintaining this illusion is that each technological "fix" directed at one problem creates a dozen more problems in need of fixing (Ludwig et al. 1993).

To help achieve sustainability, the Ecological Society of America proposed research focused on understanding the underlying processes of ecosystems in order to prescribe more effective management strategies (Lubchenco et al. 1991). Norgaard (1988) proposed that "flow resource systems" such as the services of soil microbes that affect atmospheric

gases must be understood and managed, both locally and globally.

But resource problems are not technological problems; they are human problems. The solutions lie not in better technology but in addressing our cultural beliefs and practices that are disrupting the capacities of ecosystems to sustain themselves.

Some believe that adopting a sustainable approach means increasing recycling, reducing waste, and selecting "green" products. While these are important steps, they are superficial steps that fail to address the fundamental problems. Ecosystems do not, and cannot, expand their life-sustaining capacities in response to the expanding desires of cultures or exploding global populations. We must, instead, look within ourselves as we move towards a sustainable life.

Resolving the problems of sustainability will require greater philosophical depth and perspective. The words "sustainable development" do not carry with them any sense of the moral vision that is needed. To move towards a sustainable life will require that we shed our anthropocentric notions that humans somehow live at the center of the universe. A sustainable life is based on the knowledge that humans are simply a part of larger global processes, and that it is our responsibility through our actions to build and not destroy these processes and, according to Heidegger (1962), allow for the potential of beings on the earth.

In order to accomplish this, we need a population that is both ecologically literate and competent. Ecological literacy is more than technological

cleverness. Ecological competence implies education and experience that develop the practical art of living well in a particular place (Orr 1992a:84).

While we believe that we are undergoing an explosion of knowledge, the fact is that some kinds of knowledge are growing while others are in decline. Among the losses are vast amounts of genetic information from the wanton destruction of biological diversity, due in no small part to knowledge put to destructive purposes. With the absorption of cultures into a worldwide, homogeneous and cosmopolitan society, we are also losing the intimate and productive knowledge of our landscape (Orr 1992a:152). In the words of Barry Lopez: "Year by year, the number of people with first-hand experience in the land dwindles ... herald[ing] a society in which it is no longer necessary for human beings to know where they live except as those places are described and fixed by numbers."

Society is always looking for a technique; a clever and easy way to get out of a seemingly intractable situation. The solution does not lie in managing ecological systems, or managing technology, but in learning how to manage ourselves within these systems.

Sustainable design

What then, does sustainable thinking based on ecology have to say about design?

- Left to itself, nature evolves in ways that tend to create systems that are stable over long periods of time within relatively narrow limits (Orr 1992a:58).
- The concept of sustainability implies the recognition of limits in-

herent in ecological systems. The same recognition must become an integral part of social values, laws, and institutions that affect everyone (Orr 1992a:178).

- A solution is good when it is in harmony with the larger patterns in which it is contained (Berry 1981).
- Good solutions "solve for pattern"; that is, they solve more than one problem while creating no new ones (Berry 1981).
- Our linear industrial systems should be replaced with cyclical ones that emulate nature; ones in which waste products from one process become a key resource for another, and nothing is wasted (Train 1993:12).

David Orr (1992b) said it best when he described ecological design (or sustainable design) as: "the set of perceptual and analytic abilities, ecological wisdom, and practical wherewithal essential to making things that fit in a world of microbes, plants, animals, and entropy. In other words, [sustainable design] is the careful meshing of human purposes with the larger patterns and flows of the natural world, and careful study of those patterns and flows to inform human purposes."

Instead of viewing nature as a set of limits, we should consider it a model for the design of housing, cities, neighborhoods, farms, technologies, and regional economies. The case for regarding nature as a model rests on the recognition that the biosphere is a catalogue recorded over millions of years of what works, including life forms and biological processes. A new aesthetic would evolve from sus-

tainable design; an aesthetic based on a healthy, vibrant, and thriving ecosystem. And when an ecosystem is unhealthy or not thriving due to past development, building and design should heal the scars (Orr 1992a).

Bob Berkebile, a prominent Kansas City architect and one of the contributors to the USNPS's *Guiding Principles of Sustainable Design*, suggests that "we're rediscovering that we can create buildings and neighborhoods that respond to their environment, just as a living system would" (Gilman 1993:9).

Clearly, there is simply no way we can achieve a sustainable future without major changes in our built environment. We need to go beyond minimizing the impact of each design decision—enlightened mitigation—and adopt a design process that responds to existing ecological conditions, a process that emulates the efficiency and diversity of nature and that is adaptive and evolving. This will involve shrinking our urban footprint and returning land to natural habitat. Much of our hard pavement should be replaced with urban forestry and wildlife corridors, and the rest with porous pavement to reestablish natural drainage patterns. "If we allow the systems we've hidden—like streams and sewers—to come back to the surface, we'll become more aware that they are important components of a living system, and we'll accept more of the responsibility for managing, supporting and restoring them" (Gilman 1993:11).

Because sustainable design describes an ideal, it is vulnerable to our human tendency to distort the meaning of a term when it is convenient.

Aldo Leopold wrote, "All ethics so far evolved rests upon a single premise: that the individual is a member of a community of interdependent parts. ... The land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals"; collectively, "the land" (Leopold 1949:203). Sheldon (1993:3) added, "If we human beings learn to see the intricacies that bind one part of a natural system to another and then to us, we will not argue about the importance of wilderness preservation, or over the question of saving endangered species, or why we need to develop means by which we can protect private land as well as public land, or how communities must base their economic futures not on short-term exploitation, but on long-term sustainable development. If we learn, finally, that what we need to manage is not the land so much as ourselves *in* the land, we will have turned the history of American land use on its head."

Sustainability, respect, and responsibility

So what is sustainability? Sustainability is not a list of do's and don'ts. It is not a set of techniques that can be found in a manual and mechanically applied. As with respect, where there is no one set of rules that one can follow in order to be judged "a respectful person" by society, there also is no set of rules that one can follow to achieve sustainability.

Perhaps sustainability is not something to be defined, but to be declared. It is an ethical, guiding principle based on actions and consequences, limitations, an awareness of

trade-offs, and a sense of responsibility. Responsibility for the present, not simply to strive for a built environment with much lower environmental impacts while enhancing health, community, and quality of life. Laudable though this effort is, we should strive for restorative design with *no net environmental impacts or even a positive contribution to the environment whenever we build in it*. And, above all, responsibility for the potential of all the unborn generations of beings on our planet.

Contributors

The journey towards sustainability is as much a personal journey as a professional one. It is not surprising then, that several of the authors included in THE GEORGE WRIGHT FORUM have chosen to share their personal thoughts and processes in their journey towards sustainability, and our place in the world around us.

Phil Pister is a fisheries biologist with the Desert Fishes Council who single-handedly saved a desert fish species in a bucket as the only spring it inhabited dried up. He argues that society is torn between greed and self-preservation. The solution to this conundrum is to put an emphasis on public education. We have relied on the scientists in the past; it is time to look to the philosopher to help us through these great moral debates. We must learn to think at "right angles" to gain a new perspective. Finally, Pister believes that we need a transformation of society's relationship with nature because, while we concentrate on saving species, morality may be the endangered species.

J. Baird Callicott, a professor of philosophy at the University of Wis-

consin, is recognized as an expert on the writings and philosophy of Aldo Leopold. In his essay, Callicott presents a brief history of the American experience in conservation and preservation, based on the philosophies espoused by Gifford Pinchot and John Muir. He argues that preservation and conservation are obsolete concepts and believes we must find a new way of thinking about this intractable problem. Uncomfortable with the terminology of "sustainable development," Callicott believes that sustainable thinking should reflect the symbiotic relationship between people and land, a concept advanced by Leopold. He believes that Leopold's "harmony with nature" is the correct and logical answer. Callicott argues that ecosystems should be managed, but not for commodity production. Rather, they should be managed for their own health and integrity.

Stephen Viederman, president of the Jessie Smith Noyes Foundation, takes a decidedly economic view of our human-environment relations. Describing nature as capital, he attempts to lay out a new economics for sustainability. He identifies the sources of unsustainability in our society, and then proceeds to take on the Herculean task of identifying the principles, the goals, and the characteristics of sustainability. Politics today reflects the values of competing special interests. Viederman believes that politics must instead reflect a broader set of values. He concludes his essay with an appeal for logic and science, yet asks that we not fear emotion and spirit.

Gary Meffe, a research biologist at the University of Georgia's Savannah River Ecology Laboratory, believes

that we have allowed politics and economics to direct resource management. While many believe that the "real world" is based on economic reality, Meffe argues that the real world actually consists of the immutable laws of nature. This requires a paradigm shift away from the outdated socioeconomic system currently in place, which is responsible for our current predicaments. He believes that we must mature as a species, and drop our techno-arrogant thinking. Land managers are compelled to recognize natural laws rather than political expediency and short-term economic gain. Lastly, he agrees with Pister that the answer lies in the education of our children.

The *Denver Service Center*, the design and construction center for the U.S. National Park Service, published *Guiding Principles of Sustainable Design*, a collaborative effort of individuals representing professional design and conservation groups, various offices of the USNPS and national and local governmental agencies, and ecotourism resort operators in October 1993. Site design is a process of intervention involving the sensitive integration of circulation, structures and utilities within natural and cultural environments. The *Guiding Principles of Sustainable Design* suggests that the goal of sustainable development and sustainable building design is to create optimum relationships between people and their environments. The suggested principles to be used in the design and management of park and other visitor facilities emphasize environmental sensitivity in planning, design, construction, operation and maintenance; the use of non-toxic ma-

terials, resource conservation, and recycling; the integration of visitors with natural and cultural settings; and to affect not only immediate behaviors but also the long-term beliefs and attitudes of visitors. The long-term objective of sustainable design is to minimize resource degradation and consumption on a global scale.

Javier Barba is a Spanish architect who strives to develop connections with the surrounding environment and incorporates a sense of place in projects built around the world. Through examples of his work he takes us on a journey of what he calls creative sustainable architecture. He believes that the very nature of architecture is creating a relationship between humankind and the earth and sky. Yet his dream to build a complete new island points to the inherent struggle between having respect for the environment, and our urge to modify and change the environment. This dichotomy points out the difficulty in trying to develop a sustainable approach to design and planning.

Joan Hirschman, formerly a landscape architect with the USNPS, is an assistant professor at California Polytechnic State University, Pomona. She is concerned that the term "sustainability" is popular because it can mean so many things to so many people. Sustainability cannot be trendy, and must be long-term. She is a strong supporter of the Denver Service Center sustainability initiative and takes us on a very personal journey into the conversion of information into abilities and motivation. She believes that three things are required: values, motivations, and institutions.

David Cox, a professor of Veteri-

nary Medicine, along with graduate students Val Beasley and Paul Andrews, explore alternative concepts of sustainability. They contend that economic and ecological considerations are not mutually exclusive. Focusing on the Pacific Northwest timber debate, Cox argues that the adversarial barriers long a part of the environmental-economic debate must be broken down and that long-term economic well-being depends on ecological well-being.

John Reynolds, deputy director of the U.S. National Park Service, outlines the evolution of design within the agency once a decision to build a facility has been made. He discusses the Brundtland Commission's definition of sustainable development as furthering the well-being of people. More

importantly, he recognizes the essential basis of sustainability as an attitude of respect for all life.

John R. Anfield, director of planning for Peak National Park in England, describes national parks in Europe, detailing examples from England. Located in the midst of densely populated Europe, these national parks cannot be considered natural and untouched; in fact, communities are encompassed within many European national parks. With the primary aim of these parks to conserve the environment, this suggests the pursuit of sustainable lifestyles. Anfield summarizes efforts being made to ensure that growing tourism is compatible with conservation of national park values in Europe.

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Some Thoughts on Sustainability

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One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.

—Aldo Leopold, *Round River* (1953)

Most people are keenly aware that neither individuals nor their government can long allow dollar expenditures to exceed income, yet this principle is usually (and perhaps conveniently) ignored when applied to utilization of natural resources. This strange inconsistency assumes enormous importance in any strategy that might be devised by conservation biologists and other concerned citizens in attempting to bring the United States and other developed nations into a mode of sustainable resource use.

Although it is surely prudent to be honest with ourselves in such matters, there is little comfort to be gained by acknowledging the enormity of forces which, in the pursuit of short-term financial advantage and stockholder satisfaction, will actively and steadfastly oppose any major effort to limit use of natural resources. An example here is provided by the reluctance of the timber industry and timber-dependent communities to restrict operations on old-growth forests, although they are keenly aware of the finite nature of the old-growth resource.

All one need do to become a realist in this respect is to review daily stock market reports in a major newspaper.

The various corporations listed (and there are thousands) primarily operate to achieve maximum corporate profits, with relatively little thought being directed to the long term. It is ironic how, at this stage of societal evolution, we find ourselves torn between two of our most basic motivations: greed and self-preservation. In contemplating our future in this respect, one may be either optimistic or pessimistic, depending upon one's mood at the time. On bad days there is a real tendency to assume that there is no hope, and that we had just as well "chuck it all." Then, upon a moment of sober reflection, we recognize the total unacceptability of such a po-

sition. This may prove to be the greatest challenge yet faced by humankind, and we have no reasonable alternative but to try our best. The stakes are just too high to do otherwise in a matter that will so profoundly affect all future generations.

Further complicating the issue is economic competition between nations, a number of which build economic activity around a principle of "Maximize profits in the exploitation of a resource and, when that resource is gone, shift to something else." Examples of this may be found in the attitude of Japanese industry toward tropical rainforest destruction and commercial exploitation of whales, or our own attitude toward old-growth forests. The problem of achieving sustainability obviously transcends international boundaries and becomes global in nature.

Because of the huge amounts of money involved, and the ability of money to influence the political process, it stands beyond the realm of probability to expect meaningful sustainability legislation to be enacted by the U.S. Congress or, for that matter, any world legislative body. Rather, it will need to begin at the grassroots level. Public education, therefore, assumes a role of enormous importance.

The nature and direction of public education is of course of paramount importance here.

When I began my career in fishery science 40 years ago, society looked to science as a means of solving both societal and technological problems. This, however, has turned out to be a two-edged sword. Science has indeed produced many advances for the ben-

efit of humankind, but in so doing has elevated developed nations to a bloated standard of living that obviously cannot be continued and expanded indefinitely. This is especially true when viewed in light of the explosion of worldwide population, which is expected to double again by the midpoint of the 21st century. Ironically, we now find ourselves turning, not to scientists, but to philosophers in an effort to evolve a value system within the developed nations that will allow us to be satisfied with less consumption as we work toward implementing a sustainable future. Again, the process will not be an easy one. At this writing (late September) commercial television is already gearing up for Christmas advertising, with a primary target being young children. Once established, an escalating standard of living becomes extremely difficult to change. If a reader should question this statement, think for a moment how *you* might react to a reduction in *your* standard of living or a change in *your* lifestyle, then try to anticipate the reaction of the average American citizen, the great majority of whom are not finely tuned to resource and environmental issues.

During the recent past three excellent and highly relevant books have come to my attention and have served to sharpen my thinking relative to sustainability. They are: *The Death of Industrial Civilization* by Joel Jay Kassiola, *Envisioning a Sustainable Society* by Lester W. Milbrath, and *Ecological Literacy: Education and the Transformation to a Postmodern World* by David W. Orr, all components of a State University of New York Press Series in Constructive Postmodern Thought. The latter two

volumes speak extensively of the role of education in achieving our goals. Orr (1992, p. 84) states the problem succinctly:

I see no prospect whatsoever of building a sustainable society without an active, engaged, informed, and competent citizenry. The environmental movement is almost without exception one in which citizens forced governments and large economic interests to do something they were otherwise not inclined to do. It is quite literally a democratic movement, but it will not necessarily remain such without an unwavering commitment by educational institutions to foster widespread civic competence.

He states the problem of attaining sustainability as one not only requiring a massive educational process, but also one requiring a change in our educational system. This is a concept with which I fully agree (Pister 1992) if we are to produce leaders capable and willing (in the words of Aldo Leopold and reiterated by Orr) to “think at right angles” to their particular specializations. To accomplish this will require a broadening of undergraduate curriculum to encompass a diversity of educational input, lest our educational institutions remain essentially technological factories producing missiles without guidance systems.

Perhaps a personal anecdote might serve to expand upon this point. When I enrolled in A. Starker Leopold’s curriculum in Wildlife Conservation at Berkeley more than 40 years ago, I found that it was included within the College of Letters and Science. Fortunately for me (although I could not really comprehend its signif-

icance at the age of 19), I was required to spend virtually the entire first two years taking courses in English and speech, philosophy, music, economics, foreign language, history, and other broad disciplines, most of which seemed utterly worthless to me at the time. When I registered my concern over this, Starker arranged an appointment for me with the Dean of Letters and Sciences, Alva R. Davis. Perhaps in his late 60s at the time, he listened thoughtfully to my sad tale of woe and responded essentially as follows: “I understand what you are saying. I have heard the same story many times before. But trust us. We (speaking for his colleagues in the humanities) have been in the business of refining the educational process for thousands of years. We think we have a good idea of what produces an educated person, and we feel it’s more important that your education here at Berkeley make your life than your living.”

Even at the tender age of 19 I could understand the message Dean Davis was trying to convey. His wisdom had much to do with the fact that I am writing this essay, and in retrospect it is clear that my exposure in early years to a broad humanities curriculum was paramount in establishing the values that have since directed my life, values that tell me unequivocally that sustainability in the long run is vastly more important than short-term material gain. Starker (Aldo Leopold’s eldest son) was a chip off the old block. I was taught early on to “think at right angles” to my area of specialization. The different drummer I began to hear more than 40 years ago now has me (in retirement) writing es-

says concerning the need for sustainability, whereas many of my colleagues from university classes produced essentially in the two decades following World War II are dead (either literally or figuratively) or playing out their remaining years in tour buses or golf courses. Studies in ecology or environmental philosophy were essentially yet unheard of, and consequently many graduates of that era are finding it very difficult to accept, or to fully understand, such relatively new concepts as conservation of biological diversity.

But identifying or attributing educational shallowness to a particular era of history has its shortcomings. Inertia is universal and not restricted to a particular age group. When my former freshman chemistry professor, Joel D. Hildebrand, reached the age of 100 (he published more than half of a tremendous legacy of scientific papers following "retirement" at age 70), he remarked to a reporter that he had read a dictum that little creative work can be expected from a person after the age of 35. He continued that this is surely true, because very few persons do anything creative even before 35! When I communicated my best wishes to him on the occasion of his first 100 years, he responded with a note penned in the margin of a *Science* reprint which described his latest paper, published just before his 100th birthday in 1981, concerning the state of hydrogen in liquid metals. But Hildebrand's science was only a part of his life. He was an advocate and outstanding example of the benefits of a subject-oriented liberal education which allowed his vision and values to expand well beyond his field of spe-

cialty. He could speak authoritatively in the fields of music, art, and literature as well as on molecular interactions in solutions.

Equally important to the educational process (and definitely a part of it) is the inculcation of a value system which minimizes emphasis on material gain. I once read that a person's wealth is best measured by those things which he is content to be without. Socrates put it this way: "He is richest who is content with the least, for content is the wealth of nature." At this time of year (fall) we find our mailboxes jammed with mail-order catalogs all competing for whatever discretionary funds we might have available. Some of the items offered are truly amazing, along with accompanying rhetoric designed to intimidate the reader into the belief that the neighbors will really look down their noses at you if you do not own a Swiss-manufactured gong for your front room (\$795); a \$1,450 replica of an 1890s popcorn cart; a \$2,995 authentic, restored Coca-Cola cooler; or a \$4,000 pedal-powered model of a World War II fighter plane for your children to show off to their friends—a strange and tragic way to show one's love for a child! "As the twig is bent, so grows the tree"—and society!

But as in virtually all situations in biology and in many in society, the future is perhaps best judged by the strength (and values) of the youth, in our case *Homo sapiens*. We may gain much hope from the optimism, fresh thinking, and idealism of our emerging generations.

I have a friend, Noah Moyle, who on June 13, 1992 presented a commencement address to his fellow

graduates at Davis (California) High School, entitled "Shaping a New World." Let me share some of his comments with you:

We are all artists and builders, shaping our individual lives, minds, and destinies. Always we must keep in mind the way we wish to turn out, to what shape and end we wish to grow.

I have a vision, a dream of our world, the earth. Clean cities glittering in clear, unpolluted air, the buildings melting seamlessly into ancient forest and well-managed fields. Electric trains and cars drinking energy directly from the sun as they hum quietly over the few roads and highways that still exist. The population is stable, and people have learned to be tolerant and patient, seeking happiness through knowledge each day in their long, peaceful lives. It would be the end of ignorance—a society based on sustaining itself and the earth for the future, for eternity. I can see it. I believe it can happen, and I urge you, my fellow DHS graduates, to think with me tonight, and listen to my thoughts.

I think we can all agree that our society, here in the United States, has been steadily declining in many ways over the years. Morality is an endangered species. Generations of kids are brought up in crowded cities of concrete, completely unaware of how the earth looks in its natural, wild state. This planet suffers under the strain of mankind. Ozone depletion. Brown, carcinogenic air. The rainforests, source of the world's oxygen—our breath—

being annihilated at a frightening rate. Population is screaming way out of control, and rising crime rates and violence even among youth tell of a deeply rooted cancer within the people themselves.

The meaning of human existence has become clouded, blurry. Everywhere we turn there is hate, pollution, and ignorance. People live long lives, seldom having to worry about premature death; yet, they are vaguely unhappy at the same time.

Once, human existence was simply a struggle to survive, to get enough food for the winter months, to have a child that endured past adolescence. That struggle was what gave meaning to people's lives. Then came the rush for industrial revolution—technology—and with that, the world we know today.

Technology has allowed for great advances in human knowledge and thought. Cultivation, vaccination, space-exploration—used wisely, technology is a powerful tool for furthering human understanding. Yet today we find that greed has perverted most of the positive reasons for which technology should exist. We have reached the point where our waste-bloated factories, pesticide-laden farms, and short-sighted timber companies are giving us far more irreversible damage than short-term comfort.

Any person who understands "nature" or "the wild" as the fundamental source of human inspiration and thought takes the term "technology" very, very seriously.

We all came from the wild. We thrive in it. It is our home. And each day, we see more and more pristine wilderness ground up underneath the razor-sharp cutting blades of machines. Machines designed to scrape the land into submission, to mold wilderness into grotesque subdivisions and gaudy shopping malls. Entire species go extinct, eliminated forever from the face of the earth, every day. We play God and decide what should live and what should die, irreversibly, forever altering the course of evolution.

