THE GEORGE WRIGHT
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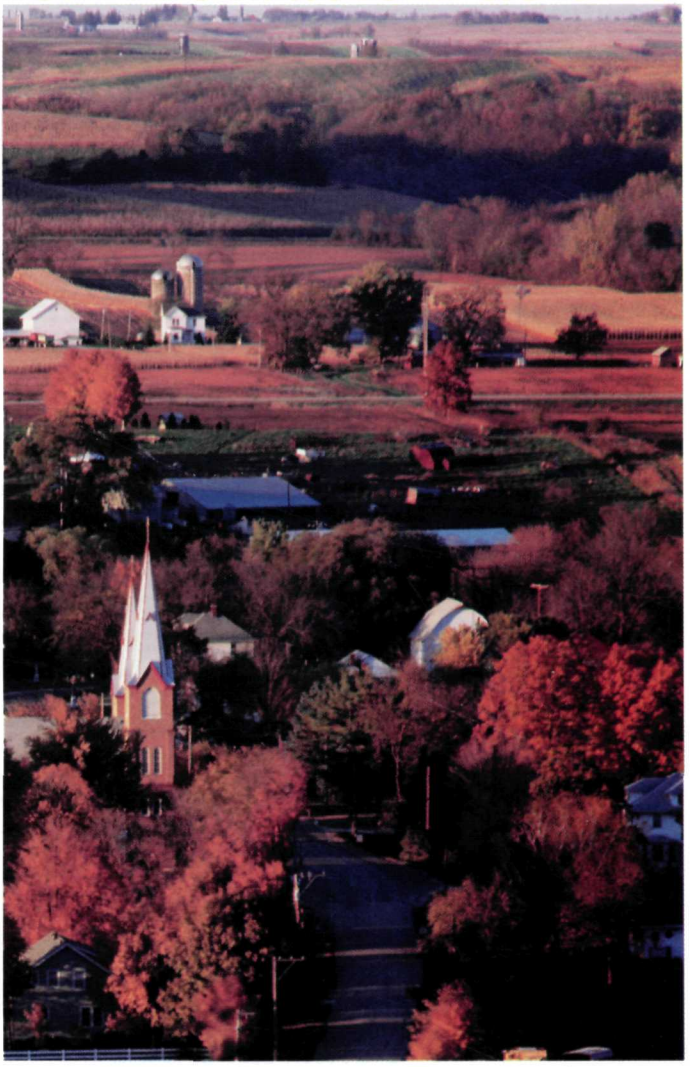
Conservation at the Landscape Scale



Origins

Founded in 1980, the George Wright Society is organized for the purposes of promoting the application of knowledge, fostering communication, improving resource management, and providing information to improve public understanding and appreciation of the basic purposes of natural and cultural parks and equivalent reserves. The Society is dedicated to the protection, preservation, and management of cultural and natural parks and reserves through research and education.

Mission

The George Wright Society advances the scientific and heritage values of parks and protected areas. The Society promotes professional research and resource stewardship across natural and cultural disciplines, provides avenues of communication, and encourages public policies that embrace these values.

Our Goal

The Society strives to be the premier organization connecting people, places, knowledge, and ideas to foster excellence in natural and cultural resource management, research, protection, and interpretation in parks and equivalent reserves.

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On the cover: Aerial view of Silos and Smokestacks National Heritage Area, Allamakee County, Iowa.
Photo courtesy of National Heritage Areas Office, National Park Service

SOCIETY NEWS, NOTES & MAIL

GWS Celebrates 25th Anniversary in Philadelphia

This year marks the 25th year of the George Wright Society, which was founded August 18, 1980, by Bob Linn and Ted Sudia. The occasion was marked at the GWS2005 Conference in Philadelphia (see next item) during a celebratory dinner. GWS Board member Bruce Kilgore gave a moving remembrance of Society co-founder Bob Linn, who died last fall, and fellow Board member Jerry Emory eloquently summarized the accomplishments of George Wright to remind the audience of the reasons why our society is named for him.

Over 750 Attend GWS2005 Conference

"People, Places, and Parks: Preservation for Future Generations," the 2005 George Wright Society Conference on Parks, Protected Areas, and Cultural Sites, drew over 750 people to Philadelphia in mid-March for a stimulating week of discussion, debate, and camaraderie. Attendance was close to the record level achieved in 2003 in San Diego, despite very tight travel budgets. Four well-attended plenary sessions, over 130 concurrent sessions, a jam-packed poster and computer demo session, and numerous special events made up the week's activities. A highlight of the week was the launching of the George Melendez Wright Student Travel Scholarship, which provided assistance that enabled 30 students from under-represented groups to attend.

If you were unable to join us in Philadelphia, you can see what you missed by sending us a check for $2.00 to cover postage and we'll be glad to mail you a copy of the 180-page program and abstracts book. A conference proceedings also is in the works.