And it is not enough that we have behemoth machines with which to mold the earth. We also have television, to plant powerful suggestions in the fertile soil of unused minds, to bludgeon individuality into oblivion. The craving for leadership most humans feel is now mainly satisfied by a glowing blue box which feeds off its own prescription of empty values and shallow morality. It is little wonder our current leaders are no better than glorified actors. It is little wonder so many “anti-utopian” authors write of television dominating people’s lives.

Yet, fellow graduates, on this night of our graduation from high school, as we dive headlong into summer and the great unknown, I tell you there is hope. We are young, idealistic. It is never too late to evoke change. And that is what the world needs now more than ever before. The earth, once a vast, slow sculpture of the forces of nature alone, is now being blindly carved by mankind. Just as we must

each work on the sculpture called “myself,” we must all together plan the sculpture called “The World.” We must gather a picture of our collective thoughts of how we wish the earth to be, of what kind of people we wish to become.

The creation of a human society which peacefully, harmoniously co-exists with all other life on the planet is our only chance for permanent survival as a world. The poet and former logger Gary Snyder has said: “Challenge the habitual modes of thought.” It is of dire necessity that we transform our present dim-sighted system of thought and action. Always keep in mind what you are sculpting, what shape you are giving yourself. When material gain is gone, you will still have the most precious of all commodities—your mind.

Together, with strong will and clear, patient vision, we can shape a new world. It is entirely up to you and to me, fellow graduates, fellow sculptors.

We may gain strength from the knowledge that there are many within Noah Moyle’s generation who share his thoughts and ideals. They can and will turn this nation around if “the establishment” will step aside and let them do it. Doing so will not be easy, but change to a sustainable society must and will be accomplished. Perhaps Max Planck (1950) said it best: “A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.” And as I see it, the

sooner the better! Thank you, Noah, and your generation. Somehow I have the distinct feeling that you will do a much better job than we have!

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Conservation in the Old World, especially forest and game conservation, seems to have evolved gradually (Peterken 1981). No doubt a parallel, but very different, practice and conception of conservation also independently evolved in the New World as well. With the wholesale devaluation and destruction of American Indian cultures that occurred during four of the five hundred years of European discovery, conquest, colonization, and finally complete domination of the Western Hemisphere, however, indigenous New World conservation thought and practice was all but lost (Viola and Margolis 1991).

The depopulation of North America was so thoroughgoing, owing more to what might be called inadvertent biological warfare than to conventional warfare (Deneven 1992a), that the English colonists could imagine that they had settled in a wilderness (Nash 1967), not in a country once fully inhabited and significantly transformed by its indigenous peoples (Deneven 1992b). Thus, two allied myths established themselves in the Euro-American consciousness: one, that the whole of North America was a “virgin” wilderness of continental proportions; the other, that North America’s natural resources, and especially its forests, were inexhaustible. The second of these is conventionally called “the myth of superabundance.”

While the wilderness myth has only been recently debunked (Callicott 1991; Gomez-Pompa and Kaus 1991), the myth of superabundance was abandoned around the turn of the

century. With the completion of the transcontinental railroad, the slaughter of the bison herds, and the subjugation of the Plains Indians, the North American frontier palpably closed and the limits of North America’s natural resources dawned on thoughtful Euro-Americans (Hays 1959). Against the background of laissez faire exploitation—unregulated hunting and fishing, logging, mining, plowing, and so on—the necessity of conservation received a good deal of conscious reflection.

George Perkins Marsh is generally credited with first articulating an American conservation philosophy in his prophetic book, *Man and Nature; or The Earth as Modified by Human Action* (1864, 1874). Marsh was mainly concerned about the adverse effects of deforestation on stream flow, soil stability and fertility, and climate. His conservation ethic was an early American version of contemporary Judeo-

Christian stewardship. "Man," he wrote, "has too long forgotten that the earth was given to him for usufruct alone, not for consumption, still less for profligate waste" (Marsh 1874, p. 33).

Ralph Waldo Emerson and Henry David Thoreau had not attained the essentially ecological understanding of the relationship between vegetation, soil, water, and climate that Marsh had. They were principally concerned rather with the aesthetic, psychological, and spiritual paucity of the prevailing American materialism and vulgar utilitarianism. As an antidote, they turned to wild nature—contact with which, they argued, invigorates and strengthens the body, inspires the imagination, energizes the mind, elevates the soul, and provides an occasion for transcending finite human consciousness. Because wild nature is a psycho-spiritual—as well as a material-resource, Emerson (1836) and Thoreau (1863) argued that Americans should preserve a significant portion of it undefined.

Emerson and Thoreau thus stand at the fountainhead of the wilderness preservation philosophy of conservation. Thoreau was probably the first American to advocate what eventually became a national wilderness preservation policy: "I think that each town," he wrote, "should have a park, or rather a primitive forest, of five hundred or a thousand acres . . . where a stick should never be cut—nor for the navy, nor to make wagons, but to stand and decay for higher uses—a common possession forever, for instruction and recreation" (Thoreau 1970, pp. 34-35).

This philosophy of conservation

was energetically promoted by John Muir (1901). Through his lively writing, thousands of American readers experienced vicariously the beauty, the physical and mental salubriousness, and the spiritual redemption that he experienced directly and personally during his many and lengthy wilderness sojourns.

Gifford Pinchot, a younger contemporary of John Muir, articulated a very different philosophy of conservation firmly grounded in utilitarian values and closely associated with the world view of modern classical science. Pinchot (1947, pp. 235-236) crystallized the resource conservation philosophy in a motto—"the greatest good of the greatest number for the longest time"—that echoed John Stuart Mill's (1863) utilitarian creed, "the greatest happiness of the greatest number."

Pinchot bluntly reduced the "Nature"—with which Marsh, Emerson, Thoreau, and Muir were variously concerned—to "natural resources." "There are two things on this material earth," he averred, "people and natural resources" (Pinchot 1949, p. 325). And he even equated conservation with the systematic exploitation of natural resources. "The first great fact about conservation," Pinchot (1947, p. xix) noted, "is that it stands for development." For those who might take the term "conservation" at face value and suppose that it meant, if not nature preservation, then at least saving some natural resources for future use, Pinchot was quick to point out their error: "There has been a fundamental misconception," he wrote, "that conservation means nothing but the husbanding of resources for future generations. There could be no more se-

rious mistake" (Pinchot 1947, p. xix). And it was none other than Pinchot (1947, p. 263) who characterized the Muirian contingent of preservationists as aiming to "lock up" resources in national parks and other wilderness reserves.

In short, for Pinchot conservation meant the efficient exploitation of "natural resources" and the fair distribution of the benefits of doing so. Science was the handmaid of efficiency, and macro-economics of fairness. Thus Pinchot's philosophy of conservation was wedded to the eighteenth- and nineteenth-century scientific world view, according to which nature is a collection of bits of matter, assembled into a hierarchy of independently existing chemical and organismic aggregates, that can be understood and manipulated by reductive methods. It was also wedded to the correlative social science of economics—the science of self-interested rational individuals pursuing preference-satisfaction in a regulated market.

John Muir and Gifford Pinchot were, for a time, friends and allies. Their very different philosophies of conservation, however, led to a falling out (Nash 1967). The personal rift between Muir and Pinchot symbolizes the schism that split the North American conservation movement into two mutually hostile camps at the beginning of the twentieth century (Fox 1981). Pinchot commandeered the term "conservation" for his philosophy, while Muir and his followers came to be known as "preservationists."

Pinchot's philosophy dominated conservation in the public sector of

the United States—the Forest Service (of which Pinchot himself was the first chief), the Fish and Wildlife Service, the Bureau of Land Management, and state departments of natural resources (Fox 1981). Muir's philosophy prevailed in non-governmental conservation organizations, such as the Sierra Club (which Muir founded), the Wilderness Society, and the Nature Conservancy (Fox 1981).

Aldo Leopold was employed by the United States Forest Service for fifteen years (Meine 1988). Thus he began his career as a conservationist solidly in the Pinchot camp. Nevertheless, he gradually came to the conclusion that Pinchot's conservation philosophy was inadequate because it was based upon an obsolete pre-ecological scientific paradigm (Flader 1974). As Leopold (1939a, p. 727) put it:

Ecology is a new fusion point for all the sciences . . . The emergence of ecology has put the economic biologist in a peculiar dilemma: with one hand he points out the accumulated findings of his search for utility in this or that species; with the other he lifts the veil from a biota so complex, so conditioned by interwoven cooperation and competitions that no man can say where utility begins or ends.

From an ecological point of view, nature is more than a collection of discontinuous useful, useless, or noxious species furnishing an elemental landscape of soils and waters. It is, rather, a vast, intricately organized and tightly integrated *system* of complex *processes*. And human beings are not specially created and uniquely valuable demigods, any more than nature is a vast

emporium of goods, services, and amenities. We are, rather, very much a part of nature. Further, the portrait of human beings in economic theory as single-minded consumers is a gross caricature. Individual welfare, from an ecological point of view, is inextricable from the health and integrity of both the social and natural communities to which we belong.

We tend to think of Leopold as having begun his distinguished career in the Pinchot school of conservation thought and gradually to have come over, armed with new ecological arguments, to the wilderness preservation school of thought. And indeed Leopold was committed to wilderness preservation throughout his life, though his reasons evolved from an emphasis on recreation (Leopold 1921) to an emphasis on the role of wilderness in scientific research and wildlife conservation (Leopold 1936, 1941).

But Leopold realized that the Muir-Pinchot schism had left North American conservation in an unfortunate "zero-sum" dilemma: either lock up and preserve pristine nature, or efficiently and fairly develop it . . . and, in doing so, necessarily degrade or destroy it. Half a century after institutionalizing Pinchot's conservation philosophy through the establishment of the Forest Service and similar natural-resource-management bureaucracies, the United States Congress institutionalized Muir's conservation philosophy in the Wilderness Act of 1964. It reads in part: "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of

life are untrammelled by man, where man is a visitor who does not remain" (Nash 1967, p. 5). Reflecting the unequal political strength of the conservationists and the preservationists, the contiguous forty-eight United States eventually became segregated into large development zones dotted here and there (mostly west of the Mississippi) with wilderness preserves adding up to only two or three percent of the total. Hoping to break out of this dilemma, Leopold advocated a "win-win" philosophy of conservation, stressing ways of inhabiting and using nature that are at the same time ecologically benign. As he put it, the "impulse to save wild remnants is always, I think, the forerunner of the more important and complex task of mixing a degree of wildness with utility" (Leopold 1991a, p. 227).

Accordingly, Leopold set out to define conservation in the following terms: as "a universal symbiosis with land, economic and aesthetic, public and private" (Leopold 1933, p. 639); as "a protest against destructive land use" (Leopold 1991b, p. 212); as an effort "to preserve both utility and beauty" (Leopold 1991b, p. 212); as "a positive exercise of skill and insight, not merely a negative exercise of abstinence and caution" (Leopold 1939b, p. 296); and, finally, as "a state of harmony between men and land" (Leopold 1949, p. 207).

Currently, Leopold's harmony-with-nature philosophy of conservation is called "sustainable development"—if by "sustainable development" is meant the initiation of human economic activity that does not significantly compromise ecological health and integrity; and, ideally, eco-

conomic activity that might positively enhance it. "Sustainable development" is, however, an unfortunate phrase. "Ecological livelihood" would be less liable to misinterpretation and misappropriation. "Sustainable" is vague and often used by economists to mean passing on enough capital and technological know-how to replace exhausted natural resources and compromised biological systems with artificial alternatives. And "development" is often a euphemism for the building of high-rise condominiums, shopping malls, parking lots, and subdivisions. In calling for a "universal symbiosis with land," Leopold had in mind changes far more radical than, say, building more energy-efficient tract houses and automobiles. He was proposing, rather, a veritable revolution in the way we human beings inhabit and use the natural environment.

How should we assess twentieth-century North American conservation philosophy as we approach the twenty-first century?

Pinchot's philosophy of conservation is no longer viable, since it is founded on a reductive, pre-ecological scientific paradigm. Even the United States Forest Service is admitting that old-growth forests are not just senescent stands of timber, overdue for clear-cutting and replanting to even-aged monotypical blocks of fast-growing trees. The Forest Service is finally coming around to the idea of ecological forest management.

Muir's philosophy of wilderness preservation is equally obsolete. First, no less than Pinchot's, it perpetuates the pre-evolutionary strict separation of "man" from "nature." It simply puts

an opposite spin on the value question, defending bits of innocent, pristine, virgin "nature" against the depredations of greedy and destructive "man." Second, it ignores the presence and the considerable impact of indigenous peoples in their native ecosystems. North and South America, for example, had been fully inhabited and radically affected by *Homo sapiens* for 10,000 or more years before European discovery (Deneven 1992b). And third, it assumes that, if preserved, an ecosystem will remain in a stable steady-state, while current thinking in ecology stresses the importance of constant, but patchy, perturbation and the inevitability of change (Botkin 1990).

Leopold's harmony-with-nature philosophy of conservation is the only twentieth-century North American philosophy of conservation that seems likely to be viable in the twenty-first century. It recognizes that human beings are as much a part of nature as any other species. But it would urge that, like most other species, we human beings learn to live symbiotically with our fellow-denizens in the various ecosystems that we inhabit. And it absorbs the enduring conservation value and the core of truth in the obsolete wilderness idea. Wilderness areas, originally set aside for outdoor recreation, scenic beauty, and solitude can best serve contemporary conservation as habitat for populations of species that, to remain viable, require deep undisturbed forest, extensive unplowed savannah and heath, uncompromised wetlands, and so on. But such areas may require invasive management—not "resource" management, but ecosystem management.

Prescribed burns, for example, may be necessary to manage savannahs and certain forests so as to maintain the mix of species that compose them.

From the perspective of Leopold's harmony-with-nature philosophy of conservation, what is ecosystem management? And how does it differ from resource management? First and foremost, resource management is commodity-oriented. Forests are managed for maximum sustainable yield, ideally, of commercial timber and pulp to supply the building materials and paper industries. Wildlife, similarly, is managed for maximum sustainable yield of game species, not of all wildlife, to provide sport and meat for human hunters. (Yet another reason why "sustainable development" is an unfortunate label for the symbiotic relationship between people and land, envisioned by Leopold, is the inevitable confusion—especially in the minds of traditionally trained foresters and other resource managers—of "sustainable development" with "maximum sustainable yield.") Ecosystem management, on the other hand, aims, first and foremost, to maintain the health and integrity of ecosystems. Commodity production is a secondary and subordinate aim, to be pursued to the extent that it is compatible with maintaining the health and integrity of ecosystems.

This understanding of ecosystem management raises two more questions: What is ecosystem health? and What is ecosystem integrity? Ecosystem (or "land") health was defined by Leopold (1949, p. 221) as "the capacity of the land for self-renewal." Currently the concept is understood to refer to the capacity of ecosystems to maintain

their functions—such as sustaining biomass production, cycling nutrients, holding soil, and modulating stream flow (Costanza *et al* 1992). This functional understanding better incorporates orderly ecological change than Leopold's more recursive definition. Let integrity, on the other hand, refer to an ecosystem's historic structure—its complement of component species in their characteristic numbers. Maintaining ecosystem integrity, so understood, is a more exacting norm of ecosystem management, since ecosystem functions may be little impaired by the incidental loss of non-keystone species, by the competitive exclusion of native species by exotics, or by the gradual and orderly change from one type of community to another.

In addition to directly managing ecosystems to maintain their health and integrity—by prescribed burns, afforestation, culling weedy species, excluding or eradicating exotics, protecting or reintroducing natives, and so on—ecosystem management entails managing human economic activities. It entails finding new ways of living on the land. Leopold himself was especially distressed by the increasing industrialization of agriculture during the mid-twentieth century (Leopold 1945) and looked for ways of making agriculture more compatible with ecosystem health and integrity (Leopold (1939b). Finding methods of harvesting timber that do not compromise the health and integrity of old-growth ecosystems is part of the current Clinton plan to resolve the jobs-versus-old-growth conundrum in the Pacific Northwest (Egan 1993). Ecological range management might be achieved by removing all domestic

stock and reestablishing native ungulates—bison, deer, antelope, and elk—in their historic numbers. Range “ranching,” in such a scenario, might consist of erstwhile cowboys and -girls culling the herds, strictly regulated by the Fish and Wildlife Service or the BLM, and selling the meat on the expanding organic and gourmet foods market (Callicott 1991).

In sum, then, a human-harmony-with-nature conservation philosophy is more consistent with evolutionary and ecological biology than are both preservationism and resourcism. The ideal of this philosophy of conservation is to share the Earth with all our “fellow-voyagers . . . in the odyssey of evolution” (Leopold 1949, p. 109) and to provide all the Earth’s species with

adequate living space. As things presently stand, however, to do that, to nurture biological diversity at every scale, takes more than setting aside habitat. It requires ecosystem management, that is, managing ecosystems primarily for *their* health and integrity, not for *our* commodity production. Since we human beings are part of nature, according to this way of thinking, human economic activities are not necessarily and by definition incompatible with ecosystem health and integrity. Complementing wildlands management, we must aggressively pursue “sustainable development,” that is, the initiation of human productive activities which are limited by ecological feasibility no less than by economic feasibility.

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A Sustainable Society: What Is It? How Do We Get There?

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I would like to offer a definition of a sustainable society.

A sustainable society is one that ensures the health and vitality of human life and culture *and* of nature's capital, for present and future generations. Such a society acts to *stop* the activities that serve to destroy human life and culture and nature's capital, and to encourage those activities that serve to *conserve* what exists, *restore* what has been damaged, and *prevent* future harm.

"Nature's capital" is the stock that yields the flow of natural resources, for example, the population of fish that regenerates the flow of caught fish that go to market, or of the trees that reproduce to provide timber over time. The natural income—that is, the yield of nature's capital—includes both natural resources (air, land, water, minerals, etc.) as well as nature's services (e.g., as when it acts as the sink for our wastes). Nature's capital is both renewable (fish and trees) and nonrenewable (oil, coal, and minerals). Nature's capital includes inputs into the economy, in terms of resources, and relates to the outputs of the economic system, in terms of the assimilation of wastes.

Under the present paradigm, we have allowed neo-classical economics to become the language of politics, a language without a moral sense

(despite its origins) and with limited relevance to real economic circumstances. In the process we have ignored values and ethics. Yes, conventional economics has an ethic, of sorts: the devil take the hindmost. But it is politics, not economics, that must reflect what we value in society. Governments and corporations speak as if the "laws" of economics are irrefutable, yet these "laws" show no concern for ecology or for equity. What is needed is a new politics and a new economics—an ecological economics—that serves as a bridge between the economy and the environment, between people and nature.

This definition of sustainability differs from many of the others that have become fashionable in that it does not focus solely on the ecological. While recognizing the primacy of the ecosystem, we must also recognize the spe-

cial role that the human species occupies within that system, and, as a result, the importance of human life and culture, justice, and equity.

Six signs of unsustainability

1. The human economy now consumes 40% of the mass of plant material produced each year by photosynthesis using energy from sunlight—the net primary productivity of the earth. The rate of increase in human use is about 2% per year, meaning a doubling in 35 years. Since humans are but one of between five million and 30 million species on earth that make use of these materials, this is ecologically impossible.

2. Global warming.

3. Ozone depletion over temperate zones.

4. Thirty-five percent of land is already degraded, and the degradation is largely irreversible in a human time scale. Soil loss exceeds soil formation rates at least tenfold.

5. Loss of biodiversity is reflected in the decline of the world's richest species habitats—tropical forests, 55% of which have already been destroyed. Present-day extinction is placed at 5,000 species per year; a rate 10,000 times higher than pre-human extinction rates.

6. The numbers of poor in the world continue to grow in spite of extensive official assistance efforts, and a quintupling of the output of the global economy since 1950. Even in the wealthy, market-oriented industrial economies of the world, 100 million people still live in poverty.

The signs of unsustainability know no political boundaries nor are they

limited to a particular economic, social, or political system.

Sources of unsustainability

How did we get here? There are no simple explanations, but a number of factors come into play.

- We have failed to accept the fact that the economic system is an open system in a closed and finite ecosystem. Until recently the *scale* of the economic system was relatively small as compared with the ecosystem as a whole and we were less aware of its impacts.
- We have been focused on resource constraints (e.g., Will we run out of oil or gas?) which are more susceptible to substitution and technological innovation. We are now noticing sink constraints—the problems of disposing of the wastes of affluence.
- We have failed to recognize that the environment is the basis for all life and for all production. It is not an interest competing with other interests, rather it is the playing field upon which *all* other interests compete.
- We have failed, as a result, to accept nature as a model and a mentor; rather, we exhibit disdain for nature and nature's forces, and a belief that we can manage it and master them.
- We have failed to examine our love affair with technology, despite the fact that today's problems are all too often yesterday's solutions. Led by scientists and engineers we have begun to believe, as one scientist put it recently, "there is nothing that we cannot do!" Or, as the

former President of Rice University observed on the editorial pages of *Science*: "There is a strong strand in our system, that is, science, that ties together the gathering of all added understanding of nature's materials, forces, space, and time with the use of the biosphere for the support of the human race through technology" (Hackerman 1993). However, as Jerry Mander observes in his recent book, *In the Absence of the Sacred*: "All new technologies are introduced in terms of their utopian possibilities. The downside of the story is left for a later generation to discern and experience, when the technology is much more difficult to dismantle."

- We have failed to distinguish between "growth" and "development," perhaps driven by our belief in technology as savior. We use the words interchangeably, based explicitly or implicitly on the assumption that there are no limits or that they are far off and therefore largely irrelevant. "Of course, growth will end some day," observed Robert Fri, president of Resources for the Future, "but this conclusion is only a troubling curiosity if technology gives us ample time before the limits are reached." However, as a recent World Bank report notes: "Following the dictionary distinction ... when something grows it gets quantitatively bigger; when it develops it gets qualitatively better. Our planet develops over time without growing. Our economy, a subsystem of the finite and nongrowing earth, must eventually adapt to a similar pattern of development" (Goodland et

al. 1992:2-3). The phrase "sustainable growth" is an oxymoron, because growth cannot, by definition, continue in a closed system. Sustained growth in the economy, as in the human body, is a cancer to be feared.

- We have failed to recognize that growth does not automatically lead to equity and justice within and among countries, regardless of the political or economic system. Sadly, there is no evidence to prove the assertion that "trickle-down" works. And, it must be clear that there cannot be any conservation of nature's resources without justice and equity.
- We have failed to examine our faith in the market system to deal with the public good, especially ecological sustainability and justice. And the market system by creating "desires and wants" above and beyond our needs, places greater strains on the ecosystem.
- Finally, we, as a people, as well as our present economic system, have failed to consider future generations, whose well-being defines the core of a sustainable world—which itself must be at the core of any conceptualization of a sustainable world.

Principles of sustainability

Now let us project ourselves well into the twenty-first century. Let us envision what a sustainable society would look like. What will be the principles upon which our sustainable society is built?

- Nature is understood to be a source of knowledge, a model to emulate, and a mentor.

- Issues of environmental deterioration, oppression, and violence are linked in analysis and action. Gender and racial oppression and efforts to dominate nature are understood as having a common psychological root. There is also be recognition that violence, in all of its manifestations—child and spouse abuse, war, disregard for the environment—are, at the core, the same. Environmental justice is a fundamental concern.
- Humility, restraint, and understanding that there are limits guide our actions, as befits good stewards. We question whether we are capable, in the words of the *Scientific American* in 1990, of “Managing the Planet,” when, as Oberlin environmentalist David Orr has suggested, “we have enough trouble managing the back 40!”
- We appreciate the importance of “right scale.” Place and locality are regarded as the foundation for all durable economies, and as the locus of action for problem-solving. Where scale is appropriate, we gain confidence in moving ahead, proceeding with the assumption that knowledge is adequate. As the former Massachusetts commissioner of agriculture, Greg Watson, observed, “we come to scale as the most powerful method for dealing with the tendency not to want to practice restraint.”
- Sufficiency has replaced economic efficiency. Acceptance of the finiteness of the earth has called upon us to recognize “enough-ness.” Wendell Berry has suggested that “we will have to learn to live more poorly.” We have learned that living within our means leads to greater fulfillment. We understand the distinction between needs and wants, and consider the impacts of our “wants” on equity and the ecosystem. As ecological economist Herman Daly suggested in 1989, this means that we use renewable resources at rates that do not exceed their capacity to renew themselves; we use nonrenewable resources at rates that do not exceed our capacity to substitute for them; and no resources are used at rates that exceed the capacity of the natural world to assimilate or process the wastes associated with their use.
- Community is understood to be essential for survival. As Martin Buber had argued in the mid-twentieth century, “society is naturally composed not of disparate individuals, but of associative units and associations between them.” Accepting this vision led to a new vision of citizenship and accountability at all levels. This has led to new and strengthened definitions of democracy and participation. Individual liberty and community are balanced, as rights are balanced by responsibilities. Equity and justice within and between communities have been recognized as central to a sustainable society. The “global community” is a community of communities, reflecting and encouraging diversity.

- Diversity—both biological and cultural—is preserved, and encouraged. As in nature, a polyculture has strengths lacking in monocultures. Diversity is an index of human and environmental health, a measure of resiliency and will provide the margin of safety.

An “ecological economics” assists us in making these principles into reality. Issue and policy-driven, it takes a holistic view of the environment–economic system and reflects wider values than the “utility” of the environmental economists, exhibiting a deep concern for moral obligations toward present and future generations. Being issue-driven, it concerns itself with sustainability, and is pragmatic. It takes a comprehensive global view over the long-term, but is also contextual. Ecological economics is concerned with the processes of institutional and individual behavior change, is tolerant of uncertainty, and is willing to ask questions for which we do not, at present, have the answers.

Characteristics and goals of a sustainable society

With this as background, what will be the characteristics and goals of our sustainable society?

Economic goals will include:

- Creation of jobs that enhance the nature of work;
- Equitable income distribution within and among countries;
- Economic stabilization and system equilibrium;
- Technology exchange, not simply technology transfer, emphasizing technologies that emulate rather than destroy nature;

- Economic self-sufficiency, at community, national, and international levels; and
- Sufficiency, rather than efficiency, since high levels of consumption are generally incompatible with the conservation and preservation of nature’s capital.

Social and cultural goals will include:

- Equity and justice, emphasizing needs over wants, especially in the North (i.e., the more industrialized countries);
- Full status for all regardless of race, gender, ethnicity, class, sexual orientation, or age;
- Maintenance of cultural diversity, including respect and support for indigenous peoples;
- Strengthened communities through participation of individuals and social groups in the conduct of their own affairs;
- Revitalization of sustainable rural communities through the development of environmentally sensitive and economically profitable agriculture, family farming, and appropriate value-added environmentally sound industrial development; and
- Revitalization of communities within urban settings.

Political goals will include:

- Political security, including community participation in defining and solving its problems;
- Strategic security, including the community’s ability to defend itself against external threats, whether economic or political; and
- Environmental security to achieve a viable balance between the com-

munity's population and the demands made upon it relative to economic endowment and performance, including its natural capital and its levels of technology. This recognizes the right to protect itself from environmental assaults generated outside the community, such as befouled air from a neighbor that destroys its forests. This right carries with it the responsibility to be protective of the rights of other communities by not transporting its wastes to them.

Ecological goals and characteristics will include:

- Ecological stability planning with emphasis on waste reduction rather than waste management and on renewable and recyclable supplies of resources, taking account of resource and sink constraints, necessitating;;
- Particular attention to unintended socioeconomic, cultural, and ecological consequences of technology, management, and regulation;
- Zero toxins as a more suitable goal for production processes;
- Balancing ecological debt within and among countries;
- Maintaining biodiversity; and
- population stabilization.

Moving toward sustainability

Having shot forward from 1993 to some time in the future to envision this sustainable society, let us role play the historian of that future date to see how we got there.

The need for systemic change

During the 1990s more and more people became aware that the prob-

lems confronting the United States and other countries of the world were not subject to band-aid solutions. The demise of communism gave breathing room, allowing people to focus attention on the nature of capitalism and free-market economics, as a contributor and a possible solution to the problems of sustainability. A search began "to define a viable 'Third Way' beyond traditional socialism and traditional capitalism," in the words of political economist and historian Gar Alperovitz, that "promises to honor equality, liberty, democracy, ecological rationality—and even ... community." The problems were understood to be systemic. But this presented an opportunity. For, to quote Alperovitz again, "*a long term environment in which the proclaimed values of 'the system' are continually denied in everyday life is a potent, if slow, solvent of traditional ideas, theories and politics.*" (Emphasis in the original.) The need for a new architecture was acknowledged, and a search was begun for new institutions, and for new relations between and among community, state, regional, national, and international institutions.

A sustainability movement

A process of "grounded visioning" began, linking "expertise" and "experience" in an interactive process. This began what we now know as the "sustainability revolution," which like the agricultural and industrial revolutions was an evolutionary process.

Gradually, the environmental movement began to change. For too long it had focused on ecological issues, with little attention to economic, sociocultural, and political contexts.

As Howard Hawkins observed, “the prevailing forms of environmentalism are not really ecological because they fail to accurately connect social dynamics to ecological dynamics. They either separate environmental problems from their social roots or provide inadequate social analysis that reinforces the systemic anti-ecological structures of society. Consequently, they all too often function more as obstacles than allies in the movement for an ecological society.”

In time, a sustainability movement began to take shape, building upon elements of the environmental movement but distinct from it, and much broader in its orientation. It directed attention to systems rather than single issues, and was holistic rather than reductionist, focusing on longer-term trends rather than on events. Qualitative change (development) rather than quantitative change (growth) was its goal, with social justice, equity, and respect (rather than management) for nature central to its world view.

The need for deep psychological changes in individuals to achieve sustainability was apparent. The movement was also inclusive of race, ethnicity, gender, class, and age. Deciding who must be at the table, to define the nature of our problems and to determine the agenda for their solutions, was given high priority.

Consumption

A process was begun that led to the uncoupling of happiness and consumption in the affluent Northern countries. The old belief that having more material goods than others was a measure of one's self-worth was rel-

egated to the shelf of history. Disproportionate consumption of resources and production of wastes was recognized as a serious cause of environmental and social problems. “Sufficiency” and “enoughness” became more common in our vocabulary.

Displacement

The agricultural chemical dealer in any American farming community in the 1980s saw himself as God's servant, contributing to feeding the world. But by the end of the decade and early in the nineties people were beginning to question his role, as awareness of the impacts of agricultural chemicals became known. Farmers and consumers became increasingly concerned about farm worker safety, groundwater pollution, soil erosion, and chemicals in the food system. By the end of the century, the agricultural chemical dealer became the devil incarnate, because the dealer and the agricultural system of which he was a part failed to make the significant changes in their way of doing business that were needed to protect the environment and rural communities.

The new sustainability movement began self-consciously to help people make the transition to more appropriate livelihoods, “standing by” those who fear isolation as they changed from business-as-usual. The sustainability movement, taking a more holistic view than the environmentalists, recognized the need to assist timber people, and those in other troubled industries, in making a transition. By understanding the problems of displacement and the need to “standby,”

the sustainability movement helped to accelerate the pace of change toward a sustainable society.

We stopped blaming the poor for large-scale environmental destruction. The role of policies, put in place by and for elites, was recognized as a major factor in poor people's impacts on the environment. And we acknowledged our own profligate consumption in the North as an even greater environmental danger.

Population stabilization

Population stabilization was recognized as important to sustainability: to achieve the goal we adopted more holistic approaches. Programs were designed to serve women's reproductive health needs, including the availability of abortion and pre- and post-natal care. Above all, serious attention was directed to improving the status of women, which had salutary effects on their lives and resulted in lower fertility and better environmental quality.

There was a growing recognition in the nineties that environmental deterioration is a function not only of the size of a population, but also of the per capita demand for goods and services, the nature of technologies, and the degree to which policies, incentives, and disincentives encourage or discourage environmental sensitivity. A systemic approach to the population situation, therefore, led to a recognition that as the process of development improves the lives of people and fertility goes down, their demand for goods and services will increase at the same time or with some lag. The poor, with good reason, will want—and have a right to—more ac-

cess to the necessities of life, and even to life's pleasures. Therefore, the unanticipated consequence of population decline would be greater impact on the environment.

Poverty and focused growth

Appropriate technologies and ecologically sensitive policies were developed to accommodate the legitimate needs of people in poorer countries in the process of development with lower rates of population growth. It had become clear, as Donnella Meadows and her co-authors wrote in 1992, that "a sustainable society would not freeze into permanence the current inequitable patterns of distribution. It would certainly not permit the persistence of poverty.... A sustainable society would not be the society of despondency and stagnancy, high unemployment and bankruptcy that current market systems experience when their growth is interrupted."

A sustainable society "lets go of its addiction to growth," and achieves a new kind of growth. To quote Meadows again: "A sustainable society is not necessarily a 'zero growth' society. That concept is as primitive as is the concept of 'perpetual growth.' Rather a sustainable society would ... ask what growth is for, who would benefit, what it would cost, how long it would last, and whether it could be accommodated by the sources and sinks of the earth."

Technology

In this new approach to development, technology was neither the root nor the solution to all of our problems. Technology became the fall back position, rather than the first line of defense. Having dealt with our needs

and wants, we then addressed how technologies would “reduce throughputs, increase efficiency, enhance resources, improve signals, end poverty, thereby contributing to the quality rather than the quantity of life” [Meadows et al. 1992].

“Living machines”, such as those developed in the 1990s by the ecologist John Todd and his associates at Ocean Arks International, became the norm rather than the exception. For example, waste water is treated with plants, bacteria, fish, and algae, obviating the use of chemicals.

Growing sensitivity to unanticipated consequences of technologies led to a more cautious approach to technology development. Assessment of the combined sociopolitical, economic, and ecological impacts of new technologies over the short, medium, and long-term became a regular part of the development process.

Environmental assurance bonding, as an extension of the “polluter pays” process, also became common. (Refunds for the return of bottles and cans are a micro-level example of assurance bonding.) Technology developers and miners of natural resources were obliged to post bonds before they began their work, limiting potentially negative impact on the environment. Excessive impact resulted in a loss of part or all of their bond, which placed the burden where it belonged—on the polluter rather than the society.

Community

The phrase “Struggle locally, dream globally,” expresses the central place of community in a sustainable society. As Alperovitz observes, “a critical re-

quirement is the reconstruction of a culture of community and commonwealth.... Only such a culture is ultimately likely to be able to sustain a subsequent larger-order politics of equity, ecological sanity, and participatory democracy.”

We began to study and refine the hundreds of community-owned and worker-owned industries already operating in the United States, as well as the fledgling efforts of places like the Highlander Center, First National Financial Project, the Rocky Mountain Institute, EcoTrust, and others to define a sustainable economy at the community level. “Trickle-up” became the model as grassroots activists networked among themselves and with other levels of the political space. Information, people, and power were recognized as one. The “blueprints for survival” handed down from above in the seventies and eighties were no longer applicable, nor acceptable as a process.

In the United States, political reform and public financing of elections became an essential element of sustainability. Campaign reforms, by taking the emphasis off fund-raising, shifted the focus of elections to the substance of the issues. As a result the quality of candidates willing to take on the difficult task of listening to people and then leading them improved. Given the role of the U.S. in “a new world order,” these changes had beneficial effects throughout the world.

The role and nature of knowledge and the universities

In April 1992 *Beyond the Limits* (Meadows et al.) was published, the

sequent to *The Limits to Growth*, which had caused such a stir twenty years earlier. The possibility of a world already beyond its limits, in "overshoot," was reiterated. The authors concluded:

The world faces not a preordained future, but a choice. The choice is between models. One model says that this finite world for all practical purposes has no limits.... Another model says that the limits are real and close, and that there is not enough time and that people cannot be moderate or responsible or compassionate.... A third model says that the limits are real and close, and there is just exactly enough time, with no time to waste. There is just exactly enough energy, enough material, enough money, enough environmental resilience, and enough human virtue to bring about a revolution to a better world. That model might be wrong. All evidence we have seen ... suggests that it might be right. There is no way for knowing for sure, other than to try it.

This, and other works, and observation and experience, led people and scientists to recognize that windows of opportunity were narrowing. Universities were one of the slowest social institutions to respond. As the president of Harvard University, Derek Bok, observed in the eighties:

[O]ur universities excel in pursuing the easier opportunities where established academic and social priorities coincide. On the other hand, when social needs are not clearly recognized and backed by adequate financial support, higher education has often failed to respond as effectively as it might, even to some of the most important challenges facing America. Armed with the security

of tenure and time to study the world with care, professors would appear to have a unique opportunity to act as society's scouts to signal impending problems long before they are visible to others. Yet rarely have members of the academy succeeded in discovering emerging issues and bringing them vividly to the attention of the public. What Rachel Carson did for risks to the environment, Ralph Nader for consumer protection, Michael Harrington for problems of poverty, Betty Friedan for women's rights, they did as independent critics, not as members of a faculty.... Universities will usually continue to respond weakly unless outside support is available and the subjects involved command prestige in academic circles.

But in time they did. The changes took place in the universities late in the nineties and the beginning of the new century. Problem solving focused on bringing all appropriate methodologies to bear on the real world issues. Multi-, trans-, inter-, and non-disciplinary approaches became standard. Systems approaches prevailed, creating alternative ways of looking at problems.

The scholar's question "What do I need to know?" was gradually replaced, as universities sought timely and effective responses to the need for a sustainable world. "What is our tolerance for uncertainty, ignorance and ambiguity, while trying to avoid harm?" became the question most asked.

A new "science," a post-normal science, developed that was pluralistic in its approach, problem-focused, holistic rather than reductionist, tolerant of uncertainty, and willing to ask ques-

tions which it did not yet know how to answer. It was concerned with process and had as a major concern not only understanding the nature of the world and its problems, but also ways of aiding systemic change. This post-normal science, as developed by J. R. Ravetz and Silvio Funtowicz, recognized that, in the real world, "facts are uncertain, values in dispute, stakes high and decisions urgent.... When research is called for, the problem must first be defined, and this will depend on which aspects of the issues are most salient. Hence political considerations constrain which results are produced, and thereby which policy implications are supported."

This focus on real world issues and sustainability, led to a new attention to the role of science in policy making. The scientific community recognized that policy was not a linear process, but one of "muddling through." The focus as a result changed to data quality, rather than data completeness. As had been observed: "It is better to be approximately right than precisely wrong."

Finally, by accepting that science is neither value-free, objective, nor ethically neutral and that the goal of science is conservation, restoration, prevention and, ultimately, sustainability, scientists accepted the idea that definition of problems for study and research required greater inclusiveness. As a result, science became a tool for strengthening community.

The development of a new economics for sustainability

Since economics had become the language of politics, it was vital to revamp definitions of "economy" and

"economics." The ecosystem could no longer be seen as external to the economic system. Traditional, new-classical economics paradigms were no longer sufficient, and had in very important ways become destructive.

The economic system could no longer be seen as a closed system, but rather as an open system within the finite ecosystem. It became clear that nature's capital needed to be recognized and accounted for. Full account had to be taken of the value of health—of the population and of nature—in calculating a community's, a nation's and the globe's eco-health. No longer could we tolerate a system where sick workers and environmental and human tragedies, such as the Exxon Valdez oil spill and the Mississippi floods of 1993, could be seen as contributing positively to our gross national product.

Prices and true costs had to be attended to. For example, the work of David Pimentel and others on the "externalities" of American agriculture, showed a cost of approximately \$250 billion per year on a total agricultural industry of some \$770 billion. Simple arithmetic helped us to understand that the costs of water and air pollution, soil erosion, worker and consumer ill health, the loss of rural community, and the like, raise the cost of a meal to something on the order of \$1,000 for each American, three times each day, 365 days each year. Calculations like that caught the attention of all but the most recalcitrant economists, most likely to be found at the so-called leading departments. The society learned the distinction between price and cost.

"Trickle-up" was joined by "trickle-ahead" as concerns for equity and distribution in both the present *and* the future took precedence with a concern for sustainability. Neoclassical economists' discount rates worked, at best, for one generation. Thereafter they have little meaning. As World Bank economist Herman Daly observed, from a neoclassical economist's perspective, it makes sense to kill the goose that lays the golden egg.

We began to accept that it is the political system, and not economics, that should be the reflection of a society's values, that should decide what is to be protected and preserved for the present and the future. We recognized that not even a new economics could or should usurp that role, although a new economics could provide a rationale for the values that make a "trickle ahead" decision meaningful. Certainly the new economics did not penalize an individual for a future-oriented decision, but rather encouraged it.

Poverty reduction became a self-conscious effort and a high priority, both in the United States and in the rest of the world. The assumption that this will come about as a result of continued economic growth was finally put to bed. At the same time, explicit attention was directed to the ways that growth would in fact contribute to equity within a market economy. Designing plans and programs to achieve limited-term growth and long-term development with equity was understood to be among the most important challenges faced by societies in the last decade of the twentieth century.

The search for sustainability led to changes in the way we taxed ourselves. Rather than tax what we want to encourage—employment and income—we began to redesign our system of taxation to tax what we want to discourage, including such things as resource depletion and waste, in all of its manifestations.

The battles over the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA) helped us to understand that trade served to undermine self-reliance, and had serious labor and environmental implications. To contribute to sustainability, trade had to serve environmental, social, and political goals of all nations and communities. This required overcoming neoclassical economic concepts that served as barriers to the sustainability, such as "comparative advantage" and "specialization," because they contributed to the destruction of biological and cultural diversity. The vice president and chief economist of the World Bank, Lawrence Summers, demonstrated the weaknesses of traditional neoclassical economics when, in an internal memo in December 1991, he asked the question "Just between you and me, shouldn't the World Bank be encouraging *more* migration of dirty industries to the LDCs [lesser-developed countries]? I can think of three reasons." These were: (1) because life is less valued there, given the ways economists calculate the value of life; (2) because it makes sense to pollute that which is less polluted; and (3) because a clean environment is something for the rich, "the demands for a clean environment for aesthetic and

health reasons is likely to have high income elasticity.” While most people responded with horror and dismay, the magazine *The Economist* suggested that it made economic sense, even if Summers was “morally careless.”

For example, the Ivory Coast gained little and lost much when it was encouraged by World Bank loans to destroy its farming base to supply cacao to the world market. Its problems were heightened when the world market price for cacao fell, and they were left with neither an export crop nor food nor the money needed to buy food for internal consumption.

The need to deal with all of these, and other issues, led to the development of a problem-oriented “ecological economics,” synthesizing ecological and economic knowledge in a new paradigm for a sustainable world. Like the sustainable society it was to serve, it was holistic, systemic, and oriented to the processes of change. Because it focused on the interrelationship between the economic system and the ecosystem of which it was a part, it avoided the invidious distinctions that characterized the traditional neoclassical economics. This helped, as a result, to obviate distinctions between such alleged conflicts as jobs *or* the environment, focusing rather than on jobs *and* the environment.

The need for political and moral will

Having put forth a partial vision of a sustainable society in the next century, we are now back in the last decade of the twentieth. George

Orwell’s observation in his 1945 essay, “Catastrophic Gradualism,” reflects our day as well: “The practical men have led us to the edge of an abyss, and the intellectuals in whom acceptance of political power has killed first the moral sense, and then the sense of reality, are urging us to march rapidly forward without changing direction.”

One thing is certain. Our present trajectory as a human community is not sustainable. While our crystal ball for divining the future is cloudy, the main outlines, if not the details, of things that we need to do, are in hand.

Pessimism being a self-fulfilling prophecy, optimism is the only course: we do have the political and moral will to change directions. Wendell Berry, the poet, novelist, essayist, and farmer, has suggested that “the answers to human problems of ecology are to be found in the economy. And answers to problems of the economy are to be found in human culture and character.” We must appeal to logic and science, but not fear spirit and emotion. We need a new vision, not correction of a faulty vision. If necessity is the mother of invention, then the crisis we now face will surely be the mother of the new vision.

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Sustainability, Natural Law, and the “Real World”

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In the realm of natural resource conservation, a very real limitation to sustainability, based on biologically reasonable and well-considered actions, seems to be the “real world.” Competent resource biologists with a long-term vision of sustainability who, for example, develop plans for endangered species recovery that include limits on suburban development, or try to limit old-growth logging to protect drainage basins, inevitably come up against powerful forces that quickly and efficiently disassemble such plans. These forces typically invoke what they call “economic reality,” or the “real world.” This alleged real world consists of powerful economic and political constraints that seemingly cannot be overcome, and border on the sacred. People who do not take them into account, and in fact do not place them at the center of any resource plan, are said to be idealists living in a dream world.