2005 GWS Board Election: Two Seats Open

Nominations are now being accepted for the 2005 election for the Society's Board of Directors. Board members Bruce Kilgore and John Reynolds have decided not to seek a second term, and so their two seats are open. We are now accepting nominations from GWS members who would like to be candidates. The term of office runs from January 1, 2006 through December 31, 2008. Nominations are open through July 1, 2005. To be eligible, both the nominator and the potential candidate must be GWS members in good standing (it's permissible to nominate one's self). The potential candidates must be willing to travel to Board meetings, which usually occur once a year; help prepare for and carry out the biennial conferences; and serve on Board committees and do other work associated with the Society. Travel costs and per diem for the Board meetings are paid for by the Society; otherwise there is no remuneration. Federal government employees who wish to serve on the Board must be prepared to comply with all applicable ethics requirements and laws; this may include, for example, obtaining permission from one's supervisor, receiving ethics-related training, and/or obtaining a conflict of interest waiver. The Society can provide prospective candidates with a summary of the requirements.

The nomination procedure is as follows: members nominate candidates for possible inclusion on the ballot by sending the candidate's name to the Board's nominating committee. The committee then, in its discretion, determines the composition of the ballot from the field of potential candidates. Among the criteria the nominating committee considers when determining which potential candidates to include on the ballot are his/her skills and experience (and how those might complement the skills and experience of current Board members), the goal of adding and/or maintaining diverse viewpoints on the Board, and the goal of maintaining a balance between natural- and cultural-resource perspectives on the Board. (It also is possible for members to place candidates directly on the ballot through petition; for details, contact the GWS office.) To propose someone for possible candidacy, send his or her name and complete contact details to: Nominating Committee, The George Wright Society, P.O. Box 65, Hancock, MI 49930-0065 USA, or via email to info@georgewright.org. All potential candidates will be contacted by the nominating committee to get background information before the final ballot is determined. Again, the deadline for nominations is July 1, 2005.

New & Noteworthy

- **NPS retirees issue "Call to Action."** The Coalition of Concerned National Park Service Retirees, which has been vocal and persistent in its criticism of the Bush Administration's policies for the National Park System over the past few years, issued a major report in the fall of 2004 titled "A Call to Action: Saving Our National Park System" that summarizes many of its concerns on privatization, budgeting, and more. In addition, the "Call to Action" lays out some of the organization's ideas on what needs to be done to return the System to what, in its view, is the proper course. The report can be viewed or downloaded at www.npsretirees.org.
- **Pitcaithley speaks about Vietnam memorial.** In January, NPS Chief Historian and GWS President Dwight T. Pitcaithley attended an international conference in Ghent, Belgium, titled "Memory and Identity." He presented a paper on the Vietnam Veterans Memorial, its relationship (physically and emotionally) to other memorials and monuments on the National Mall, and its place in the still-contested memory of the war. Pitcaithley approached the paper from his perspective as a historian and as a combat veteran who served in Vietnam in 1966. He shared the conference session with a representative from the Ministry of Culture, Republic of Vietnam.
- **Harmon to head WCPA region.** In February, GWS Executive Director Dave Harmon was named regional vice chair for North America of IUCN's World Commission on Protected Areas. This is the principal international voluntary network of professionals working in protected natural areas. Harmon will be responsible for organizing the North American roster of volunteers to carry out WCPA's work plan over the next four years. The work plan will draw from actions agreed to at the fifth World Parks Congress (Durban, South Africa, 2003) as well as the recent World Conservation Congress (Bangkok, Thailand, 2004) and the protected areas program of the Convention on Biological Diversity.
- ***The International Journal of Biodiversity Science & Management.*** This newly launched quarterly publishes articles on all aspects of biodiversity, from basic research to

modeling, management and policy. Contributions addressing natural and semi-natural ecosystems, agricultural, urban and forested systems, fisheries, and biotechnology, and particularly those that integrate data across temporal and spatial scales, are welcomed. Articles may be either interdisciplinary or drawn from fields such as landscape ecology, biochemistry, genetics, conservation and development, tourism, participatory management, indigenous peoples and their knowledge, cultural, religious uses and values, trade and environment, and law and policy. Details at www.sapienspublishing.com.

- ***Miller wins NPS award for excellence.*** Abby Miller, the Society's vice president, was recently honored with the 2004 National Park Service Director's Award for Professional Excellence in the field of natural resources. Miller received this major award at a ceremony held at the 2005 GWS Conference in Philadelphia. She was recognized for her career-long contributions to fostering natural resource science and management in NPS, and particularly for her instrumental role in organizing and administering the agency's national program, including the Natural Resource Challenge. Miller, who retired from her post as deputy associate director for natural resource stewardship and science just prior to the conference, will continue her work on the Board. She is serving her second term.