This typical and powerful “real world” view places short-term human interests, often expressed as immediate resource depletion and financial gain, far ahead of any long-term naturalistic or humanistic vision of sustainability. Current resource use, for this generation and even just this year (e.g., “get the timber cut and out”), is given far greater credibility than a long-term, inter-generational perspective. This folly is a very powerful and difficult one to fight. In essence, it places constraints of the “real world” on many resource conservation plans that would otherwise upset the *status*

quo of multiple-use, short-term economic gain, and political expediency. These constraints are often based on two-, four- or six-year election cycles, or even one-year budget cycles.

Are these constraints real and necessary? More significantly, are they the most important constraints on resource management, or are there larger issues that bear on sustainability? I will argue that these traditional views, powerful and pervasive though they may seem, are unrealistic and are in fact the very antithesis of the “real world”; nothing could be more artificial and ignorant of truly critical issues

and constraints on resource use and sustainability than short-term economic and political considerations. For such a view implicitly, if not explicitly, denies the existence of, or assigns a secondary and diminutive role to, something far more powerful in the long-term: *natural laws*.

Natural laws are in fact the only "real world" that counts in the long-term, and are the rules that govern whether humanity will maintain itself in a sustainable manner; yet, they are blatantly ignored by most decision-makers and many resource managers. For example, the traditional economic models that guided western industrial expansion for several centuries ignore natural law: natural resources are explicitly assumed to be infinite or totally substitutable, and waste products are assumed to be irrelevant (e.g., Simon 1981; see Daly 1991 for a comprehensive critique of these models). This is hardly the "real world." In fact, the entire "real world" as used today is an absurdity; it is based on socioeconomic systems that are new inventions, several hundred to perhaps 1,000 years old at best, and artificial constructs of humankind. They have the potential to work sufficiently in the short-term and under low human population densities, with abundant resources and free ecosystem services, and with many costs "externalized." With high density and fewer resources, natural systems begin to break down, as we have seen through much of the 20th century, and the reality of natural law catches up to this "real world."

So let me define what I propose as the real "real world": physical, chemical, and biological laws that have op-

erated for not hundreds, but billions of years. For example, natural selection, the first and second laws of thermodynamics, electromagnetic forces, material and energy flow through ecosystems, and heritable genetic variation are all the real world. All have been operating in their present form for billions of years, and show no indication of fundamentally changing in response to human needs and desires. All operate independently of and in total disregard for what humanity does. None can be changed or engineered to suit our needs, despite the misguided and dangerous fantasies of some. Hardin (1993) relates the following, which nicely illustrates fundamental misunderstandings of natural laws:

[W]hen plans were being made in Stockholm for the 1974 World Population Conference in Bucharest, 'as each new perpetual-motion-machine solution was propounded,' to furnish the world with unlimited supplies of energy, one of the scientists would simply point out that it violated the second law of thermodynamics. Finally, in frustration, one of the economists blurted out, 'Who knows what the second law of thermodynamics will be like in a hundred years?'

This is a telling example of the type of pathetic and tragic thinking in our economic and political machines that creates environmental and social catastrophes. Yet, this is the type of thinking that has guided and led human actions with respect to resource use for generations. Natural law means nothing to short-term, narrowly trained thinkers.

By comparison to natural laws, the so-called real world of politicians, economists, and other supposed managers of our world is a trivial and fleeting experiment in evolutionary time and is meaningless by comparison to natural laws that are incontrovertible and inviolate. One can violate an economic or political law if one wishes: a person could steal money from a bank and possibly not get caught; another can murder and perhaps get away with it. But as talented as one might be in corrupt and unethical behavior, one still cannot violate natural laws that are inconvenient to their desires: we cannot by-pass entropy; we cannot ignore gravity; we cannot consistently destroy habitat, toxify groundwater, clear-cut old growth forests, or desertify grasslands through overgrazing or poor agricultural practices and expect natural systems to continuously support exploding human populations at ever-increasing standards of living.

Much of this comes down to attempted control and remodeling of natural systems to better suit human development in the short-term. The human species has adopted a perspective that we can and should control nature, even re-model nature, to our own ends. "Improvement" of forest stands or fishing returns through manipulation are good examples of remodeling nature. "Improvement" in these cases is merely a synonym for "changing nature for short-term human benefit." Ultimately, of course, this is a ludicrous and even childish notion, and has been coined "the arrogance of humanism" by Ehrenfeld (1981) and "techno-arrogance" by Meffe (1992). Attempted control of,

and technological mastery over nature is failing, will continue to fail, and can only result in great human suffering as the human population grows exponentially while ecological support systems continue to be modified or destroyed. The managerial emphasis instead should be to recognize natural laws of ecology and evolution, and work within their constraints. It is time to mature as a species and recognize and accept limitations, rather than forge blindly ahead with outdated, frontier mentalities of conquering and engineering nature.

Largely, this involves a major dose of humility, something many humans seem loathe to embrace. Accepting constraints and limitations is foreign to the engineering, techno-think mentality that has driven our civilization for the last two centuries and our resource agencies for this century. But technology is irrelevant with respect to normal functioning of ecosystems; it can only degrade them. The idea that nature may be "improved" is an absurd concoction of high-level managers who are either justifying their jobs or trying to re-design nature for short-term human gain.

Now there is nothing wrong with the latter in limited circumstances. Obviously, we need agricultural systems, lumber production, mining, and the like; nobody realistically expects people to just sit in unspoiled forests and worship nature. However, such activities should not be passed off as sustainable development. There is nothing sustainable about clearcutting ancient forests for lumber or clearing tropical lowlands for cattle grazing. They are one-way streets; we do not return to the original systems in

any meaningful period of time, if ever.

Real sustainability will require dropping the techno-arrogant approach to that part of nature that we truly are serious about sustaining. Rather than thinking like an engineer, we need to "think like a mountain" (Leopold 1949; Grumbine 1992). That is, managers of the natural world should think very long-term, accept natural systems as they are, and manage them with an appreciation for the dynamic states in which they have always been. They would do well to heed Rachel Carson's closing words in *Silent Spring* (1962): "The "control of nature" is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man." Natural resource managers should recognize the real world of natural law rather than human fantasies of how nature should work for our benefit. Management of truly sustainable systems must work within the framework of constraint and natural law. Political expediency and short-term economic gain have no place in truly sustainable systems.

We cannot simply re-invent natural biological laws to suit our image of short-term economic gain, four-year political cycles, and perpetually expanding economies. This flies in the face of everything we know about natural law and common sense. Yet, we have allowed politics and economics to emerge as the guiding principles that direct resource management, while ignoring the natural laws that guide the world from which we take resources. I cannot think of a more foolish and self-defeating way to approach human long-term well-being and sustainability.

The typical response to this attitude is that the system cannot be changed because of momentum. I counter that it *must* be changed if our resources and natural systems are not to be depleted and altered to the point of no return, leaving us eventually to face collapse of the very systems that support human life. The human momentum in behavior and philosophy that must be overcome is minuscule compared with the long-term results of ignoring natural laws and their forces. Continued disregard of natural law simply cannot be sustained in the long term, and resource agencies must not only accept this, but lead the way in changing the *status quo*.

So what is the conscientious and progressive resource manager to do? If we want to retain any semblance of ecosystem function, biological diversity, and long-term sustainability, not only of resources but of reasonable quality of human life, we need a philosophical renaissance that recognizes supremacy of natural law over artificial, human institutions, or what those currently in economic and political power tell us is the "real world." We must recognize limits to our control of nature, and limits to the ability of natural systems to suffer abuse upon abuse yet still provide the services we expect of them, including continued and abundant natural resources.

How do we do this? I believe education at all levels is the answer: education of mid- and high-level resource managers whose training and value systems are sadly out of date, of politicians and economists, who typically have no training or interest in resource management, and especially of the public at large. This can best be

done through absolute honesty by resource managers of the consequences of continued growth in human population and capital. We can no longer sugar-coat what we know is happening to the natural world through public relations blitzkriegs that serve only to continue agency funding and advance careers. I am reminded of my visit to an Idaho salmon hatchery, whose public displays praised the glories of salmon hatcheries, indicating what a wonderful job they are doing in protecting our resources. Yes, perhaps they are doing a good job, but their displays should instead tell visitors how unfortunate and desperate it is that hatcheries need to exist at all, and that they are last-ditch efforts at recovering the resources that our control-of-nature mentality has destroyed. They should be teaching that hatcheries will only be a success when they can be dismantled because of healthy runs of native fishes. Such honesty and revisionist thinking is long overdue in many of our resource agencies.

I realize that the public makes extraordinary, conflicting, and unrealistic demands on resource managers, but that is no reason to comply; the public and political leaders are generally ignorant of the ecological realities surrounding resource issues. Rather than accede to unrealistic demands based on ignorance, it is up to re-

source experts trained in the natural laws of ecology and evolution to inform, rather than conform to fantasy. We would not let the public guide medical professionals in the best way to perform a surgery, nor would we tell our auto mechanics how to fix a transmission. Yet, the public, largely through untrained political and business leaders with self-rewarding personal agendas, tells resource managers how to manage nature.

In closing, there is a saying that goes "unless we change direction we might just get where we're going." This is a sobering thought relative to resource conservation and sustainability. Directions in resource agencies must change, as must basic human value systems, if real sustainability is to be achieved. Directions must change by rejecting the artificial notion of the traditional "real world" of resource management, and accepting the realistic world of natural laws of ecology and evolution. Nothing short of 3 billion years of the history of life is at stake.

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What on Earth are We Doing?

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(Ed. note: This is an edited summary of the *Guiding Principles of Sustainable Design*, a collaborative effort of individuals representing professional design and conservation groups, various offices of the USNPS, other national as well as local governmental agencies, and ecotourism resort operators.)

Introduction

Human beings are not interacting well with the Earth. As World Bank economist Herman Daly has stated, “we are treating the Earth as if it were a business in liquidation.” The connotation of development has eroded from improving the quality of life for humans to an economic activity that assumes endless growth is both possible and desirable. What can be done to counterbalance the damaging effects of human activities on this planet? Sustainability has come to the forefront in the last 20 years, and may provide the general guidance humankind needs. Sustainability is a concept that recognizes that human civilization is an integral part of the natural world, and that nature must be preserved and perpetuated if the human community is to sustain itself indefinitely. Sustainable design is the philosophy that human development should exemplify the principles of conservation, and encourage the application of those principles in our daily lives.

Sustainable design, sustainable development, design with nature, environmentally sensitive design, holistic resource management—regardless of what it’s called, “sustainability,” the capability of natural and cultural systems to maintain themselves over time, is key.

The USNPS’s Sustainable Design Initiative

Two events in particular were instrumental in creating the USNPS’s Sustainable Design Initiative: the Vail Symposium and the Maho Bay workshop. In October 1991, five working

groups studied “the state of the parks” as part of organizational renewal activities associated with the Vail Symposium marking the 75th anniversary of the USNPS. They found

that the USNPS is being stressed by a variety of factors, including population increases, park visitation increases, demographic changes, increased numbers and types of sites to manage, environmental degradation, lack of capable leadership, and the need to protect whole ecosystems. The working groups acknowledged that certain environmental stresses are beyond the scope of standard park management, and that sustainability is a way of addressing these stresses on a broader scale.

In November 1991, the Sustainable Design Initiative was officially launched with a workshop in Maho Bay Camp, Virgin Islands National Park. Participants from professional design and conservation groups, national and local governmental agencies, various offices of the USNPS, and ecotourism resort operators brought diverse perspectives and ideas, and a strong commitment to develop practical advice on sustainable design. The outcome was a set of guiding principles for the application of sustainability to the management of sensitive natural and cultural resource areas. The raw data generated at the Maho Bay workshop subsequently was augmented with information from additional sources and edited by the Denver Service Center of the USNPS into a formal publication.

The *Guiding Principles of Sustainable Design*, published in October 1993, is a collaborative effort intended to provide a basis for achieving sustainability in facility planning and design, emphasize the importance of biodiversity, and encourage responsible development decisions in parks and other conservation areas, particularly

where related to ecotourism. This merger of sustainable development and ecotourism provides tremendous opportunities for affecting visitor perceptions of the natural and cultural world, and developing conservation-oriented values.

The suggested principles to be used in the design and management of park and other visitor facilities emphasize environmental sensitivity in planning, design, construction, operation and maintenance; the use of non-toxic materials, resource conservation and recycling; and the integration of visitors with natural and cultural setting. The goal is to affect not only immediate behaviors but also the long-term beliefs and attitudes of visitors.

Interpretation

Interpretation must be redefined to provide better knowledge of resources, appreciation of their relevance to us, and positively influence human values, thus leading to the protection of the overall environment.

Natural resources

A basic premise of sustainable development is that facilities must, to the fullest extent possible, function within the ecosystem and its constraints rather than separately. Although it is not always readily apparent, ecosystems provide direct ecological services to the human developments within them. If an ecosystem becomes overloaded or severely stressed, these services are jeopardized.

Natural behavior within an ecosystem. We must develop a basic understanding of natural behavior within an ecosystem before we can design facilities to function sustainably within it.

Links between ecosystems. We must ascertain the links between ecosystems to avoid changes in one that may have consequences in another. Natural resource protection will involve planning and government controls over a wide geographical area to account for these connections.

Fragmentation of habitats. Habitat fragmentation must be minimized because this causes loss of biological diversity.

Energy subsidies for ecosystems. Sustainable development must limit imported energy to sustain human needs, and instead take advantage of renewable energy sources within the local ecosystem. A basic question should be how the development could function, or even if it should, if the energy subsidy were unavailable or created significant disruptions in distant ecosystems.

Human demands on ecosystems. Because the demands of human use on an ecosystem are cumulative, new proposals must account for the previous use of resources so that effects of past activity, proposed development, and anticipated future use do not exceed the ecosystem's capability and resiliency.

Acceptable limits of change. Even with sustainable development, change is inevitable in an ecosystem. Limits of acceptable change must be developed that are well below the ecosystem's capability and resiliency to ensure that natural stresses or disasters do not cause the whole system to collapse. The limits must be respected scrupulously.

Ecosystem monitoring. The effects on surrounding resources of developing

and operating facilities must be routinely monitored and evaluated as an early warning of potential stress to the ecosystem; action should be taken immediately to correct any problems.

Cultural resources

Much of what is valued in historic developments is their response to the climate, natural setting, and use of locally available building materials. A symbiotic relationship of human activities within their host environment is evident in the occupants' structures, such as the Anasazi cliff dwellings at Canyon de Chelly National Monument in Arizona. The vernacular response to climate, setting, and materials provides opportunities for presenting positive lessons in ecologically sound design. Conversely, many of our historic military, industrial, and engineering sites afford opportunities to discuss ecological excesses of the past. The architectural style, landscape design, and construction materials of sustainable development should reflect the indigenous cultural heritage of the locality or region.

Sustainable site design

Site design is a process of intervention involving the sensitive integration of circulation, structures, and utilities within natural and cultural environments. Sustainable design is not a reworking of conventional approaches and technologies, but a fundamental change in thinking and in ways of operating. Beyond a change in basic approach, sustainable site design requires holistic, ecologically based strategies to create projects that do not alter or impair, but instead help *repair and restore* existing site systems.

The "Valdez Principles for Site De

sign,” developed by the firm Andropogon Associates, can serve as policy guidelines in site design for developed areas of national parklands.

- Recognition of context. What are the impacts of the project on the larger community?
- Treatment of landscapes as interdependent and interconnected. Fragmented landscapes must be reconnected to establish contiguous networks able to support a variety of natural plant communities and habitats.
- Integration of native landscape with development. Developed landscapes should be redesigned to support a variety of components of the native landscape to provide critical connections to adjacent habitats.
- Promotion of biodiversity. Site design must be directed to protect local plant and animal communities, and new landscape plantings must deliberately reestablish diverse natural habitats in organic patterns that reflect the processes of the site.
- Reuse of disturbed sites. Instead of siting new development in remaining rural and natural areas, previously disturbed areas must be reinhabited and restored.
- Making a habit of restoration. Every development project should have a restoration component for all site systems, including soils, water, vegetation, and wildlife.

Construction methods and materials

The goal to leave the landscape visually unimpaired after development drives the need to evaluate every construction method and material used.

There should be no residual signs of construction or environmental damage. Preservation of the natural landscape is of great importance during construction because it is much less expensive and more ecologically sound than subsequent restoration. Careful organization and sequencing of construction should be emphasized. Material staging should be carefully planned to use only areas subsequently to be developed. Procurement should be scheduled to limit the amount of material to be accommodated on site at any given time during construction. Careful planning of the construction process can help identify alternative methods and techniques that minimize resource degradation. Projects must be adaptable to reflect unforeseen environmental conditions. And, throughout construction, resource indicators should be monitored to ensure that resources are not being adversely affected.

Building design

To ascertain the most environmentally sensitive building materials, the complete life-cycle energy, environmental, recycling and waste opportunities and implications of each material must be examined. This cradle-to-grave analysis involves tracing the effects of a material or product and its by-products from its initial source availability and extraction through refinement, fabrication, treatment, transportation, and use, and then predicting its eventual reuse, decomposition, or disposal. Tracing includes the tabulation of energy consumed and the environmental impacts of each action and material. The selection of materials for a sustainable

design is then a matter of evaluating the positive and negative environmental consequences for the lowest possible total environmental loss.

The goal of sustainable development and sustainable building design is to create optimum relationships between people and their environments. More specifically, sustainable development should have the absolute minimal impact on local, regional, and global environments. Planners, designers, developers, and operators have an opportunity and a responsibility to protect the sanctity of a place, its people, and its spirit.

Sustainable design balances human needs (rather than wants) with the carrying capacity of the natural and cultural environments. It minimizes environmental impacts, importation of goods and energy, as well as generation of waste. In an ideal situation—after determining that the proposed development is indeed necessary in the first place—it would be constructed from natural, sustainably harvested materials collected on site; generate its own energy from renewable sources such as sunlight or wind; and manage its own wastes. Sustainable design is an ecosystematic approach that demands an understanding of the consequences of proposed actions. The long-term objective of sustainable design is to minimize resource degradation and consumption on a global scale.

Energy management

Responsible energy use is fundamental to sustainable development and a sustainable future. Each site has primary renewable energy resources,

such as sunlight, wind, geothermal and tidal energy, or biogas conversion. With existing technologies, the intelligent use of primary renewable energy resources can benefit any development. Energy management must balance the justifiable demand with appropriate supplies.

Water supply

The challenge of sustainable design in terms of water resources applies more to those areas where fresh water is not limited than to arid areas where the economics of high-cost water tends to promote wise stewardship. The cornerstone of any domestic water supply program is conservation. Water conservation includes using reclaimed wastewater effluent, gray water, or runoff from ground surfaces for toilet flushing or irrigation of planted landscapes and food crops. It also involves the widespread use of water-conserving flush toilets, and where practical, composting toilets. All other plumbing fixtures should be evaluated to limit water consumption.

Waste prevention

Because experience has shown that there is no completely safe method of waste disposal, the only way to avoid environmental harm from waste is to prevent its generation. Pollution prevention means changing the way activities are conducted and eliminating the source of the problem. It does not mean doing without, but doing differently. Preventing pollution in a sensitive resource-related setting means thinking through all the activities and services associated with the facility and planning them in a way

that generates less waste. Reduction, reuse, and on-site biodegradation and recycling are the key components of a sustainable waste prevention approach. A material doesn't become waste until it is thrown in the garbage can. If a material can be reused, it is a resource, not waste. Reuse is the best form of recycling. Recycling can be maximized through the purchase of products for which there is a ready market as recycled materials. Ideally, if no other reuse or recycling option exists, materials used at a facility should be recycled, even at a net loss, rather than sent for disposal. We should limit to the greatest possible degree materials that become waste problems; nothing should be purchased that ultimately will become toxic.

Facility maintenance and operations

An essential goal of a high-quality, well-maintained sustainable development should be the hiring and training of individuals who excel in local artisan skills. These artisans should be absorbed into the design, construction, maintenance and management of sustainable facilities as part of a sustainable personnel program to complement sustainable development. Employees who are involved in a project from the outset would be more

likely to show the pride required to maintain the facilities at the highest levels of quality.

The role of these operations is to facilitate good visitor experiences without the depletion of resources and to promote environmental and cultural resource awareness and education. Sustainable development operations should help impart to both visitors and staff an enhanced set of values supporting sustainable human behavior toward the Earth. Sustainability must be visible in all aspects of facility operations, including visitor services and concession operations, maintenance, utilities, and waste handling. By interpretation and example, visitors can learn how to adapt some of the sustainable methods to their personal lifestyles.

Through adopting the concept of sustainability, the USNPS is hoping over the next 75 years to more effectively accomplish its conservation ethic and 1916 Organic Act mission, "which purpose is to conserve the scenery and natural and historic objects and the wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."



Integrated Bioclimatic Architecture

Javier Barba

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In the last few years there has been much talk concerning “sustainable” or “ecologically responsible” architecture, that is, architecture respectful of the earth’s resources and its natural beauty.

Unfortunately, many of the architects and designers who profess interest in the concept of sustainable architecture do not practice it in their own work for whatever reason, be it their client’s lack of interest or their own lack of conviction. In fact, most other architects ignore the issue altogether, preferring to regard architecture as fashion. This is, in my opinion, a terribly irresponsible view, because in terms of energy use and visual pollution, buildings have had an increasingly severe and damaging impact on the environment. For me, this makes the issue of sustainable architecture not only an important consideration but also a necessary one. As for a building philosophy for national parks, which were created to conserve nature for future generations, it seems to me that sustainable architecture, or what I refer to as “integrated bioclimatic architecture,” is the only logical and responsible approach. I say this speaking from experience. Unfortunately, I have seen some of the natural treasures of my own country—the

once splendid and untrammelled Costa Brava and the Costa del Sol—ravaged by indiscriminate and unimaginative development.

What is integrated bioclimatic architecture? It is architecture that arises out of the landscape, with the site determining the orientation and construction of a building, not just aesthetically, but also mechanically, determining its heating, cooling, and lighting too. Thus, it is an architecture that respects nature and its resources and provides its occupants with the most comfortable and pleasing environment possible. However, this architectural approach need not be a restrictive one for imaginative practitioners, as integrated bioclimatic architecture encompasses examples of vernacular architecture, like the typical white stucco Mediterranean fishing village, as well as mimetic architecture, which draws on the materials, textures, even the plants of the surrounding landscape for its inspiration. Indeed, good integrated bioclimatic architecture should exist in harmony

with the site and be visually dramatic because architecture that does not provoke emotion is not good architecture.

Earth-sheltered house

My own first integrated bioclimatic project was a commission to design a weekend house just north of Barcelona, not far from the sea (Figure 1). The site for the house was a steep slope, off a much-frequented road that snakes round the hilly, pine-covered countryside, with a splendid view of the sea. It was the sort of site that gives some architects nightmares, but I saw it as the fulfillment of a dream. I realized the best solution for this difficult spot was an earth-sheltered house, a construction type I had longed to design, but one I had yet to find a client willing to try. Apart from dealing with the problem of the steep slope, I also wanted to avoid cluttering the beautiful, still unspoiled landscape with one of the white stucco Mediter-

anean villas that stuck out like sore thumbs on the neighboring hills, for by this time I had already come to the conclusion that nature has the right to priority and it is we who must adapt ourselves to it.

To get a sense of the spirit of the place, as well as to understand such mundane matters as the site's drainage, I visited the property for several months before finishing my designs, observing it in different seasons and weather. I wanted to create an entrance that would be dramatic and exciting, but which would not interfere with the landscape. I accomplished this by making a cavernous entrance for the house. You literally have to descend deep into a hole in the earth, and then, when you enter the house, you find yourself in an ample, bright, white-walled living room with an extraordinary and unexpected view of pine-covered hills and, in the far distance, the sea.

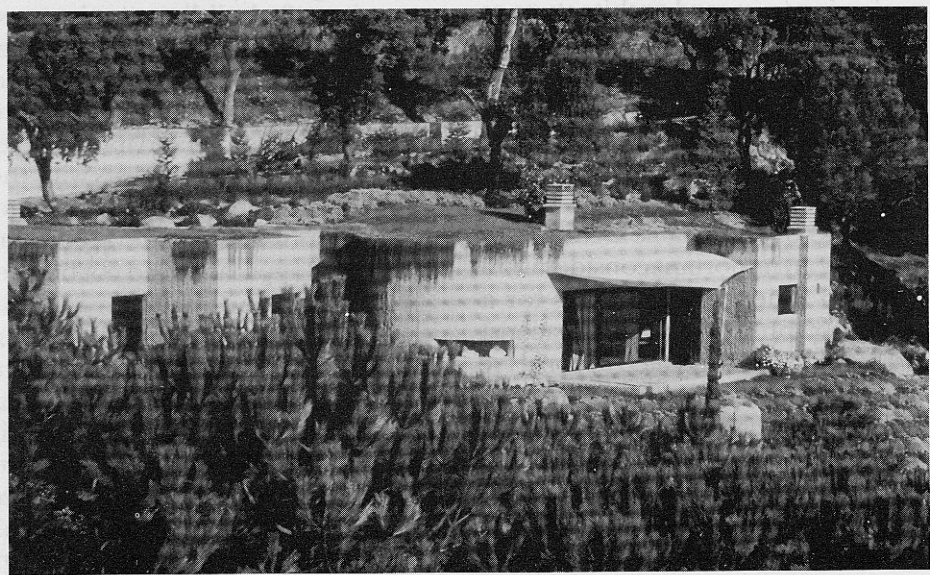


Figure 1. Earth-sheltered House near Barcelona

I chose to make the south-facing walls of the house, which are the only ones visible, out of concrete mixed with quartz, mica, feldspar, and granite from the area. To give the exposed walls a softer, more organic feel, I had the concrete poured into serrated molds to produce a triangulated surface, and then had the edges chipped away. With the aid of an earth mover, I arranged huge boulders around the center of the house and its cave-like entrance, blending the textures of stone and concrete and further erasing the distinctions between house and landscape. The integration was complete when creepers and flowers native to the region were planted amidst the rocks and the earth-covered roof.

By burying the house I had made a striking residence for the client and solved the problems of the site. Its earth covering insulated the house from the noise of the road and from temperature changes. Its south-facing windows allow generous sunlight, adding warmth in winter and providing views of the distant sea. In summer, canvas awnings outside on the terrace protect the windows from the strong sun. The terraced land below the house provide the perfect plateau for a pool, and the property has become inviting for strolling and gardening.

Menorca house

An equally challenging project was a vacation house on the Balearic island of Menorca, off the northeast coast of Spain (Figure 2). The site is a marvelous rocky hillside that descends into the sea, truly one of the most spectacular spots on the Mediter-

anean, and one that many environmental groups were anxious to protect. In Menorca, the vernacular architecture is mostly white-washed structures, which look handsome when clustered together in a fishing village, but to place such a building there would have been disastrous as it would have been utterly out of harmony with the striking landscape. However, it happens that there is another Menorcan vernacular, an ancient one. For this island was settled in prehistoric times by a people who lived in the island's many caves and built numerous stone megaliths. It was from this vernacular that I drew my inspiration, as well as from a rather severe, square-shaped tower that already existed on the site.

I envisioned a stone building connected to the stone tower that up close would have a powerful, primordial shape—in this case, several stone walls slanting outward—and which would be able to hold its own against the drama of the landscape. However, at a distance, the building would disappear into the craggy hillside.

My first concern, however, was to excavate a rather tacky white balustraded viewing platform that had been built adjacent to the tower years earlier. The stones that I dug up were saved to cover the walls of the block concrete structure as an economical use of materials and energy. My efforts toward energy conservation also extended to the design of the house, as I wanted it to be as bioclimatic as possible. Heating was not a concern because the house is only used during the summer, but cooling was a very real one as Menorca is very hot and humid in summer. By orienting the

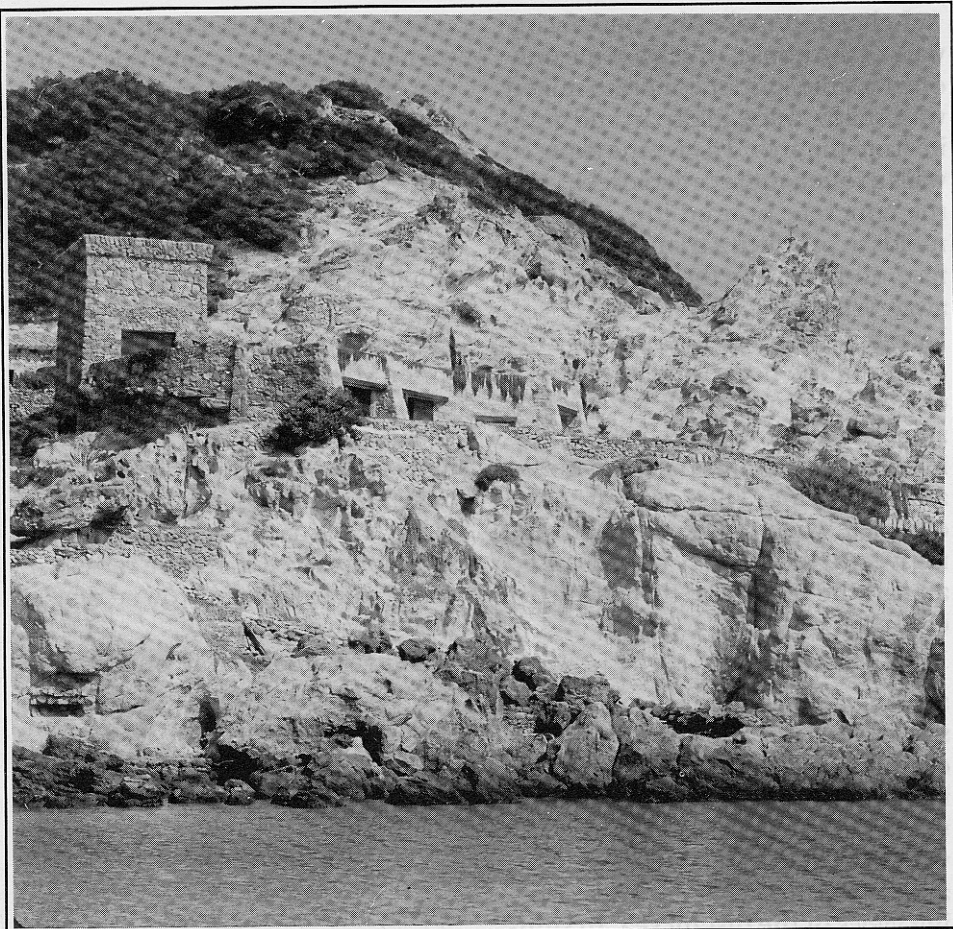


Figure 2. Menorca House

house toward the east, I was able to maximize the views and ensure that the sun hit the house at an angle at which its heat rays were least intense. I also placed an atrium deep within the interior of the house. This enclosed court brings in natural light so that the interior is not dark and provides cross-ventilation. Finally, to further integrate the house into the landscape, I inserted planters around the perimeter of the roof, which are one meter wide and planted with indigenous veg-

etation that thrives in the hot, windy, salty climate.

Borobudur Resort

However, the project that may best correspond to the problems inherent in building sustainable architecture in a national park is the luxury resort I am currently designing in central Java, Indonesia, not far from Borobudur, the sacred Buddhist temple. The area has protected status through Unesco, and it is illegal to construct anything

there that might be considered visually polluting to the natural beauty of the place, which is beautiful, indeed. The surrounding countryside is tropical with many palm and mango trees, verdant valleys, terraced hills of rice paddies, jungly mountains, and distant volcanoes. There is no question that this place has a special energy which should be respected and preserved.

The resort itself is to be located on a hillside overlooking the Borobodur temple in an area currently occupied by rice paddies. Two streams run along each side of the land, with another smaller creek running down the center. There are also some interesting formations of black volcanic rock scattered among the paddies. After spending a good deal of time at the site, it was obvious to me that a mimetic architecture was called for. However, I also knew that mimetic architecture alone would not meet the demands of this project as it was to be a tourist hotel, albeit a luxury one, and visitors would want to have more of a feel of the native architecture and culture, so I would have to incorporate vernacular architecture into the design. It was not difficult to find examples of this architecture as there is a village just a short distance away, peopled by the farmers who cultivate the rice paddies and many of whom will work in the hotel when it is completed.

My idea is to place the 50 bungalows, which are the most extensive part of the project, underground, so that the impact of building in this unique site will be minimized (Figure 3). Almost all the other structures—the entry, the common rooms, the bars, and dining room—will be “Pendopos,”

which is the traditional building style with timber-roofed construction supported on timber columns and without walls. The back-of-the-house areas will also be underground, and out of sight. In this way, the visitors will feel directly related to their surroundings and the local villagers will feel we have been respectful of their land and culture.

Guests will pass through a patio with walls made of the local black stone—the same stone used for the Borobodur—which will be lavishly planted. Before them will be the entry lobby in the form of a Pendopo, surrounded by a reflecting pool, which will be illuminated at night to reflect the Pendopo, as if it were a jewel. The water from the reflecting pool will travel throughout the resort, creating different pools and waterfalls, which will acoustically and visually enrich the communal areas. The entry lobby will have dramatic views of the Borobodur and the surrounding valleys, but the rest of the constructions—the bungalows—will not be visible, as they will be nestled into the contours of the land. Each bungalow will have its own unobscured view of the Borobodur, its own garden, swimming pool, and outdoor sleeping area. Because of the way the land will be terraced and planted, however, each bungalow will be sheltered from the views of the others. In this way, all of the guests will have an extraordinary sense of privacy and peace.

I am very excited by this project because I consider it unique. I hope that, when it is completed, its unusual mix of vernacular and mimetic architecture, its extraordinary view of the seventh wonder of the world, and its rare

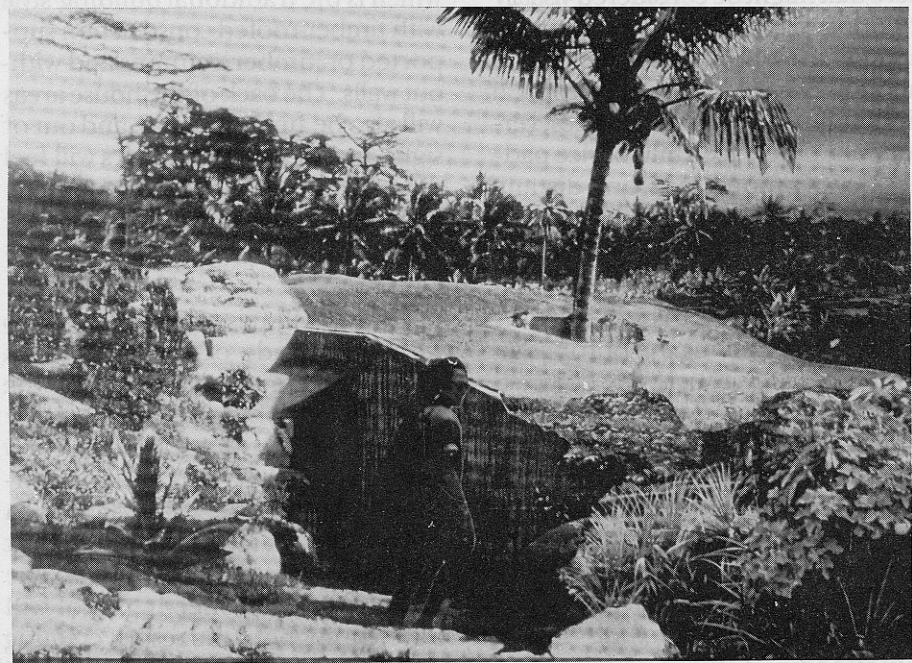


Figure 3. Artist's Conception of Borobudur Resort Bungalow

sense of privacy and tranquillity will give impetus to other architects, designers and hotel companies to conceive holiday resorts in a new way that is at once architecturally sophisticated and culturally and ecologically respectful.

Barcelona waterfront island

My final example, a proposal to build an island off Barcelona's coast, is a very different one indeed, for here I am suggesting a way to improve upon nature. The recent redevelopment of Barcelona's waterfront has provided its citizens with a wonderful view of the sea. However, as attractive as it is with its sandy beaches, blue waters, sailboat-filled harbors, and myriad of wind surfers, it is still somewhat boring. Because it borders the city, it has a rather urban feel. Recently, I

began thinking how wonderful it would be to live on an island and still be in Barcelona, and I got the idea of bringing the best of the Costa Brava, with its beautiful rocks, trees, and mountains, to Barcelona. My idea is to build an island of two mountain knolls that would be connected to the mainland by a bridge about 40 meters out in the sea (Figure 4). From the waterfront all you would be able to see is a wild, green mountainside covered with scraggly oaks and pines. I think this new sense of perspective when looking out at the sea would add greatly to the view, making it more beautiful and exotic.

But perhaps the most interesting part of the project will be what you do not see. The two mountains will fit inside each other like half rings, creating

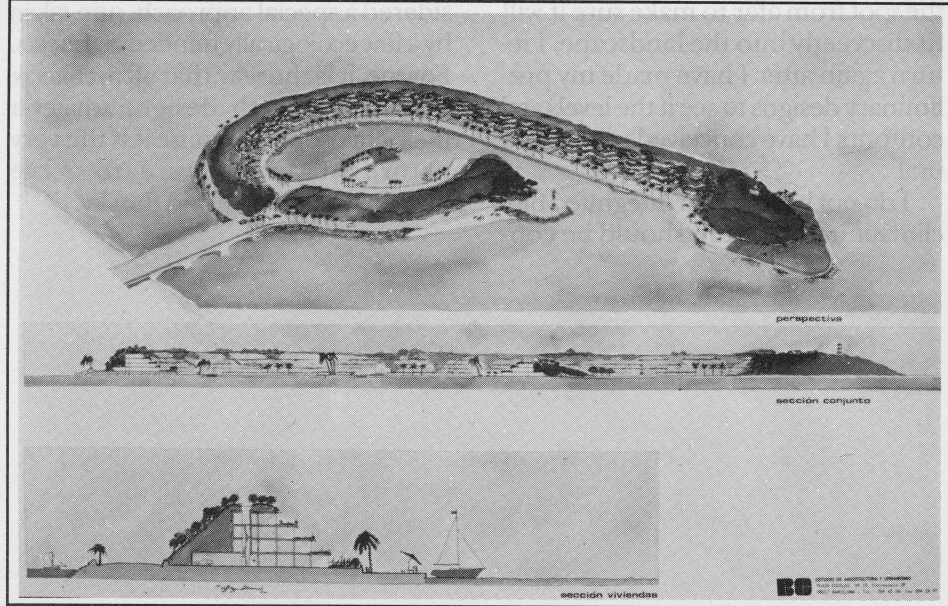


Figure 4. Perspective and Section Drawings of Barcelona Waterfront Island

a protected harbor that will be obscured from view, even when approached from the sea. In this harbor will be a marina and the interior mountainsides will be terraced with earth-sheltered apartments for couples and small families. The bottom rim of structures, those nearest the harbor, will house restaurants, bars, and shops. Inside the mountain there will be a parking garage.

Conclusion

As you can see from these examples, integrated bioclimatic architecture is not so much a style as it is an approach. Key to its successful practice is that, once you understand the building program, you let the site's landscape determine the shape and form of the building. When I take on a new project, I spend a great deal of time visiting the site and getting to know it. It is not enough that you understand its dimensions, its spatial

characteristics, and its drainage; you must feel its energy. Thus it is important to visit the site early in the morning, at midday, and in the evening. You need to know how the wind blows over it and how the sun strikes it. You need to become familiar with its views, the morphology of its stones, its dominant colors, its different textures and even its smells, as well as the type, color, and fragrance of the various plants that inhabit it. I take numerous pictures so that I will remember not only the strongest elements of the site but also the sweetest, such as a place where mushrooms grow year after year that should not be disturbed, since as a mushroom hunter I know how difficult good mushrooms are to find. I also like to bring a portable drafting table so that I can sketch what comes when the land first speaks to me.

After I have sited the project, I view

the spot from afar to make sure it will fit discreetly into the landscape. I return again after I have made my preliminary designs to see if the levels and contours I have conceived will be natural.

I do not believe that integrated bioclimatic architecture should be con-

sidered a special approach, one taken by a few ecologically minded architects. For me, it is the way that all architects should approach design, whatever their philosophy, because it is the very nature of architecture to relate humans to the earth and the sky.



Strengthening the “Ability” of Sustainability: A Personal Perspective on Motivations and Sustainable Design

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Introduction

Sustainability is easy to repeat as a word, more difficult to grasp as a concept, and even more difficult to achieve as an action. Despite its importance in land management, there seems to be a feeling that it has entered popular culture before it has had a chance to ripen, becoming petrified before setting fruit. Pronouncements that sustainability is the “buzzword” of the 1990s are common: “Sustainability is so popular Michael Jackson will likely sing of it on his next album” (Hester 1992, p. 162). The short-term commitment implied by the term “buzzword” and the long-term commitment implied by the term “sustainability” are diametrically opposed. How can we open a crack in this rapid-paced, fad-oriented society for a concept like sustainability to seep in and fuse with our ideas and actions regarding land management? How do we strengthen the “ability” part of sustainability?

William Ruckelshaus, former administrator of the U.S. Environmental Protection Agency and member of the World Commission on Environment and Development (the “Brundtland Commission”) recently wrote (1989) that in order to move toward a sustainable world, we have to articulate a clear set of *values* consistent with the principles of sustainability, establish *motivations* to achieve these values, and develop *institutions* to effectively apply the motivations.

One would think that the U.S. National Park Service (USNPS) would

have an easy task of helping this value shift toward sustainability along, since the agency’s 77-year-old mandate has the values of sustainability embedded in its words: “to provide for the enjoyment of the scenery and the natural and historic objects and the wildlife [within the parks] ... in such manner and by such means as will leave them unimpaired for future generations.” This call is precisely parallel with the Brundtland Commission’s definition of sustainable development as that which “meets the needs of the present without compromising the ability of

future generations to meet their own needs" (WCED 1987, p. 43).

The Denver Service Center (DSC) design arm of USNPS has taken a further step in restating and updating values statements in the spirit of sustainability through its Sustainable Design Initiative [see article by Reynolds in this issue]. USNPS individuals have created a *Guiding Principles* document (USNPS 1993) to record principles, goals, strategies, and checklists to guide national park design. This document is an important milestone in the growing sustainable design movement because it applies the constellation of principles developed by many far-flung, relatively small-scale groups to an influential, large-scale national agency. Goals such as "promote spiritual harmony with, and embody an ethical responsibility to, the native landscape and its resources" are representative and attest to the desire to apply a sustainable value system to design (p. 32).

This emergence of principles is a positive step toward articulating sustainability values. Publication of this document also attests that there is institutional support for this idea, as there is support at larger scales for various new commissions and councils on sustainable development, resulting from 1992s Earth Summit and Agenda 21. Thus, by Ruckelshaus' formula, two of the three components necessary to "eat our developmental cake and have the environment, too" are moving into place.

The third component, motivation, is the focus of this paper. Achieving goals of sustainability can mean sacrificing comforts, changing habits, and

thinking in a manner that considers larger-scale, longer-term implications. People must be motivated to do things that are more difficult. Using national park design as an example, how can designers, under intense pressures and deadlines to satisfy often-conflicting needs, be motivated in tight budget times to take the extra difficult steps necessary to carry through the dozens of principles, guidelines, and recommendations stated in the *Guiding Principles* document?

In addressing motivations, I suggest drawing from and refining the old personnel standbys: increasing knowledge, skills, and abilities, with the latter being the key to achieving sustainability. Developing knowledge and skills entails providing information and a process by which to assimilate data. But to develop abilities in the largest sense, people must combine information and process with inherent interests, talents, and drives. They must overcome obstacles and draw from those elements that give them unique perspectives. This is what leads to fresh and dedicated contributions. Paying increasing attention to personal-scale motivations is part of a movement evident elsewhere in society, and important for organizations such as the USNPS to recognize. In this essay, I describe the steps underway and those still needed within the sustainable design movement to motivate positive personal-scale action and attitudes. I draw from my own experiences with developing knowledge, skills, and abilities in the interest of encouraging readers to take an important moment to look within and examine their own motives and inherent interests and seek further ways to build

on these through the sustainable design movement. As we move toward an era focused on acknowledging environmental and personal context, we each have to continually reach within to find where we can be most effective.

USNPS design and planning activities are the focus here, because they must address the use/preservation tightrope assigned by the mandate. Since design and planning follow similar processes, but are usually considered variations in scale, I will refer to "design" to encompass both.

The shifting scale of concern

The importance of motivating people to achieve global goals through local efforts has reached cliché status: "Think globally; act locally." The scale of local activism is increasingly shifting, however, from a community level to more of a personal scale. Much emphasis in recent literature is placed in two areas: strengthening an individual's sense of self-knowledge and effectiveness and appealing to individuals' innate motivations (pain and pleasure) to achieve goals of sustainability. This shift toward self-focus is evident within many recent writings, from popular self-help books to environmental behavior research. A few eclectic examples follow.