CONSERVATION PRACTICE AT THE LANDSCAPE SCALE

DANIEL N. LAVEN, NORA J. MITCHELL & DEANE WANG, guest editors

Examining Conservation Practice at the Landscape Scale

Daniel N. Laven, Nora J. Mitchell, and Deane Wang

Introduction

TODAY, MANY CONSERVATION EFFORTS OPERATE AT THE LANDSCAPE SCALE. This large geographic scale for conservation practice has developed for several reasons. First and foremost, the fields of conservation biology and landscape ecology indicate that effective conservation of biota that have extensive home ranges or migrate over large territories requires a landscape-scale approach to protecting these organisms (Forman and Godron 1986). Concurrently, there has been an increased recognition of cultural landscapes and associated understanding of the value of traditional land use and practices that have created regionally distinct areas (Alanen and Melnick 2000; Rössler 2000; Phillips 2002; Barrett and Mitchell 2003; Fowler 2003; Harmon and Putney 2003; UNESCO World Heritage Centre 2003). Finally, there is a growing awareness that the inherent linkage between nature and culture manifests itself in a complex pattern at the landscape scale, ranging from a mosaic of wild and managed spaces (Harmon 2002; Brown, Mitchell and Beresford 2005) to broad gradients from urban to wildland (Bradley 1984). Experience has also illustrated that conservation strategies across this diverse set of land uses and social contexts can be complementary and mutually reinforcing especially when considered in a broader biophysical and cultural landscape-scale framework (Phillips 1998; Beresford and Phillips 2000; Mitchell and Buggey 2000; Minteer and Manning 2003;).

A landscape-scale approach has begun, in many places, to successfully achieve conservation goals; however, many challenges remain. For many contemporary researchers and practitioners, landscape-scale approaches represent substantial shifts in conservation thought and practice (Minteer and Manning 2003; Phillips 2003). Establishing government-administered protected areas has been a cornerstone of conservation in many countries around the world, beginning in the United States with Yosemite (originally set aside as a state reserve in 1864) and Yellowstone (in 1872) national parks. Yet it is now widely acknowledged that many protected area boundaries do not encompass the scale necessary for ecological processes or the scope required to represent the full story of cultural heritage. In addition, this strategy of designating areas to be protected, as important as this has been and continues to be for con-

servation, has often resulted in isolated "islands" of partial protection embedded in a landscape impaired by fragmentation and habitat loss (Harris 1984, Robinson et al. 1995, Shafer 1995, Bissonette 2002). For this reason, ecologists urged a broader network approach that featured networks across a landscape mosaic (e.g., Dyer and Holland 1991), and in 1998 the World Conservation Union (IUCN) emphasized the importance of transitioning from "islands to networks" (IUCN unpublished report, cited in Phillips 2003). To build effective networks over larger landscapes does, however, require new strategies and innovative collaboration across disciplines and political and ecosystem boundaries.

Lessons from the landscape of experience

During the last fifteen years, there has been an emergence of collaborative models that involve a diversity of stakeholders and interests that operate at different and often overlapping scales across large biocultural regions (Wondolleck and Yaffe 2000; Brunner et. al. 2002; Brown Mitchell, and Tuxill 2003; Tuxill, Mitchell, and Brown 2004; Brown, Mitchell, and Beresford 2005). As a result, collaborative efforts with diverse sets of partners are now filling roles once played exclusively by state and federal entities (Brick, Snow, and Van De Wetering 2001).

Given this current surge of interest in landscape-scale conservation, it is timely to examine recent experience. In fact, the genesis of this thematic issue of *The George Wright Forum* is an annual lecture series, titled "Conservation at the Landscape Scale: Emerging Models and Strategies," which seeks to share knowledge about new approaches. The series is cosponsored by the National Park Service Conservation Study Institute and the Rubenstein School of Environment and Natural Resources at the University of Vermont (for additional information and an archive of lectures, please visit www.uvm.edu/conservationlectures or www.nps.gov/csi).

This thematic issue of the *Forum* describes a number of large-scale conservation initiatives. Five case studies are included, ranging from cross-international boundary work in the northern Appalachians (Emily Bateson) and the Rockies (Charles Chester) to the conservation efforts of the regional watershed of the Potomac (Glenn Eugster); and from the cultural heritage of America's distinctive regional landscapes (Brenda Barrett) to the biodiversity of the Brazilian Atlantic forest (Gustavo A. B. da Fonseca et. al.).

Brenda Barrett illustrates the landscape-scale strategy embraced by national heritage areas, which are collaborative initiatives where the National Park Service is one of many partners. Although many heritage areas are initially driven by conservation of cultural resources, many areas also embrace ecosystems such as riverways. This strategy relies on the notion of heritage to link people to landscapes through a common vision, while integrating conservation goals with economic and community development interests. In the next paper, Glenn Eugster describes the identity of the Potomac region for a diverse set of residents and stakeholders, reviews the challenges, and begins to shape a way forward that recognizes the scale and diversity of the place.

The remaining papers adopt international perspectives and explore landscape-scale initiatives in the context of biodiversity conservation. Charles Chester's paper provides an abbreviated history of transbor-

der conservation in North America. From this context, he analyzes the Yellowstone to Yukon Conservation Initiative (Y2Y), and concludes by offering lessons learned for landscape-scale conservation from this experience. In the following paper, Emily Bateson introduces a similar, newer transborder effort in a region that spans the Canada–U.S. border from Nova Scotia to New York. Although Two Countries, One Forest (2C1 Forest, or "to see one forest") is still in its formative stages, this initiative builds on the Y2Y experience by creating a unifying vision and framework for the ecological health of the Northern Appalachian region. The next paper by Gustavo A. B. da Fonseca and colleagues argues that the conservation of biodiversity hotspots is most effective in a landscape-scale context. They make a compelling case for broadening the focus of conservation planning to the landscape level. Doing so, they argue, will greatly increase opportunities to integrate conservation and sustainable development goals by addressing ecological and economic dynamics together. The final paper, by Jeffrey McNeely, reminds us that past trends in conservation are but one indicator of the future, and he challenges us to think more deeply in imagining new directions. McNeely describes the recent IUCN experience with scenario planning as one tool for encouraging dialogue among diverse interests in thinking about a shared future. Clearly, the ability to engage diverse stakeholders is critical for landscape-scale efforts given their reliance on partnerships and collaboration.

Concluding remarks

This varied set of examples illustrates the complexity, multiple benefits, and urgent challenges of landscape-scale conservation, while also identifying a wide range of elements that contribute to success. These models require network building, new forms of partnerships, and, in some cases, new forms of governance (Goldsmith and Eggers 2004; Tuxill, Mitchell, and Huffman 2005). Recent experience also suggests that successful landscape-scale efforts can integrate ecological, cultural, and recreational values with economic and community development. It is key that conservation strategies be integrated more fully into development plans and future visions for a region. As a broader range of values are considered as part of large-scale efforts, it will be important to find ways to integrate multiple perspectives and objectives and to engage new constituencies.

Acknowledgments

The editors of this thematic issue thank their colleagues at the University of Vermont—Steve Libby, Walter Poleman, and Robert Long—who have discussed the topic of landscape-scale conservation and have worked together to plan the last three lecture series on this topic. We also acknowledge our colleagues and co-sponsors of the lecture series, including Glenn McRae at the Snelling Center for Government, Bob Costanza and Marta Ceroni at the Gund Institute for Ecological Economics and University of Vermont, Jessica Brown at QLF/Atlantic Center for the Environment, and Megan Camp at Shelburne Farms, Vermont. Finally, we thank Mike Soukup of the National Park Service and Ted Smith of the Kendall Foundation for their support of this issue and the associated lecture series.

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National Heritage Areas: Places on the Land, Places in the Mind

Brenda Barrett

Introduction

HERITAGE AREAS ARE NOT A NATIONAL PARK SERVICE DESIGNATION. The development of a heritage area initiative is a locally driven strategy by which a region identifies its common values and its heritage. This strategy is distinguished by its collaborative nature, working across boundaries both political and disciplinary, to create a common vision for a region based on its shared heritage. It gives residents of a region a sense that they can determine the future, and that it will be a more valuable future if it builds on the past and includes the landmarks and stories that gives the place a sense of continuity. Heritage areas may encompass watersheds, regional landscapes with a distinctive culture, and political subdivisions, but whatever the underlying heritage values, they are first understood and mapped in the minds of the people who live there.

Over time, funding, support, and recognition for these special regions have been sought from the national, state, and local level. The National Park Service (NPS) assists a collection of twenty-seven[1] congressionally designated national heritage areas (along with many other areas that have sought NPS aid). While these twenty-seven areas do not represent the full range of possible heritage initiatives, they offer a good starting point to examine the demographic and geographic factors that have served as the cradles of heritage area development.

Water and waterways

The earliest NPS designations—Illinois & Michigan Canal National Heritage Corridor, John H. Chafee Blackstone River Valley National Heritage Corridor (Figure 1), and Delaware and Lehigh National Heritage Corridor—started with a working waterway as an organizing principle. The National Park Service, with its conservation mission, its historic preservation program, and the more recent community-based Rivers, Trails and Conservation Assistance (RTCA) program, was a natural partner.[2] These corridors all contain the remains of historic canals and other waterpower systems from an earlier age. These regional resources had already attracted the interest and support of the adjacent communities and affinity groups. Watercourses are also the centerpieces of many of the more recent national heritage areas; for example, Hudson River Valley National Heritage Area, Schuylkill River Valley National Heritage Area (Figure 2), and Yuma Crossing National Heritage Area on the Arizona–California border that features the Colorado River with a story of transportation and irrigation (Figure 3).

River corridors and canals often flow

across jurisdictions and require intergovernmental cooperation. Waterways are powerful attractions as they offer recreational amenities for walking, boating, and contemplation. Through heritage areas, communities are rediscovering waterways in their backyards and turning them from polluted backwaters into focal points for fun and learning.