In her book *A Revolution From Within* (1991), Gloria Steinem reverses the feminist adage that "the personal is political," which underscored the need for political consideration of issues such as day care, education, and health. Now Steinem states that "the political is personal" and she records political problems stemming from leaders' personal lack of security and esteem. Until individuals build their

own sense of contribution, security, and strength, they will not have the ability to foster these qualities in others, and positive political change will not occur. Steinem supports her position with a quote from former Czechoslovakian president Vaclav Havel: "Only a person or a nation self-confident in the best sense of the word is capable of listening to the voice of others and accepting them as equal to oneself. Let us try to introduce self-confidence into the life of our community and into the conduct of nations" (p. 10).

Lester Milbrath, author of *Envisioning a Sustainable Society: Learning Our Way Out* (1989), also writes that we need to learn our way out of existing patterns by strengthening our personal values, becoming more self-reliant, living simply but richly, and touching the earth less with our material demands. Those who develop this personal understanding cannot shrink from the responsibility of funneling it upward in scale.

In a recent *Atlantic Monthly* article, authors Ridley and Low (1993) question sustainability's assumption that we must persuade people to change selfish habits for the greater good. They believe that people are not effectively motivated by calls for global sacrifice, selflessness, or moral shame, but rather by actions that cause them either personal pain or bring them individual benefits. In searching for motives to achieve environmental goals, this means increasing the costs of being a resource free-rider and increasing the benefits of being a cooperator. To effect change, we need to tap into these rational and consistent motivations as individuals, and bene-

fits will filter up into larger scales. Roger Walsh, in his article "Toward a Psychology of Sustainability" (1991), also asserts that we must appeal to personal motives to achieve sustainability, but argues that, in the long run, it is better to build trust by appealing to people's positive motives, rather than by condemning or threatening them.

Studies by behavioral analysts and others show the importance of human behavior modification in avoiding the "tragedy of the commons." Effective behavior-change techniques include establishing material and social incentives and disincentives, persuasion, prompting personal insight and intrinsic satisfaction, identifying attitude-consistent behaviors, providing specific information, and training. The success of these in accomplishing goals of sustainability often depend on change occurring on an individual scale (De Young 1993, Dwyer and Leeming 1993). De Young writes that individually initiated changes may be the key to crafting a conserving society where a sense of challenge, excitement, and enjoyment are the most important, long-term intangible dividends.

Organizations must recognize this shift toward self-focus and the growing need for personal empowerment. The USNPS, in its 75th anniversary summary (the Vail Agenda), has gone through agency-scale self-examination and has realized the importance of organizational renewal. Personal renewal is also important, and building communication, cooperation, and a sense of contribution is particularly powerful to effect change on larger scales. In Buddhist writings, it is said

that to straighten the crooked, you must do a harder thing: you must first straighten yourself.

Increasing knowledge and skills

Providing access to information and a process through which to assimilate this information is at the heart of developing knowledge and skills needed to meet the goals of the sustainable design movement. Studies show that providing information increases knowledge and emotional arousal regarding environmental issues and results in increased motivation and activism (Symes et al. 1993). Providing effective information about sustainable practices is underway within USNPS, especially within the Denver Service Center. Through frequent educational seminars, publications, and personal and computer networks, designers have growing access to technical information such as efficient energy systems design, biological sewage treatment systems design, environmentally responsible building products, etc.

Increasing individual skills is dependent on having an appropriate method by which to assimilate and apply information. Without a clear design process in place along with the rapidly accumulating data and numerous complex goals, designers are in a situation akin to drinking from a fire hose. Over the last twenty-five years, USNPS design has been informed largely by an accountable overlay process (McHarg 1969), inspired by the need to evaluate alternatives and impacts, as required by the National Environmental Policy Act. This method of compiling and overlaying resource data layers has become distilled into

an approach acclaimed for enabling a thorough consideration of existing resource conditions, but criticized for not addressing the spatial and temporal qualities of the site. Although language has recently been included within updated design-process documents that encourages designers to think in connected, dynamic terms, specific examples have not yet been included demonstrating how to feature cycles, flows, connections, and change over time (Johnson 1990). Furthermore, USNPS's Sustainable Design Initiative does not yet include a detailed process within the *Guiding Principles* document that instructs designers on how to specifically analyze, model, and design site structure and function (Lopenske 1993). Integrating process and principles is a vital next step needed to provide designers with confidence and skills in assimilating the dozens of complex guidelines included in the document.

The ecosystematic design process developed by Lyle (1985) and utilized in design studios is one of several processes that can be appropriately applied to the USNPS Sustainable Design Initiative. The ecosystematic design process is inspired by patterning change based on the essential order of ecosystems: their structure, function, and location. The goal is to create forms reflecting inner ecological processes, or, as a popular statement summarizes, "form follows flows." Seven steps are followed in the design process that encourage alternating between intuitive, creative right-brain cognition and more disciplined left-brain thinking. Briefly, the initial step (inception) is flavored by exhilaration and uncertainty, where designers col-

lect initial impressions and early project information. The second and third steps (information and modeling), are more precise and analytical. The process emphasizes use of models to define and clarify underlying or invisible processes. Descriptive models most often include representations of a site's vegetation structure, hydrological functioning, and locational patterns, such as existing land use. Predictive models indicate how change will affect site structure, function, and locational patterns. These models are used in the next creative stage, where the final four steps occur (possibilities, predictions, plan, management). Here goals and objectives are refined, concepts and alternatives generated, a plan selected based on information from predictive models, and post-planning management detailed. This process has driven over eighty-four design projects over the last seventeen years, and has resulted in award-winning designs, recognized for their ability to balance present-day and future human needs with landscape structure and function (Hirschman in press).

Increasing abilities

If information and processes are the water of the phrase: "You can lead a horse to water but you can't make it drink," then abilities comprise the drinking. How individuals transform information and methods into abilities that propel them to address complex projects and plans depends on their personal motivations. Many externally applied incentives can be employed by an agency to assist this transformation, such as tying performance standards with utilization of sustainable

design information and techniques, providing material incentives and disincentives, etc. However, drawing from De Young (a behavioral scientist) and Walsh (a psychologist), how can agencies spark more individually initiated approaches to assisting the process of transforming knowledge and skills into long-lasting, creative, energized, inherent abilities?

I would like to call attention to a small but potent USNPS program designed to help strengthen and emphasize personal abilities for larger-scale benefits. The Denver Service Center's Office of Professional Employee Development has created a communications coordinator position, held by a landscape architect, Linda Wright. Suggested by the DSC's Management Advisory Group, the intent of this position is to help DSC strengthen the "Service" portion of the organization's title.

Wright approaches her tasks from a personal perspective. Many of her activities, such as administering personality type indicator tests and leading communications workshops, aim at assisting individual employees in recognizing their own motivational bases, their strengths, and blocks toward achieving goals. The goal is to reinforce the idea that people have diverse viewpoints, but once personal preferences and styles of communication and working are recognized, stronger abilities to communicate, cooperate, and lead can be developed. Moving up in scale, individuals who foster a cooperative spirit as a normal mode of operating can work more effectively in interdisciplinary teams,

which can be more instrumental in bridging the organizational gaps in USNPS between parks, regions, and central offices. The key is individual ownership and accountability and a sense of contributing at a personal scale, which filters up to larger scales.

Wright works closely with the Sustainable Design Initiative coordinators, Rich Giamberdine and Bob Lopenske, to help communicate the larger goals of the sustainability initiative while helping people develop their own personal role in fulfilling this vision. Strengthening individuals' sense of value and increasing their ability to achieve personal goals is a strong motivational force that links well with the larger goals of sustainability.

This program is in its early stages and should be encouraged to develop a system for evaluating long-term effectiveness. The ultimate success will lie not in one office's attempt to strengthen communication and abilities, but in the overall reinforcement of a sense of personal responsibility. Each individual must be encouraged to ask key questions: "What is inherently interesting about this project, what motivates me?" "What is the greatest good I can achieve with this project?" and "How can I look at standard operating procedures with new eyes, informed by the values of sustainability?" However, values and motivations are not enough to accomplish the shift toward sustainability: each individual must also be permitted by the agency to act on the answers to those questions. This is where Ruckelshaus' trilogy of values, motivations, and institutions come together to cre

ate beneficial change.

Personal development of knowledge, skills, and abilities

In line with the focus of this essay, I illustrate the importance of attending to the personal scale by drawing from personal examples. I feel these experiences demonstrate one individual's attempt to sift out inherent interests and motivations that lead to accepting the more complicated work of sustainable design. As Walsh states: "There is a growing trap that a lot of us fall into of thinking that a real contribution has to entail suffering for us. But we are in this for the long term, and if it is not reinforcing we are going to burn out" (p. 66).

As I peer into my own roots, I find that my primary motivators are consistently to seek niches and previously unlinked connections. Development of knowledge, skills, and abilities applicable to sustainable design came as I contentedly worked on park design projects while employed as an USNPS landscape architect and began noticing a gap. I witnessed or read about recycling, solar design, and wetland sewage treatment technologies around the country, yet they still at that time were not applied to national parks. The gap between our mandate and our practices grew increasingly evident. Others recognized this gap as well and the Sustainable Design Initiative grew from this realization.

I joined the faculty at California State Polytechnic University, Pomona, to teach design and participate in the Center for Regenerative Studies, where up to 90 students will grow their own food, cycle their own wastes, and generate their own power.

"Regenerative" was felt to be a more dynamic term than "sustainable," implying renewal, and therefore was selected as the center's focus. Information from this center can be applied to national park design issues, and the center is one of the first institutional construction projects built almost entirely with "green" materials. My interests in leaving USNPS for Cal Poly Pomona were in part to absorb as much technical data as possible in the interest of eventually applying these back to park design. My motive rears its head again: to connect USNPS sustainability and Cal Poly regenerativity.

While technical knowledge is useful, the heart of what I do to contribute toward sustainability is to teach processes by which design students can treat land as dynamic, three-dimensional, connected systems. By combining Lyle's methods with my previous background in landscape ecology, a hybrid design approach that emphasizes cultural modeling is developing and my skills are growing from this experience. Connection and niche motivators are quite evident here as well.

In developing sustainable design abilities, I have to dig deeper to find out what is inherently interesting to me that makes it easy to shift to the complex ecosystematic design process. My own design-process roots are deeply intertwined in the overlay process, yet I draw more now from other sources as my knowledge and skills grow. What appeals to me about dynamic, natural-system-driven design approaches is that the act of designing systems is a marvelous system in itself, and prominent models, such as water and mineral cycling, energy flows, and

succession and disturbance are models themselves for how design occurs. Design is like the hydrologic cycle: ideas burst forth from creative designers, are applied to a particular site, are changed and modified over time, become accepted and evaporate in importance, then burst forth again, sometimes centuries later, as in the case of many arid-land approaches to water harvesting, for example. Design is like energy flow: during creative stages of inception and possibilities, many ideas come forth that must be stored like potential energy for use when supplies run low. They are renewable and enlighten the process. And if there was a second law of idea thermodynamics, it would state that in a closed system (i.e., an office removed from the design site), the amount of ideas in forms available to do useful work diminishes over time. In design, succession and disturbance are constant companions as one alternative idea builds on another until a climax plan arises. But often a disturbance, such as a funding cut or political change, can unpredictably strike and burn the plan to the ground. Then it starts again slowly, utilizing the nutrients from the ashes of the last effort to move toward beneficial change. Thinking that design is a linear process, somehow separate from natural processes, has lost its appeal to me. We must think in terms of cycles and layers, time and space, to provide for future generations.

As I write of my own motives, I speculate whether I'm tapping into the universalities of a changing design era. I trust my goals are shared by others. In design I seek simplicity (one design that serves multiple purposes, such as

trail corridors that interpret history, ecology, and community), I seek diversity (because without planning for diversity, we get sameness), I seek context (articulating what makes a place and its people who are committed to it so unique through plants, design materials, language, symbols, etc.), and I seek healing. I seek the appreciation—not the fear of—change over time and ways to celebrate change in a variety of ways: by using building materials that change with the natural elements over time, or perhaps by safely featuring dead trees and their teeming bird and insect life in a design. I seek to provide in design what I seek for my own well-being. It is essentially a personal task, but acknowledging what motivates us individually gives us valuable information to know how to extrapolate outward in scale to design for other humans, species, and generations. Tackling the more difficult tasks of creating sustainable designs does not then seem so difficult; it becomes a necessity.

Achieving sustainability in the Context Era

A new era is upon us. The environmental-regulation-inspired overlay era of the last quarter of a century is blending into what could be called the Context Era, an era focusing on environmental and personal context. Environmental context is more strongly recognized by managers, designers, and visitors as they move even farther beyond thinking of parks as collections of "scenic objects" by thinking in systems that include ecological and social processes. Personal context involves acknowledging our own history, strengths, blocks, and inherent mo-

tives, and drawing from these for better communication and cooperation. When we stop and scrutinize our own motivations, test them through the vehicle we select (design, resource management, etc.), evaluate them,

change them appropriately in line with sustainable values, communicate them, and encourage institutions to accommodate them, will we begin to strengthen the "ability" part of sustainability.

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Balancing Management Goals for Ecological Systems on a Sustainable Basis: An Analysis of the Pacific Northwest Timber Dispute

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Introduction: Goals for Management of Ecological Systems

By law, U.S. agencies with jurisdiction over public lands and protected areas must balance ecological interests with other management goals: economic activities, infrastructure for human support, recreation, and aesthetics. For an agency to realize long-term success in balancing these competing goals, management decisions must avoid destabilizing the ecological system.

There are two major obstacles to sustainable management of ecological systems so as to achieve a balance among multiple goals. They are: (1) balancing environmental and economic interests, and (2) adopting a clear, scientifically sound definition of the term "sustainability" which reflects the balance between competing environmental and economic interests.

Balancing environmental and economic interests

Historically, environmental interests (management and protection) and economic interests (productivity and growth) have been considered inherently incompatible. The traditional conflict is based on the presumption that favoring either goal, by necessity, is detrimental to the competing alternative. Under this view, management decisions have often satisfied economic interests. There are exceptions, however, such as establishment of the National Park System, which was based partly on the growing concern that wilderness areas were rapidly disappearing.

The natural environment is important for many reasons that are inseparable from economic interests. Economic activity represents, at least in part, our need to use natural resources in order to survive. Natural systems provide us with "the soil we plow, the air we breathe, [and] the water we draw." For example, root action on rocks helps create soil, and plants and animals regulate atmospheric gases that affect respiration, temperature, and precipitation (Wilson 1992). Also, plants and animals found in natural ecosystems have direct economic value as sources of medicines,

foods, natural pesticides, and a range of industrial products (Plotkin 1988). Moreover, cross-breeding of crop plants with wild relatives may protect commercial plant varieties from diseases, or increase their nutritional content. The resultant economic benefits are often great (Plotkin 1988).

Using resources faster than the rate at which they can be replenished will diminish or eliminate the future supply. The world cannot be completely divided into zones in which only environmental or economic interests prevail. Although there are ecological systems that should be preserved and protected in a pristine state, many can successfully support economic activities. It is important that we learn to balance interests by adopting a management approach that will satisfy both on a sustainable basis.

The difficulty in defining "sustainability"

Scientists, interest groups, politicians, and others who have recognized the importance of both economic and environmental integrity have promoted the use of natural resources on a sustainable basis (Lubchenco et al. 1991). However, management on a sustainable basis is difficult because, while there appears to be an emerging theoretical understanding of sustainability, we lack the scientific knowledge to apply fully the concept in practice (Lubchenco et al. 1991). Furthermore, the political process has failed to produce an adequate definition of "sustainability" in the law.

Limited scientific knowledge

Science has not progressed to the point where the "health" of ecological systems can be completely analyzed,

Recognition, understanding, and control of ecological problems will, in the long term, require many disciplines cooperating in the application of knowledge and joint research, with a focus on sustainable management (Haskell et al. 1992; Lubchenco et al. 1991).

Scientific and economic definitions of sustainability

There is no clear, scientific consensus on a definition of the term "sustainability." Various definitions can be found in the literature. Ecological sustainability "implies the system's ability to maintain its structure (organization) and function (vigor) over time in the face of external stress (resilience)" (Costanza 1992). Others "emphasize sustainability of narrowly defined 'economic' productivity over time" (Haskell et al. 1992). A scientific trend, however, is to define the concept of sustainability in terms of a balance between environmental and economic interests. Perhaps one of the better working definitions of combined ecological and economic sustainability is that it is a "relationship between dynamic human economic systems and larger, dynamic, but normally slower-changing ecological systems such that human life can continue indefinitely ... [and] in which the effects of human activities remain within bounds so as not to destroy the health and integrity of self-organizing systems that provide the environmental context for these activities" (Norton 1992).

Complexities inherent in implementing sustainable management

The political process has not yielded a consensus definition of "sustainability" which is reflected in

the law. There are numerous social, political, legal, economic, and scientific influences which compete to shape governmental policy regarding the use of natural resources (Schaeffer and Cox 1992).

Current economic systems create incentives to maximize personal welfare by exploiting natural resources for short-term gain. Such incentives may ultimately lead to exhaustion of natural resources (Hardin 1968). Many people would acknowledge the need to preserve natural resources sufficient to sustain human populations indefinitely. The problem is in asking any particular party to reduce its rate of utilization. The short-term consequences of doing so may include reduced profit, loss of jobs, reduced consumption, and, in some instances, reduced quality of the standard of living. This is particularly troublesome if a single group, corporation, or industry believes it is being singled out to bear a disproportionate burden.

Legal definition of sustainability

No clear definitions of ecological or economic sustainability are reflected in current federal law. There are few federal statutes that require sustainable land management. The Multiple-Use Sustained-Yield Act of 1960 (MUSYA) addresses "sustainability" in a limited context, that of "sustained yield." Sustained yield is "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources on the national forests without impairment of the productivity of the land" (16 U.S. Code 531(b)). MUSYA has been largely unenforced by the courts except in connection

with other statutes, and federal agencies responsible for management of public lands have typically enjoyed a great deal of discretion under MUSYA. Nevertheless, there is a trend suggesting closer scrutiny of agency actions requiring compliance with multiple-use, sustained-yield objectives (Bobertz and Fischman 1993).

The evolution of sustainable management of ecological systems: the Pacific Northwest timber dispute

The United States has been struggling with the need to balance environmental and economic interests for many years. The Pacific Northwest timber dispute is perhaps the most notable "hot spot" in the controversy between environmental and economic interests.

From 1985 to 1989, timber harvesting in the national forests in Washington and Oregon reached record highs of 4.5 to 5 billion board feet per year. As a result of intensive logging in the region, the northern spotted owl was listed as an "endangered species" under the authority of the Endangered Species Act (ESA). After litigation in which the U.S. Forest Service attempted to harvest timber without planning for spotted owl habitat, a federal district court enjoined the agency from selling timber from spotted owl habitat until it submitted a plan to ensure viable populations of the owl (*Seattle Audubon Society v. Evans*, 1991).

The timber industry lobbied for a plan that would minimize any detrimental effect on itself. Environmentalists were concerned about saving the last 10% of the old-growth forests remaining in Washington and Oregon.

The Forest Service, hampered by an Administration sympathetic to the timber industry (*Seattle Audubon Society v. Evans*, 1991), was unable to develop an acceptable plan (*Seattle Audubon Society v. Moseley*, 1992).

There were numerous legislative efforts targeted at resolving the dispute. Each represented an attempt to compromise, but none gained enough support to be passed (Environmental and Energy Study Institute Legislative Report 1992).

Preview of a change in national environmental policy

The controversy in the Pacific Northwest was a significant issue during the presidential election of 1992. The Clinton-Gore platform stated that the nation must "shatter the false choice between environmental protection and economic growth" (Clinton and Gore 1992). The campaign stated that their environmental policy was based significantly on this fundamental principle. After the election, the selection of Bruce Babbitt as secretary of the Department of the Interior, which is responsible for a most public lands and protected areas, signaled that the new Administration was serious in establishing this principle as a primary part of the national environmental policy. During Senate confirmation testimony, Babbitt set the tone for the resolution of environment-versus-economics disputes in general: he stated that the Department's highest priority would be to balance conflicts between economic development and environmental protection on a sustainable basis (Senate Confirmation Hearings, 19 January 1993).

Clinton's proposed resolution of the dispute

When President Clinton came into office, he responded by convening a "timber summit" in April 1993. He also created a Forest Ecosystem Management Assessment Team composed of scientists, economists, and sociologists to study the area and develop a series of possible solutions to the crisis aimed at protecting the ecosystem that supports the northern spotted owl while allowing for economic activity to continue.

The option submitted by Clinton to the federal district court centered on protecting owl habitat by protecting watersheds. The focus on watersheds also sought to protect salmon runs and the vital salmon industry in the region. The plan sets aside 80% of the remaining old-growth forests in reserves and reduced harvesting levels from the highs of the 1980s to about 1.2 billion board feet per year. The Administration anticipates a loss of about 6,000 timber jobs and proposes to provide \$1.2 billion to retrain workers as well as remove a federal subsidy on log exports (*Time Magazine* 1993).

Conclusion

The Pacific Northwest timber dispute, and the controversy over balancing environmental and economic interests in general, have influenced legislative efforts to reauthorize the ESA. During the 102nd Congress (1991-92), legislation was introduced which sought to factor economic considerations into the environmental protection structure of the ESA. One bill proposed an "economic impact analysis" before the implementation of ESA requirements, with protection

granted only when the benefits outweigh the economic costs (H.R. 4058, 1991). There has been much support for compensating groups for economic losses sustained as a result of impositions from ESA requirements (e.g., H.R. 4058).

This controversy has also influenced legislation covering the protection of wetlands. One legislative effort proposed an "ecological value" ranking system for wetlands. Under this system, wetlands could be classified as of "critical" value (and thus protected), of "significant" value (which would allow for some development), and of "limited" value (exempt from protection under the Clean Water Act) (H.R. 1330, 1991).

The approach represented by these bills, however, does not address the issue of balancing. They did not focus on using the environment in economically useful and ecologically sustainable ways. Rather, they focused on choosing between environmental and economic interests without specifically planning for combined sustainability. While these legislative efforts did not prevail, they are representative of the types of approaches which have been introduced and considered.

Attempting to balance environmental and economic interests has traditionally been viewed as a significant political risk in national politics in the United States. Yet there are some strong indications that there is growing support for balancing approach.

The election of the Clinton-Gore ticket and selection of Babbitt signal, to some degree, an acceptance of the balancing approach.