Relict lifeways

Not every heritage area has a watercourse, but all are working landscapes and almost all are communities that are under stress. They are places that are losing or have lost their traditional economic base and are facing a loss of population, particularly young people. Many areas have the historic infrastructure of extinct or dying industries or long-outmoded transportation systems, and some still bear the scars of resource extraction. Quinebaug and Shetucket Rivers Valley National Corridor has a wealth of textile mills, most still magnificent and most still underutilized. Essex National Heritage Area interprets the long-past age of sail and the troubled fishing industry of this part of the New England Coast. Several areas are not just working landscapes, but worked-out landscapes, like those areas that tell the heritage of anthracite coal mining in the Lackawanna Valley in Pennsylvania and bituminous coal mining in the southern part of West Virginia. Rivers of Steel focuses on the Pittsburgh steel story and hopes to preserve a few landmark furnaces of what were once miles of mills on the banks of the three rivers' navigational system. Only the Automobile National Heritage Area, represented by the "MotorCities" region in Michigan, and Silos and Smokestacks in northeastern Iowa, still have a strong economic reliance on the traditional industries of the region.[3]

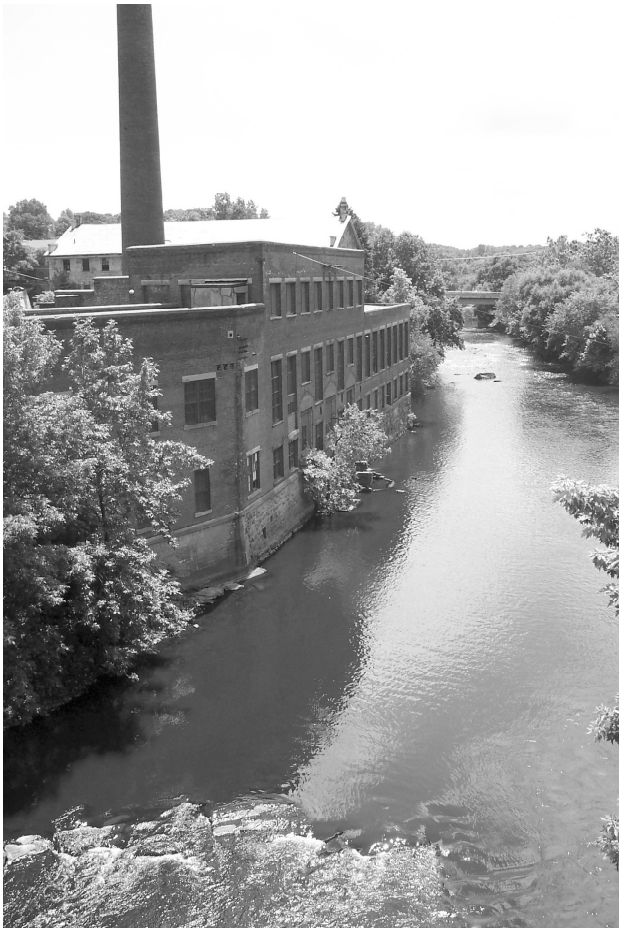

Figure 1. Mill in Woonsocket, Rhode Island, along the Blackstone River Valley.
Photo courtesy of Natural Heritage Areas Office, National Park Service

The power of people

NPS has defined a national heritage area as "a place where natural, cultural, historic, and

Figure 2. Kayakers exploring during the Schuylkill River Sojourn, Schuylkill River National Heritage Area. *Photo courtesy of Dan Creighton*

scenic resources combine to form a cohesive, nationally distinctive landscape arising from patterns of human activity shaped by geography. These patterns make national heritage areas representative of the national experience through the physical features that remain and the traditions that evolve in them."[4] This definition is poetic and has been very useful, but it does not place enough emphasis on the key ingredient: the people that live there. Most heritage areas are driven by the commitment of local residents, many of whom have deep roots in the region. They are often people who have parents and grandparents with a stake in the traditional industries or lifeways of the region. Many areas still have a few craftsmen and women who carry on traditional trades and professions. Many communities still sponsor traditional regional celebrations and festivals. Many residents can still read the landscape, whether to identify a coal tipple and a breaker, or to tell the difference between wheat and alfalfa. However, they are not so sure that their children will have this knowledge or be able to participate in this culture, or that the familiar landmarks that define the region will be around in the future.

Using the NPS definition, many outstanding cultural landscapes would clearly qualify for national heritage area designation. Examples could include the archetypal landscapes of New England, ranching vistas in the West, the rolling fields and prairie remnants of the Central Plains, and the lush agricultural valleys in the Northwest. But heritage areas don't come together solely based on the significance of the landscape and its special characteristics.

Heritage areas emerge where people work together to create a strategy to tackle the issues of shifting economies, homogenization, and indifference. While heritage tourism may ultimately be an outcome, heritage areas are primarily focused on addressing the needs of the local community first. Perhaps that is why most heritage areas begin with educational programs about local history and efforts to make the landmarks and landscape accessible to the people who live there. It should be no surprise that some of the most innovative heritage education programs in the nation are found in heritage areas. In the Lackawanna Valley National Heritage Area, for example, children interview grandparents about the past and script radio shows based on these stories. Selected stories are then broadcast on a local commercial radio station.[5] The Rivers of Steel National Heritage Area has a cultural conservation program that offers apprenticeships in traditional music and crafts, folklorist residencies focusing on contemporary living traditions, and a referral program for folk and traditional artists.[6] To reach across a large geographic area encompassing 37 counties in Iowa, Silos and Smokestacks has developed a web-based program on the region's farming heritage called "Camp Silos." Visitors learn about the agricultural heritage of the region, and can watch the birth of baby piglets, or contemplate a growing cornfield on the "corn cam."[7]

Common questions about heritage areas

As of early 2005, Congress has designated twenty-seven national heritage areas, placing them in the portfolio of the National Park Service. There are also over a dozen

Figure 3. Aerial view of the wetlands, Yuma Crossing National Heritage Area. *Photo courtesy of National Heritage Areas Office, National Park Service*

new proposals still awaiting action by Congress. Overworked NPS and congressional staffers facing yet another heritage area proposal sometimes ask: How did all these communities find out about heritage area designation? Who told them about this idea?[8] How did so many communities come up with the idea to establish a heritage area? And even more importantly, Why did they come up with this idea? And finally, What is the role of NPS?

Let's start with the last question first. What is the role of the NPS in the national heritage areas program? First and foremost, national heritage areas are about partnerships, and in recent years the National Park Service has increasingly recognized the value of a partnership approach to resource management. The days when national parks were scenic wonders carved out of the public estate are long past. From the time when the national park idea migrated back East, the agency worked in partnership with others in a more complex and peopled environment. Concurrently, the NPS mission expanded to include historic birthplaces, battlefields, wild and scenic rivers, places offering outstanding recreational opportunities close to the large centers of population, and partnership parks where the agency owns little or no land. These newer park models, in particular, have brought the agency into closer and closer contact with new neighbors who often have their own ideas on the appropriate goals for a park unit.[9]

Constituent communities demanding that NPS expand its reach to assist in the preservation of resources that the communities deem important is not new. Many of the more recent models of national parks have not come from NPS carefully expanding its "product line," but from congressional action in response to community demands. So on one level the question of how did NPS get into the heritage area business is clear. Congress acted and NPS reacted. The continued interest in national heritage area designation has stimulated both congressional[10] and administration attention. In May 2004, NPS Director Fran Mainella assigned the National Park System Advisory Board responsibility for reviewing the National Heritage Area Program and making recommendations for the appropriate role of NPS.[11]

Although it is clear that NPS needs to provide a clearer definition of its role in assisting national heritage areas, this understanding does not answer the first question posed above, namely, Why have certain regions coalesced around their shared heritage, overcome conventional boundaries, and, against considerable odds, formed working partnerships? And then asked NPS to be a partner, while making it clear they are not turning the responsibility or the resource over to the federal government to manage. Unlike other groups that seek NPS assistance to "save" a significant resource or "provide" a certain natural or recreational experience, the heritage area movement only asks that NPS be a partner in an enterprise that is usually well on its way. The National Park Service's role is to offer assistance in management planning, interpretation, and resource preservation, and, of course, to provide funding.

Opportunities for resource conservation

From the NPS viewpoint, national heritage areas provide real value. Heritage areas are a cost-effective way to preserve nationally important natural, cultural, historic, and recreational resources through the creation of a working partnership between federal,

state, and local groups.[12] Through partnerships, heritage areas are tackling the conservation of resources that NPS has not been able to address. People in heritage areas are working to preserve large-scale industrial sites such as the Carrie Furnaces in Pittsburgh, all that remain of the once-mighty Homestead Steel works, and the automobile story in the MotorCities region of Michigan.[13] Heritage areas also help to coordinate the efforts of many smaller groups to conserve the components that define a larger landscape. Heritage areas open doors to recreational experiences that were previously unknown or underappreciated. They bring the past alive with educational programs and festivals, and train the next generation of culture bearers. Finally, heritage areas set a stewardship vision that places history and nature in a landscape context, helping people to see both the heritage and the future in their own backyards.

Opportunities for community renewal

The reasons why certain areas travel this partnership path perhaps may be found by examining the characteristics of these areas. Of the twenty-seven national heritage areas, most are regions in transition, and change is stressful to people and to the communities in which they live. Many designated areas are places where the economic foundation of the area—whether industrial or agricultural—is collapsing. These areas are often depopulating and losing their young people, or repopulating with an influx of new people who have not shared in the heritage of the region. They are communities that are facing an uncertain future.

While more work needs to be done, preliminary analysis of the demographics of national heritage areas seems to confirm that these are areas that are undergoing change, and not always in a positive way.[14] On average, national heritage areas have experienced lower population growth compared with the states they are located in and with the nation as a whole. National heritage areas have large populations of persons over 65, and all but four (two of which include the younger urban populations in Chicago and Detroit) have an elderly population higher than the national average. National heritage areas have a median household income that is, on average, $1,530 lower than the state median and $2,200 less than the national household income.