The Clinton Administration has taken a calculated political risk by quickly intervening in this dispute and proposing a solution to a difficult problem which had not been resolved by the disputants, nor by Congress. While the balancing approach does not satisfy all interests, it does strike a compromise which is intended to break the impasse. Most importantly, it is a solution aimed at providing long-term environmental and economic benefits.

The United States has the opportunity to enter a new era of environmental management and protection which focuses on achieving a balance between environmental and economic interests on a sustainable basis. The resolution of the Pacific Northwest timber dispute is indicative of the balancing approach which will be part of U.S. national environmental policy for the next several years. This approach should evolve as a workable, politically effective, economically productive method of accounting for competing interests. By beginning to break down the adversarial barriers traditionally associated with the environment-versus-economics debate, we may focus our time and resources toward developing a balance which will ensure long-term environmental and economic benefits.

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Sustainable Design and the U.S. National Park Service

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The 1916 Organic Act of the U.S. National Park Service establishes this as our purpose: “to conserve the scenery and the natural and historic objects and the wild life [within the parks] and to provide for the enjoyment of the same ... unimpaired for the enjoyment of future generations.” In 1978, the Organic Act was amended to further define our responsibilities—and to send us the clear message that Congress reserved for itself the authority to authorize activities that in any way lessened the essential values for which the USNPS or any of our particular park areas, regardless of designation, were created. This amending legislation states: “The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high value and integrity of the National Park System and *shall not be exercised in derogation of the values and purposes for which these various areas have been established*, except as may have been or shall be directly and specifically provided by Congress” (emphasis added).

As I read the Act and think about what Congress (which *makes* the laws) is saying to us in the Executive Branch (which *carries out* the laws), it is obvious that we in the USNPS have been handed an ethical, moral, and legal imperative to perform our management responsibilities in ways which preserve the natural and cultural resources entrusted to us in the strictest and most enlightened way possible.

Congress has “delegated” to us very few “blanket authorizations” to affect the natural and cultural resources of the parks. By far, the activ-

ity in which we have the most discretion is park development. Congress has left it to us to determine what is appropriate, how much is appropriate, and where it is appropriately placed. Congress has done so in order that we might provide necessary facilities to allow for visitor enjoyment and to manage the park and its visitors while they are there.

Based on the explicit “no derogation” language of the 1978 amendment to the Organic Act, as well as “unimpaired” from the Act itself, I have to conclude that for over 62

years, under greatly different social and environmental conditions, Congress is surprisingly clear in its desire for us to hold the parks as inviolate as possible.

How this conclusion applies to design, construction and maintenance is where the concept—and realities—of sustainable design come into play.

For many years, and especially before Mission 66, the USNPS was respected and revered worldwide for our sensitivity in design. This is not to be unexpected, because the mores and definitions of management philosophy were heavily affected by the landscape architecture profession. Frederick Law Olmsted first defined park development standards in Yosemite Valley, before it became a national park. He, and the American Society of Landscape Architects, were influential in the creation of the USNPS, and in its initial philosophies and policies. Landscape architectural philosophy became USNPS philosophy from the very beginning.

The concepts of rustic architecture, of a visual oneness between park development and the park itself, were of utmost precedence in the early management of the USNPS. We learned, as did everyone else, that we epitomized the ability to design and build as one with the land.

But something has happened in the world since then. In spite of the leadership of George Wright, in spite of the Leopold Report, in spite of the growth and maturation of ecological theory and practice, the large mass of the design world has stuck more to *art* than it has to *science*. This situation is not at all surprising. After all, it is

much easier to *see* the visual effects of something than it is to *know* even the local ecological effects, let alone effects that occur some distance away or over long periods of time.

Today we, and the rest of the design world, are on the leading curl of a new wave, the wave of sustainable design. Sustainable design, as Carol Franklin of Andropogon Associates says, “is not a reworking of conventional approaches and technologies, but a fundamental change in thinking and in ways of operating—you can’t put spots on an elephant and call it a cheetah.”

Sustainable design is truly an addition of science to art and engineering. It is an unfolding of ecological and holistic thinking into what has, up to this time been primarily an aesthetic undertaking combined with engineering expertise to physically allow a given design to be constructed. Environmental considerations, with only occasional exceptions, have to date largely been limited to geotechnical considerations and to accommodating the movement of water, and even then based more on engineering requirements than ecological principles.

Sustainable design is based on deep philosophical underpinnings that surround the morality and ethics of respect. First, respect for the environment, in an ecological as well as an aesthetic sense. Second, respect for all peoples from all times, including their own cultures as practiced and valued by them. And finally, respect for the advancement of knowledge and its rigorous use in arriving at decisions. Sustainable design is not a repudiation of historic parameters of design.

Rather, it is the shedding of past limitations to unfold greater potential for usefulness. To be good at sustainable design, a designer must be good at traditional design. However, being good at traditional design does not necessarily mean one will be good at sustainable design.

To be able to “buy into” sustainable practices of any kind, including design, a practitioner must give up any conscious or unconscious pretense of arrogance, and replace it with a pride based on humility and respect. “Arrogance” as I use it, means believing that human beings are *more* important than anything else on earth. Rather, we are only *equally* important. “Humility” means that each of us believes we are equally important to the rest of what makes up the world, be it forest, ocean, air, a migratory song bird, humans of another color, men, women, rocks, and so on—and that they are equally as important as ourselves. “Pride” means proud to be equal, rather than proud to be better.

In these respects, sustainability is a social, as well as an ecological or cultural precept. The final concept behind sustainable practices is that we must continue to learn, and then apply what we have learned as quickly as possible.

There is a direct relationship here to the Organic Act of the USNPS. Congress expects no impairment, no derogation. They have iterated that statement twice in organic legislation, 62 years apart, and many more times in park specific legislation. To me, that means they are serious about it. And since we know more now than we did in either 1916 or 1978, it seems to me

that “no derogation” is a constantly evolving standard—as we know more, we are obliged to change our ways to incorporate what we know.

Sustainable design is about adding what we know today to what we knew yesterday, about evolving our practices. Therefore, it is not only a philosophy, it is also a standard—but a standard that constantly evolves based on new science that creates the need for new practices. In its most universally accepted common definition, the standard is expressed; the philosophy implied: “Sustainable design is designing to meet the needs of today without compromising the ability of future generations to meet their own needs.”

As discussed in the USNPS’s newly published “Guiding Principles of Sustainable Design” (Denver Service Center, 1993) there are nine basic areas of consideration that must be addressed in and are integral to park development activities.

These are:

1. *Interpretation*: use of the park and the development itself to impart sustainability principles to users.
2. *Natural Resources*: the relationship of the design concepts and the resulting construction to the local, regional and global environment. Nearby and far away effects must be considered through the life of the project and its operation.
3. *Cultural Resources*: the past remains of human activity and existing cultural practices must at the least not be adversely affected, but, rather, enhanced and given further value and protection.
4. *Site Design* must recognize the larger site context, treat landscapes

as interdependent and interconnected, reduce habitat fragmentation, integrate native landscapes, promote biodiversity, reuse disturbed areas, and make a habit of restoration.

5. *Building Design* must (a) be subordinate to the ecosystem and cultural context; (b) reinforce and exemplify environmental responsiveness; (c) enhance appreciation of environment; (d) create a "rite of passage" into a place that is special; (e) use simplest appropriate technology; (f) use renewable indigenous building materials when possible; (g) use cradle-to-grave analysis in decision-making for materials and construction techniques, (h) optimize use and flexibility; (i) identify opportunity for reuse and recycling; and (j) provide full access to people with physical or sensory impairment.
6. *Energy Management* must reduce off-site energy production demands and reduce overall energy consumption.
7. *Water Management* must reduce need and reuse and recycle water in ways that are respectful of availability.
8. *Waste Prevention* must be achieved so as to reduce or eliminate unused end products.
9. *Facility Operations and Maintenance Practices* must reflect a philosophy that, once built, a sustainable facility must be operated with equally sustainable practices.

There are three highly significant efforts related to park management and design going on in the USNPS today which demand to be integrated

with each other to expand the arena of sustainable practices.

The first is the Sustainable Design Initiative which I have described here. The second is research into improving design based on user experience; it is called "user-centered design." It aims to improve design through analysis of how visitors and other users actually use a facility.

The third is a USNPS approach to the "carrying capacity" issue, aiming at developing a useful process by which a park can determine appropriate operating goals and standards to ensure high-quality visitor experiences and a fully protected resource base. Appropriately titled Visitor Experience Resource Protection," this approach is being developed to be analogous to the U.S. Forest Service's Limits of Acceptable Change and the National Park and Conservation Association's Visitor Impact Management processes.

All three of these efforts are important evolutionary experiments and discussions of new approaches to do a better job of planning, designing, and managing parks. All three should be valued equally, studied, debated, and tried, and then monitored and improved. All three should be integrated into the best of our agency's superb past to evolve to a better future.

As a next step, the USNPS also needs to establish and follow sustainable practices in all of its operations. Several activities, a few of which follow, are already underway. The USNPS is engaging in a recycling program with Dow Chemical in several parks. Experimentation with alternative energy vehicles is happening here and there.

Many offices already use only recycled paper. Our integrated pest management program is one of the oldest organized sustainable practices in the government. The Association of National Park Maintenance Employees is working on "green maintenance" initiatives. And much, much more.

The two conclusions of this article are, first, that the concepts of sustainability are part and parcel of the philosophical underpinnings of the Organic Act and its amendments; and,

second, that it is our ethical, moral and legal responsibility to embrace the emerging philosophy, help shape it, and practice it.

To be willing to evolve from our traditional excellence, based on an opportunity to lead in learning to live in a way which lends the highest quality of life to all future generations: I can think of no greater contribution to the planet, and to ourselves, that we could make.



Sustainable Tourism in the Nature and National Parks of Europe

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The nature and national parks of Europe

There are more than 10,000 protected areas in Europe, and they are quite varied. IUCN-The World Conservation Union (IUCN) has identified ten categories of protected areas. They are: (I) scientific reserve or strict nature reserve; (II) national park; (III) natural monument; (IV) managed nature reserve or wildlife sanctuary; (V) protected landscape; (VI) resource reserve; (VII) natural biotic area or anthropological reserve; (VIII) multiple-use management area; (IX) biosphere reserve; and (X) World Heritage Site. Category I (scientific reserve/strict nature reserve) has the highest level of protection. Category II (national park) areas are fully protected and usually state-owned. There are 143 national parks in Europe. These are comparable with North American national parks. However, Category V (the protected landscape) is much more common in Europe, with 1,097 examples at the last count. The ten English and Welsh so-called national parks are in fact Category V protected landscapes! These national parks, unlike American examples, are mainly in private ownership. The significance of the designation is to provide strong legal protection for these areas.

The administrative systems, legal protection, resources, and staff of European nature and national parks vary enormously. Later in this article the Peak National Park is explained, but it is unusual in the strength of its powers and the size of its budget and staff.

The Federation

The Federation of Nature and National Parks of Europe is a non-political independent international voluntary body. It has approximately 200 members from 31 European countries. All the English and Welsh national parks are members. It has a small staff based in Bavaria, Germany. The president for 1993 to 1996 is

Aitken Clark, who is chief executive of the Broads Authority (National Park) in England.

The main aims of the Federation are to:

- Encourage practical co-operation and exchange of information, experience, and staff between national parks and nature parks and

- with other organisations and individuals responsible for nature conservation;
- Promote international joint efforts to establish new parks and to improve the management of existing ones; and
- Disseminate information and technical knowledge on the management of natural and cultural heritage protected within the parks.

It is worth emphasising the *management* of the *natural and cultural* heritage. Within a densely populated European context there are few areas which are not managed and where the centuries of occupation are not part of the cultural landscape which has been protected. For example, the English and Welsh national parks have three aims: the conservation of the area, the provision of opportunities for outdoor recreation, and the interest of the local people. In the Peak National Park alone there are 38,000 residents.

Loving them to death?

The European Federation recognises both the importance and the dangers of tourism for Europe's protected areas. It considered the topic so important that in 1991 it set up its first working group to look at sustainable tourism for protected areas in Europe. The project was supported by the European Commission (DGXXIII) Tourism Unit under its Rural and Cultural Tourism Programme.

The project had four aims:

- To develop guidelines to help managers of protected areas and the tourism sector take a new approach to tourism in and around protected areas.

- To identify case studies illustrating how sustainable tourism is being developed for protected areas and to begin to produce a database of such information.
- To report the current position of sustainable tourism related to protected areas in Europe.
- To recommend the action required at international and national level and within the tourism sector to achieve sustainable tourism.

The working group was chaired by Norbert Heukemes from the Hautes Fagnes–Eifel Nature Park in Belgium. The Countryside Commission of England seconded Rosie Simpson to manage the project. A fourteen-member working group from eleven European countries was set up which included several managers of protected areas together with representatives from the tourism and research sectors and from private governmental and non-governmental organisations. I was privileged to be a member of this group.

We had an interesting working method, as we were attempting to use practical experience of tourist management in protected areas from many parts of Europe. We set up three workshops. They were held in: The Broads, England (covering northwestern Europe); Triglav National Park, Slovenia (covering the Mediterranean area); and Tatra National Park, Slovak Republic (covering Eastern Europe). At these workshops were presented 40 case studies of sustainable tourism projects within the protected areas. Sixteen are used in the published report (FNNPE 1993).

The general conclusions of the report

We first had to decide, What is sustainable tourism? Our definition is: "When tourism is sustainable, the natural and cultural resources and the environmental, social and economic well-being of an area are maintained forever."

Several trends in tourism to and within Europe are apparent. Steady growth (3 to 4.5%) is predicted over the next decade, with tourism to the Mediterranean region expected to double in the next 30 years. There will be a growing demand for holidays based on nature and outdoor activities and for cultural and educational tourism, and an increase in tourism that is "environmentally friendly." At the same time, there will be a 45% increase in the number of cars in Europe over the next 20 years.

We then defined tourism activities that are generally *compatible* with protected areas. First, there are those activities based on the areas' special character and quality, such as appreciating nature or cultural and educational tourism. In general, these activities are quiet and done on a small scale or in small groups. Second are those activities that cause no damage, disturbance, or pollution.

In turn we looked at tourism activities that are generally *incompatible* with protected areas:

- Large-scale facilities associated with organised or mass tourism (for example, time-share developments).
- Activities that are noisy, involve large numbers, or that repeatedly disturb the wildlife (for example, water skiing).

- Skiing and other large-scale sports facilities and events (for example, the impact of the 1992 Winter Olympics on Vanoise National Park in France).
- Motorised recreational activities (for example, motor rallies within national parks).

We realised that protected areas could not be looked at in isolation and that there was a need for *zones* for sustainable tourism in and around protected areas. We defined these as: (i) a sanctuary zone; (ii) a quiet zone; (iii) a zone for compatible forms of tourism without further development; (iv) a zone for sustainable forms of tourism development; and (v) a zone immediately outside the protected area that would be developed sustainably.

Guidelines for sustainable tourism in and around protected areas

Apart from the case studies, guidelines for sustainable tourism formed the core of our report. We were very much aware of the range of skills and experience within different protected areas and therefore set out a fifteen-step process for managers of protected areas (Table 1). Finally we felt there was wider action needed for sustainable tourism in and around protected areas. We recommended stronger legislation and effective enforcement of controls, national strategies and policies for sustainable tourism, a European charter for sustainable tourism operation in and around protected areas, a European action programme for sustainable tourism in and around protected areas, and improved training.

Table 1. Steps in Sustainable Tourism Planning

1. State clear conservation aims.
2. Compile an inventory.
3. Work in partnership.
4. Identify the values and image on which to base sustainable tourism.
5. Assess the carrying capacity and set standards that must be maintained.
6. Survey and analyse tourist markets and visitors' needs and expectations.
7. Identify tourism activities that are compatible with the protected area.
8. Propose "new tourism products" to be developed.
9. Assess the environmental impacts of proposals.
10. Specify the types of visitor management required, such as zoning and channeling, interpretation, and education.
11. Propose traffic management systems.
12. Devise a communications and promotional strategy.
13. Establish a programme for monitoring and review.
14. Assess resource and training needs.
15. Implement the plan.

Case study: Managing Dovedale

One of the most useful parts of the project was the series of case studies which were presented. Sixteen of these are written up in the report and with a contact person in that park who can be reached for further details. The case study of Dovedale in the Peak National Park needs to be set in context.

Figure 1 shows the locations of the national parks of England and Wales. **Figure 2** shows the more detailed location of the Peak National Park. It was established in 1951 with an area of 555 square miles. It has 38,000 people living within its boundaries, and about 16 million more live within one hour's travel time.

The result of its particular location in the north of England, particularly between the conurbations of Manchester and Sheffield, means that the Peak National Park is under the greatest pressure. It has about 22 million visits per year, which makes it the most-visited national park in Europe, and the second-most-visited in

the world. (I believe the Great Smoky Mountains National Park in Tennessee and North Carolina is the most-visited American national park with approximately 9 million visits per year. Yellowstone has about 3 million per year.)

The national park is also under intense pressure for development of housing, recreation developments, and even quarrying. The National Park Authority only owns 4% of the land. About 12% is owned by the large national conservation charity, the National Trust.

The Peak National Park has a board, with one-third appointed by the national government and two-thirds by the local government in the area. It has a budget of about £7 million per year (50% central government, 25% local government, and 25% direct income) and has a staff of more than 200. Apart from the powers which are familiar to North American readers of having information, interpretation, rangers, field staff, etc., the strongest powers are as a planning authority.

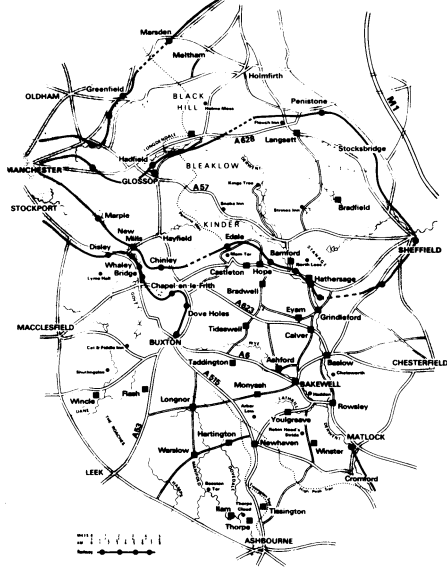


Figure 1. National Parks of England and Wales

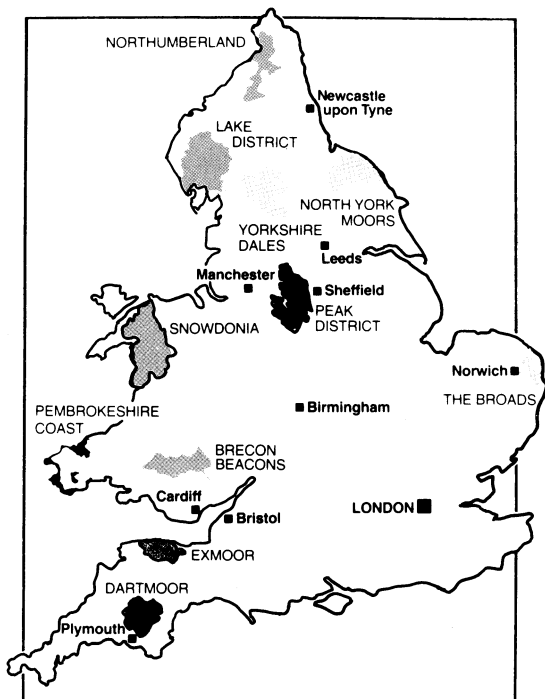


Figure 2. Detailed location of the Peak National Park

Any building in the park has to be authorised by the park authority, and more than 1,000 applications a year are so received. More than 80% of applications are approved, but usually with tight conditions controlling materials, siting, and design. There is an appeal system against refusal. Normally, no compensation is payable for a refusal.

This is the background to the case study of Dovedale, which is a popular beauty spot in the southern part of the National Park.

Too popular for its own good?

Dovedale first became famous 300 years ago after a well-known local figure described it in a book on fishing. The River Dove winds through a series of magnificent limestone dales and then into a deep gorge. The area is tremendously popular, attracting over two million tourists each year, around three quarters of a million of whom walk the Dovedale footpath. As many as 2,000 people an hour use the famous Stepping Stones river crossing on busy Sundays in summer.

Most visitors were arriving by car and parking in a very visible car park. They were causing traffic congestion and parking problems as well as eroding footpaths and valley sides—in a nationally important wildlife and geological site.

Visitors have been a mixed blessing for local people too. Owners of the car park and caravan site and those providing tourist accommodation earn money from them. However, farmers have suffered in their everyday work with problems from traffic jams, trespassers, disturbance to sheep, and lit

ter left by visitors.

Carrying capacity

Park managers could see that the carrying capacity of the valley was being exceeded and that action was needed. Although the national park owns no land in Dovedale, it is responsible for working with landowners and other organisations to make sure that the landscape beauty is conserved. A management plan was produced and discussed with landowners, including the National Trust (the previously mentioned conservation group), as well as with visitors and local people. There was general agreement that action was needed to ease the problems, improve visitor facilities, reduce pressure on the landscape and wildlife, enhance the dale, and help the local community.

Elements of the plan have been implemented jointly by the national park, landowners, and local councils. *Car parking within the dale has been reduced from 750 to 400 spaces* and new, smaller landscaped car parks have been built within three kilometres (Figure 3).

A ten-year scheme of footpath restoration was carried out. An all-weather path was created allowing visitors to enjoy the dale throughout the year without causing erosion. Only natural limestone has been used so that the path blends into the landscape. The work was carried out by local contractors and volunteers.