Since heritage areas coalesce around places of history—particularly places that were once dependent on now obsolete transportation systems, extractive industries, and redundant agricultural and manufacturing economies—the above demographic and economic conditions are not unexpected. As the demand for these outmoded systems and their products decline, and when communities are bound to place by infrastructure, transportation, and power and availability of natural resources, then the economic viability of the area may decline. Unless new opportunities arise, the young people will leave, the birth rate will drop, and the resident population will become older and older. For example, in Pennsylvania, a state once known for its dominance in manufacturing and extractive industries, the number of children under age five has been falling for a decade, and only Florida has an older population.[15] Pennsylvania also has the most national heritage areas (six designations) and strong state heritage regions program (twelve designations).

This correlation with regional change does not conclusively answer the question

of why these regions develop heritage initiatives as a response to the stress of economic or community dislocation. However, one theory first proposed by NPS planners working on the *Low Country Gullah Culture Special Resource Study*[16] is that heritage-based initiatives may be a version of what anthropologists call a "revitalization movement."

This concept was first described by Anthony Wallace in 1956.[17] He posited that under normal societal conditions the existing institutions meet the needs of the community. However, if a society is placed under stress, for example through domination by a more powerful group, or as in heritage areas by community and economic dislocation, then a revitalization movement may emerge as a response. Revitalization movements are an attempt by the community to construct a more satisfactory cultural environment, often drawing on what is seen as valuable about the past. They propose to revive portions of traditional culture and combine them with new elements to meet the future. While Wallace noted that many revitalization movements are based on religious principles, he also notes that secular revitalization movements seem to be more common in the worldlier twentieth century. He also states that the success of such initiatives depends upon their relative "realism" and the amount of consensus or opposition they encounter.

Now it may be a bit extreme to compare the flourishing heritage area movement across the country to such phenomena as the revival of Ghost Dances of the Plains Indians or the rituals of the Unification Church. People in heritage areas drive late-model cars, go to ball games, and shop in strip malls. In fact, they are very much like us and, in some cases, they are us. Yet how do we explain the emergence of heritage areas as an idea or "phenomenon," and how so many communities seem to have simultaneously discovered the concept and invented its core principles of partnership and planning around the values of shared heritage. Perhaps it is enough for now to accept it as an outward manifestation of a renewal of the spirit of place with goals of educating the next generation, enlightening visitors, and strengthening the physical and social fabric of the region. However, as the number of areas proposed for designation multiply, the National Park Service and the National Heritage Areas Program are challenged to demonstrate the value of the federal government's investment and to better define what constitutes success. The upcoming report by the National Park System Advisory Board on the *Future of the National Heritage Areas in the National Park System* may help define how the program fits into the nation's larger conservation mission, and perhaps will redefine how NPS interacts with the communities that make so many of those conservation stewardship decisions on the ground.

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Endnotes

1. A list of the twenty-seven National Heritage Areas can be found on the National Park Service website at www.cr.nps.gov/heritageareas (retrieved January 5, 2005).

2. The National Historic Preservation Act was passed in 1966, the National Scenic Trails Act in 1968, and the Rivers, Trails, and Conservation Assistance (RTCA) Program was developed in the early 1980s; all expanded the work of NPS outside of the boundaries of national park units.
3. For more information on the twenty-seven National Heritage Areas, their historical themes and resources, see www.cr.nps.gov/heritageareas.
4. This definition was articulated by Denis P. Galvin, former deputy director of NPS, in testimony before the House Resources Subcommittee on National Parks and Public Lands on October 26, 1999. This definition and other suggested criteria for national heritage areas can be found at www.cr.nps.gov/heritageareas/ (retrieved February 26, 2004).
5. Information on the educational programs developed by the Lackawanna Valley National Heritage Area is available at www.lhva.org/MENUeducation.htm (retrieved February 26, 2004).
6. Information on the programs of the Rivers of Steel National Heritage Area is available at www.riversofsteel.com/culturalconservation.asp (retrieved February 26, 2004).
7. Information on the programs of Silos and Smokestacks is available at www.silosandsmokestacks.org/3fun/index.html (retrieved February 26, 2004). "Corn cam" refers to a remote camera located in an agricultural field that provides video footage of harvest activities to an interpretive site.
8. By the second session of the 108th Congress, members had introduced designation bills for sixteen new areas and study bills for nine new areas.
9. A discussion of the historical development of the heritage areas idea and the variety of units in the NPS is provided in Brenda Barrett, "Roots for the heritage area family tree," *The George Wright Forum* 20(2): 41–49 (2003); also see *Branching Out: Approaches in National Park Service Stewardship* (Fort Washington, Pa.: Eastern National, 2003).
10. During the 108th Congress, Senator Craig Thomas, Chair of the Subcommittee on National Parks, convened two oversight hearings on national heritage areas, held a two-day legislative workshop, and ordered the Government Accountability Office (GAO) to review specific program issues. The GAO report, titled *The National Park Service: A More Systematic Process for Establishing National Heritage Areas and Actions to Improve their Accountability is Needed* (GAO-04-593T), is available at www.gao.gov (retrieved January 2, 2005).
11. The chair of the National Park System Advisory Board, Doug Wheeler, asked board member Jerry Hruby to undertake a review of the National Heritage Area Program as part of the work of the Board's Partnership Committee. A series of meetings have been convened and recommendations will be presented to the Advisory Board at its spring/summer meeting in 2005.
12. A March 2003 survey by the National Park Service estimated that the national heritage areas leverage eight dollars to every dollar allocated by NPS.
13. Constance C. Bodurow, "A vehicle for conserving and interpreting our recent industrial heritage," *The George Wright Forum* 20(2): 68–88 (2003).
14. The information in the following section is based on an unpublished analysis of 1990