Traffic management was improved with a total ban on cars at the busiest times. Further improvements will be seen if current proposals are accepted to ban traffic on one stretch throughout the whole year. This will allow easy

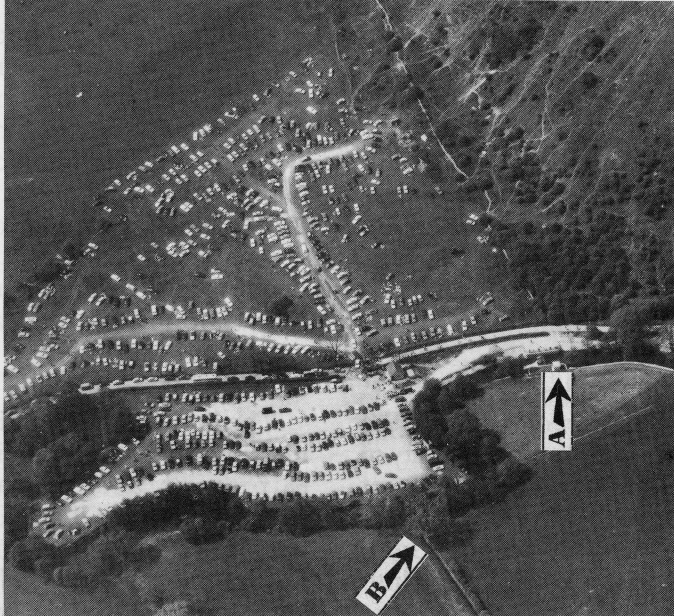


Figure 3. Aerial View of Dovedale Car Park Before and After Reduction (Upper Photograph from 1980, Lower from 1991; Orientation Arrows Point to Same Location in Both)

and safe year-round access for walkers, families (especially those with baby buggies), and people with disabilities. Other aspects of the project include improved ranger services, better public toilets and information for visitors, an environmental education service based at the nearby youth hostel, and the restoration of eroded areas.

Results of the scheme

The scheme has been successful in reducing the number of visitors to the area and in increasing the capacity of the footpath for walkers in a way that is sensitive to the environment. Traffic congestion has been reduced, local peoples' needs have been taken into account, and the nature and landscape of Dovedale has benefitted. The Dovedale project has also demonstrated the value of working in partnership, an approach that involves listening, understanding, discussion, negotiation, and joint funding by all the partners concerned.

A number of key aspects are essential for success: a clear management plan is needed; the park authority must be able to act as a catalyst and co-ordinator for change; and the park or its partners must have the powers, negotiating skills and resources, and will to implement the plan.

Park managers also had the confidence to enable them to reduce the capacity of the area and to restore it. Although only limited information was available on the visitors and ecology of the area, park managers used their professional judgment to take decisions. Sometimes action is needed urgently to make tourism use sustainable and to avoid further damage.

Conclusions

The protected areas of Europe vary in their attractiveness, their exposure to pressure, and the management regimes applied to them. The Federation of Nature and National Parks of Europe tries to bring the best experience to all. The strength of the report *Loving Them to Death* lies in its rich experience of the managers of many of these protected areas, which are for the first time brought together in an attractive report. Sustainable tourism is a fashionable topic at present. The challenge for the Federation is to ensure that the best of standards identified in the report are brought to bear in many of the other protected areas of Europe. That requires political commitment, professional skill, and resources—which are often singularly lacking!

Reference

- FNNPE [Federation of Nature and National Parks of Europe]. 1993. *Loving Them to Death? Sustainable Tourism in Europe's Nature and National Parks*. Diana Shipp (ed.). Grafenau, Germany: FNNPE. [This title is available from FNNPE, Kröllstrasse 5, D-8352 Grafenau, Germany. Telephone 49(0)8552 2839 Fax: 49(0)8552 3242. The price is 30 Deutschmarks.]



A Science Agenda and Strategy for the United States National Biological Survey

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Secretary of the Interior Bruce Babbitt clearly described his vision of a modern National Biological Survey in early 1993 when he said:

The National Biological Survey will produce the map we need to avoid the economic and environmental ‘train wrecks’ we see scattered across the country. NBS will provide the scientific knowledge America needs to balance the compatible goals of ecosystem protection and economic progress. Just as the U.S. Geological Survey gave us an understanding of America’s geography in 1879, the National Biological Survey will unlock information about how we protect ecosystems and plan for the future.

In order to produce the information needed to avoid these catastrophic natural-resource-based clashes, the National Biological Survey will have to prepare inventories of the nation’s biological resources to document where we’ve been, monitor dynamic living systems to identify current trends, and conduct biological research to predict future ecosystem behavior. All of this information must be transferred effectively to governmental agencies, the scientific community, and the public if it is to be useful in influencing public and private policies. Decomposing this complex task into its constituent components requires that we predict those trends in biological systems that will conflict with economic development.

Biotic trends

The rapidly increasing human population in the United States, along with evolving national attitudes toward natural resources, drive several major trends in biotic resources, such as those described below. The pervasive unsustainable consumption of “renewable” resources; fragmentation of habitats; human alterations of air, water and soil; and the spread of alien species require immediate attention to

avert economic, social, and environmental catastrophe. The National Biological Survey must address these issues and use them to frame an agenda to define the next generation of biological inventories, monitoring programs, and research on ecosystem behavior.

The *unsustainable consumption of “renewable” resources* drives populations and communities to failure. For ex-

ample, serial depletion of coastal fishery stocks and harvest of ancient forests in the 19th and 20th centuries supported economic development, but seriously eroded the biological productivity on which continued economic productivity depends. California's red sea urchin fishery, currently the state's largest coastal fishery, provides a graphic example. In southern California, commercial and recreational divers sequentially exhausted a series of five abalone species from 1950 to 1980. In the early 1970s, the commercial fishery shifted to a new resource base, red sea urchins, but was forced to expand into new territory in northern California after less than a decade when stocks began to decline in the mid-1980s. Today, the urchin industry must develop new markets for yet another species, purple sea urchins, to "sustain" the fishery. Ironically, it takes 20,000 metric tons of urchins to provide the same economic return as 2,000 tons of abalone, so even greater biological productivity is required to support the economic status quo. Now, with few *new* forests or fish populations to exploit, we must learn either to restore ecosystem integrity and productivity, or live within the limits of reduced biological productivity.

Land-use practices that fragment habitats erode society's productive resource base when populations and communities collapse from lack of appropriate space, i.e., critical habitat. Habitat fragmentation threatens not only tropical rain forests; throughout North America native ecosystems are being carved into smaller and smaller remnants. Florida's Everglades, the great midwestern prairies, California's

Mediterranean ecosystems, dammed river basins, and intensively developed coastal zones are but a few examples of the seriously fragmented habitats in the United States. Habitat alterations threaten migratory birds and fisheries with the loss of critical marshes and estuaries. The loss of wide-ranging predators that require large expanses of continuous habitat alters ecological community structure and function, thereby precipitating and accelerating loss of biodiversity.

Human alterations of air, water, and soil drive ecosystems toward unstable and less-productive states. Pollution can simplify systems either by reducing species outright or the resources available to various populations. Productivity of individuals and ecosystems may be reduced due to contamination of food and water sources. Pollution stress added to variations in natural stresses, such as weather or parasite levels, may bring communities to crisis conditions.

The spread of alien species causes loss of biodiversity and disrupts ecosystem structure and function. The virtual extinction of native birds on Guam caused by introduced brown tree snakes provides a sobering example of the serious ecological consequences of alien species. Alien species introduced by human activities, both intentional and accidental, are wrecking havoc on native Hawaiian flora and fauna, Floridian aquatic systems, and plant communities across the entire nation.

The NBS science agenda

The National Biological Survey's scientific agenda needs to address the trends described above with directed programs, not simply collections of re-

related projects. Predicting future conditions of biological systems and determining cause-effect relationships to prevent "train wrecks" requires forecasting, based on past trends, information regarding potential conditions (e.g., reproductive efforts, recruitment, and population age structures), and experimental manipulations (research). Putting an astronaut on the moon 30 years ago was relatively easy compared with the task of predicting the future health and conditions of biological resources in America and predicting potential conflicts between their health and human activities. Managing the deterministic physics and engineering processes for space flight is straightforward compared with accurately anticipating the behavior of complex biological systems that are fundamentally probabilistic functions.

Resources and time frames of NBS endeavors need to reflect the magnitude and complexity of its mission. Even though significant national biological inventories and monitoring programs exist, such as the NWI, BEST, and NAWQA, it is not reasonable to assume that all of the required information about biological resources in the United States is currently being collected and only needs requires organizing by NBS so as to be useful. In fact, the methods for collecting much of the necessary information do not yet exist and must be developed by original research on ecosystems and population biology. NBS needs to lead the exploration of ecological restoration, develop ecosystem monitoring protocols, improve understanding of population viability, invent ways to predict ecosystem behavior,

and explore adaptive ecosystem management, as well as coordinate the myriad sources of information already in place.

NBS must develop *ecological restoration techniques*, because we are well beyond the point of merely managing the remaining system fragments to extract the last sustainable yields, or simply reducing impacts, and hoping systems will self-heal. We must learn to restore ecosystem productivity through creative development of original concepts, such as designating marine wilderness to replenish fisheries, achieving better fire prescriptions, and beginning innovative landscape alterations and watershed manipulations. NBS must develop better *measures of ecosystem dynamics and processes*, i.e., institutionalize techniques to monitor the ways in which populations change over long time intervals and at large geographic scales. NBS must develop a better *understanding of population viability* to know how populations are maintained and what they require to survive. NBS must develop the ability to *predict ecosystem behavior* and understand the relationships among environmental conditions and population dynamics. Techniques for making measurements and modeling processes are well-developed for small scales (site or field measurements, plants, small populations, small community models), and very large scales (satellite remote sensing of plant cover, global climate models). However, because many issues require landscape-scale understanding, NBS must develop the *means for transferring information among scales*. Finally, NBS must develop *adaptive management* approaches that recognize the experi-

mental nature of ecosystem management.

National focus

As Machiavelli warned his prince, a new organization that seeks to change established ways of conducting business has few allies. To overcome this potential handicap, the NBS could use the National Park, Wildlife Refuge, and Wilderness Systems to expand national attention from these highly regarded components of the national heritage to the nationwide plight of biotic resources. Using these exceptional public lands as examples of NBS efforts to emphasize cooperation among agencies and to achieve balanced environmental protection and economic progress will also enhance NBS credibility and relevance with the public. National park managers have long sought to adopt an ecosystem management approach, but rarely have they achieved success until recently. NBS-led research in the parks and refuges, applied to ecosystem management by on-site managers, could effectively demonstrate the advantages of using ecosystem-level research and monitoring to assure *sustainable* development and avoid environmental "train wrecks" by providing real-life examples of ecosystem management.

The National Park, Wildlife Refuge, and Wilderness Systems are integral parts of American society and its natural resource base. These areas are rapidly becoming islands of quasi-natural habitat in a sea of development. The contrast in resource conditions across park and refuge boundaries in-

tensifies conflict over often-painful local resource allocations. The parks, refuges, and wilderness are environmental microcosms at the leading edge of society. As we learn to "save" the "crown jewels" of our natural heritage, we can learn to sustain development and assure economic prosperity based on long-term environmental stability.

Today, national parks are more than the pleasuring grounds envisioned by their 19th-century American creators. In addition to providing opportunities for outdoor recreation, sources of inspiration, and emotional retreats from stressful modern life, they are also repositories of the nation's heritage of biological diversity. They protect diversity of everything from genotypes and populations to ecosystems and landscapes. America's wilderness areas are remnants of native ecosystems that may serve as measures of environmental and economic soundness that help set societal goals for sustainable development. National parks are also focal points for public and scientific concerns, and have historically supported scientific activities with their existing infrastructure.

If the pioneers of the National Biological Survey focus on the National Park, Wildlife Refuge, and Wilderness Systems as they chart a course to help the nation balance environmental protection with economic progress, they will not only resolve critical issues for these special areas, they will also help realize the potential of wildlands to resolve society's broader environmental issues and produce truly sustainable economic development.



Is the U.S. National Park Service Ready for Science?

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It is becoming increasingly evident that we are entering into a period of rapid change in American society. This process will be at least partly driven by pressures from a world population explosion and competition for remaining resources. Every day the world's population increases by some 240,000 people. The United States's annual growth rate of 0.81% ranks near the top for industrialized nations, resulting in almost two million additional Americans every year. Emigration is expanding the array of ethnic diversity and the accompanying variety of views and perceptions regarding cultural and economic values.

An equally impressive rate of change is occurring in science and technology, allowing the industrialized nations to explore new avenues of economic growth and changes in lifestyle. We can only speculate about where these changes will lead the United States, but we can be quite sure that government at all levels, including the U.S. National Park Service, is going to be affected by these changes, and in some cases will, by necessity, be instruments of change. It is essential that all of the U.S. government agencies responsible for land and resource stewardship closely examine how their current mission may be affected and how the mission itself may be required to change.

A shift in mission paradigm

One of the most fundamental questions relating to change in the USNPS is the repeated call for the agency to make a major shift in the basic interpretation of its mission. The USNPS has been receiving a strong message from the scientific community, segments of the public, and the Congress that it is past time for the agency to change from a primarily public-use/service management paradigm to a resource stewardship paradigm. Although a gradual shift in this direction has occurred at the park and regional level as a result of enlightened management driven by severe resource threats, this has been largely a "bottom-up" process. A major shift in

USNPS policy, driven from the top, has not yet occurred. The bulk of funding and staffing still is focused on the day-to-day public-service operation functions in the parks.

Many of the benefits that would be derived by the USNPS shifting to a resource stewardship paradigm based upon sound scientific principles have been recognized for at least three decades. The actual need for an institutional shift to this paradigm has become increasingly urgent as the years of inaction have passed and each succeeding blue-ribbon panel report and commission analysis suggesting this shift has been placed on the shelf. Jonathan Jarvis, in a recent article in *Park Science* titled "Action vs. Rhetoric: Resource Management at the Crossroads," provided an excellent summary of the various studies and reports that have been completed to date. Although the Vail Agenda does not explicitly call for a major shift in agency focus, it does state that "The primary responsibility of the National Park Service must be the protection of park resources".

The 1992 National Research Council (NRC) Report, *Science and the National Parks*, prepared by the Committee on Improving the Science and Technology Program of the National Park Service, presents an excellent discussion of "Conservation Amidst Change" in the USNPS. This profoundly insightful analysis of the formation of the basic USNPS interpretation of the 1916 Organic Act mission statement illustrates the continued USNPS emphasis on a passive style of resource stewardship focused on maintaining the status quo for recreational enjoyment, in spite of repeated

calls for change. This discussion ends with the statement that, "unfortunately, these repeated exhortations [to change to a more scientific and aggressive management style] have gone largely unheeded, even though they are all the more relevant today. And even where action has been undertaken, it has been marred by inconsistent administrative support and fluctuating budgets." The Committee determined that the primary reason for this failure to respond to the call for change is that "the USNPS remains an agency guided strongly by tradition" and the original philosophical tenet of passive management focused on public service and recreation.

(The NRC report should be required reading for every USNPS employee. The second reading is even better than the first.)

Science and the stewardship paradigm

A critical element in successfully breaking through the "tradition barrier" and pursuing the stewardship mission paradigm is the immediate improvement of the agency's science capability. This is essential to achieve credible research and resource management programs and bring about an improved understanding and appreciation of the value of good science to park management. National parks must now be managed in a complex local and regional context that requires an in-depth scientific understanding of park resources. Development of this understanding will provide the foundation for the effective application of USNPS stewardship policy. As of this writing, the critically needed focus on science as the basis for park management has not oc-

curred. After careful analysis, the NRC report found that "little meaningful and consistent action has been taken by the National Park Service in response to repeated recommendations for a substantially stronger research [science] program."

During this period of post-Vail Symposium self-evaluation, and change in USNPS and Department of the Interior leadership, it is critical that positive action be taken now to provide a science base to support the agency's resource stewardship mission requirements.

Science and resource management

In July 1993, the USNPS director, Roger Kennedy, asked the National Park System Advisory Board to re-evaluate the recommendations made in the NRC Report in light of the formation of the National Biological Survey (NBS). One of the recommendations found in the committee's ensuing report, titled "Science in the National Parks, Adapting to Change," was that, in light of the transfer of most of the agency's research-grade scientists to the NBS, the USNPS had to make an even stronger commitment to developing not just a strong research program, but a strong applied science program in the parks. As far as the biological sciences are concerned, these resource management programs would have to be developed and managed primarily by park resource management staff.

This worries a lot of park managers, particularly those of the larger national parks. When the final decision was announced that all of the biological science research personnel stationed in the parks, Cooperative Park

Study Units (CPSUs) and central offices would be transferred to the NBS, many superintendents became very concerned about the impact this would have on the future quality and "scientific credibility" of their resource management programs.

It seems that although research-grade scientists are evaluated on the quality of their research and publications, many park-based research staff have been serving as senior science advisors to the park superintendent and have also been deeply involved in resource management operations. There has been a reason for the evolution of this situation. In general, the research grade evaluation (RGE) system supports a grade structure reaching GS-15 and therefore attracts and retains highly educated and qualified scientists. Resource management staff fall under the General Schedule (GS) pay system. The GS classification system rarely supports non-supervisory grades at the park level above GS-11. Although the USNPS has some skilled and dedicated resource managers, most of them are graded from GS-7 to GS-11 and very little training and career development has been offered to enhance the basic skills that they brought to the job. They have also been spread so thinly that they rarely have had the time to address the larger strategic resource management needs of the parks. Therefore, there has been a natural reliance by superintendents on the higher-graded research staff that are recognized experts in their field.

There is a well-founded fear that the loss of these high-graded, highly competent RGE employees from park and regional staffs will leave an sub-

stantial gap in the scientific capability of many park, regional, and agency-wide natural resource programs.

Many park managers are now finding that a strong reliance on RGE staff to support resource management programs was not a good policy, although at the time it might have been perceived as the only good alternative. Considering the repeated recommendations of past review commissions on science and resource management needs of the parks, many observers question why the USNPS didn't start the process of building a scientifically credible resource management program carried out by park biologists and other "applied scientists" decades ago. In retrospect, RGE staff should have been focused on obtaining new information on emerging issues and the resource management staff capability should have been continually expanded and improved to apply this new information to prepare and execute both tactical and strategic resource management programs. Although some limited progress has been made as a result of implementation of the natural resource trainee program, the recent development of the agency's inventory and monitoring pilot park program, and scattered heroic efforts made by individual USNPS regions and parks during the past decade, in general, the development of strong resource management capabilities based on sound science has not occurred. Now we have a crisis situation in some parks that relied heavily on the expertise of their RGE staff to address resource issues.

Is the USNPS ready for science?

So now what? We have had every blue-ribbon advisory group, every ma-

jor national conservation organization, thousands of concerned citizens, and even the Congress tell the USNPS that the agency must get on with the job of building a scientifically credible resource management capability so that management of parks is driven and supported by sound science. Where do we go from here? Is the USNPS finally ready for science?

As of this writing the answer is not yet clear. In spite of numerous lawsuits and admonitions from friends and critics alike, there is no definite signal that the USNPS has yet made the commitment to become a resource stewardship agency. Recently, a very well respected agency watcher was overheard as saying that "The USNPS brain is moribund." I guess this is a straightforward way of saying that the USNPS has a substantial institutional inertia (in the form of tradition) to overcome to bring about any meaningful change in the fundamental management strategy. On one hand, there are forces within the agency that advocate a return to an even more basic traditional style of management. In contrast, there is another, growing group of superintendents and resource managers that have come to understand the essential need for management based on sound scientific information. The USNPS seems to be poised (or balanced) on this decision point. It is to be hoped that one of the leading questions currently being reviewed is, *Is the USNPS ready to adopt a resource stewardship paradigm based on science that looks to the future and insures the ecological integrity of the parks?* If the answer is "yes," then the obvious follow-up question is, of course, "How can it best be achieved?"

Resource stewardship

There has never been a greater opportunity for the USNPS to embrace the concept of resource stewardship. The term "resource stewardship" rather than "resource management" or "protection" seems more appropriate to describe the USNPS mission, because it connotes a long-term commitment to sustaining, not just the fabric, but the very integrity of the parks, be they one of the last great natural places or a piece of our cultural heritage. In addition, "stewards" are acting on behalf of someone else, in this case the American public. The USNPS managers must view themselves not just as the day-to-day protectors of the parks, but as stewards with a vision, a vision of the public value of the National Park System in the year 3000.

To initiate evolutionary change and achieve this vision, the USNPS must first find the will to do so. The will of the USNPS is greatly enhanced or slowed by the level of support throughout the Administration and in the Congress. At all levels the support is now there. Never before in the history of the USNPS has the potential support for ecologically and scientifically sound park stewardship been so great. This is indeed an astrological window. All of the planets are lined up to allow for, if not a cosmic event, at least a significant turning point in the management philosophy of the US NPS. This may be the only time in the history of the agency that the agency itself is the only obstacle to accomplishing this shift.

Elements of a successful resource stewardship mission

Much needs to be done. The fol-

lowing are some of the key recommendations that have been made to date.

- USNPS managers, at all levels, must realize that we are entering into an even more complex government service arena that demands a management sophistication equal to that found in the private sector. The parks can no longer be managed in isolation. Superintendents must have sufficient understanding of park resources and greater ecosystem processes in order to integrate park and regional resource protection strategies.
- The USNPS must recognize that an effective and responsive science program is essential to understanding park resources and developing sound stewardship strategies.
- The USNPS should adopt and quickly move forward with the recommendations of the NRC Science and the National Parks report and those of the National Park System Advisory Board.
- The USNPS must develop an understanding of the strengths and weaknesses of its internal culture. The ingrained bias that prevents the formation of science-based programs must be overcome through the careful and thoughtful application of senior-level leadership.
- The USNPS must adopt the highest standards for science, including minimal recruitment standards for new resource managers and science advisors, and a well-defined program of training and professional development to maintain a high-quality staff capability. Many

of these recommendations are detailed in the draft Natural Resources Professional Development Program document.

- An organizational structure throughout the USNPS should be established that assures a career ladder for scientists (resource managers and RGE staff) from entry level through the supervisory levels into top management.
- A high priority must be given to creating resource management organizations in the larger parks that include an adequate staff of biologists, ecologists, hydrologists, and other scientists of sufficient professional capability to address resource issues and obtain scientifically credible answers to difficult questions.
- Parks with complex and or controversial resource issues that requires a substantial research program should consider establishing a position of senior science advisor. This person would assist the chief of resource management in obtaining needed research and would also serve as the senior science advisor and principal liaison with the research community.
- A major effort is needed to obtain additional staffing and funding for

science positions, particularly in the parks. In addition, upper level management should encourage superintendents to adjust the priorities of existing funding to support the greatest stewardship needs and prepare long-term stewardship strategies to continue to improve each park's scientific management capability.

- An agency-wide educational program is needed to bring about an understanding, at all levels and in all disciplines, about the critical necessity for the acquisition of sound scientific information to support park management.
- Rangers and interpreters throughout the USNPS should be called upon to educate the public about the relationship of science to perpetuating park ecosystems and preserving cultural resources.

The discussions in this article certainly do not contain all of the answers, nor have they even asked all of the needed questions, but the achievement of these ten elements should go a long way to prepare the USNPS to fully embrace science as an integral part of the resource stewardship process. *The question still remains: Is the USNPS ready?*



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