and 2000 census data by Suzanne Copping; see www.census.gov/population/cen2000/ for regional population statistics.
15. Brookings Institution Center on Urban and Metropolitan Policy, *Back to Prosperity: A Competitive Agenda for Renewing Pennsylvania* (Washington, D.C.: The Brookings Institution, 2003).
16. National Park Service, *Low Country Gullah Culture Special Resource Study,* Public Review Draft (Atlanta: NPS Southeast Region, 2003).
17. Anthony Wallace, "Revitalization movements," *American Anthropologist,* 58(2): 264–281 (1956).

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The Right Direction: Imagining the Future of the Potomac

J. Glenn Eugster

Introduction

THE ENVIRONMENTAL QUALITY OF THE POTOMAC RIVER HAS IMPROVED DRAMATICALLY over the past four decades, but it still has a long way to go. What further steps can be taken to restore the river and the region to its former grandeur? What are the new threats on the horizon?

Before they became my life-work, rivers and streams were my first love. Many people have had love affairs with the Potomac and its tributaries. In a letter written in 1954 to the *Washington Post,* Supreme Court Justice William O. Douglas said this about the Potomac: "It is a refuge, a place of retreat, a long stretch of quiet and peace at the Capitol's backdoor. A wilderness area where man can be alone with his thoughts, a sanctuary where he can commune with God and with nature, a place not yet marked by the roar of wheels and sound of horns." All of us have been shaped by our love affairs with rivers like the Potomac and our feelings motivate us, as they did Justice Douglas, to take action to protect and restore these special places.

The right direction

This topic brings to mind geographer D.W. Meining's book *The Interpretation of Ordinary Landscapes.* Meining said that "even though we gather together and look in the same direction at the same instant, we will not—we cannot—see the same landscape. We will see many of the same elements, but such facts take on meaning only through association; they must be fitted together according to some coherent body of ideas." He went further to say, "any landscape is composed not only of what lies before your eyes but what lies within our heads." Each of us has a perspective, but there are many views of the Potomac (see box). Each of these views is a value that we as individuals, or a community or a region hold special.

The Potomac: What do we mean?

The Potomac has a strong regional and national identity with both residents and visitors. Throughout this article I refer to the idea of a "Potomac Region," which

Ten views of the Potomac

1. Potomac as nature
2. Potomac as habitat
3. Potomac as artifact
4. Potomac as ecosystem
5. Potomac as people
6. Potomac as commerce
7. Potomac as history
8. Potomac as recreation
9. Potomac as place
10. Potomac as aesthetic

some will interpret to mean a watershed or a river basin. Some will interpret it as a series of landscapes. Some will interpret it to mean a valley. All are correct. Most of all, this idea of the Potomac is that there is a region with recognized qualities that has been claimed by its residents who are working to keep it special.

How is the Potomac doing?

Managing the environmental quality of the landscapes of the Potomac Region is complicated work. In order for us to manage—and achieve—environmental quality we must understand the political, cultural, and economic context of the Potomac. We must incorporate the interaction of living and human-made things, the impacts of humans, and the socioeconomic and cultural influences that humans contribute.

As we look at the Potomac Region, and its future, we need to ask ourselves four questions:

- What is the current situation?
- What alternatives are possible?
- What can cities and other government agencies and private-sector organizations do to protect, manage, and use parks, open space, and recreation areas, and to demonstrate sustainable practices?
- Most importantly, what are we, as individuals, prepared to do about the current situation?

What is the current situation?

Four noteworthy reports, or "scenes of the same view" on the state of the Potomac, can be used to answer this question. First, let's look at an ecosystem management perspective since the Potomac region is nested in the larger Chesapeake Bay region. In 1983, *Choices for the Chesapeake: An Action Agenda* was published, describing a summary of a Chesapeake Bay Conference held in Fairfax, Virginia. The report recognized the following problems in the Potomac region:

- Increase in the number and diversity of oxygen-robbing algae blooms;
- Decline in the abundance and diversity of submerged aquatic vegetation;
- Increasing levels of nutrients;
- Decrease in landings of shad and rockfish; and
- High levels of metal contamination in the water and sediments.

Second, let's look at a water quality, quantity, and living resources perspective. In 1994, the Interstate Commission for the Potomac River Basin (ICPRB), along with 25 government and private-sector organizations, published *The Potomac Visions Report to Develop and Implement a Long-Range Strategy to Protect and Enhance the Water Quality and Living Resources of the Potomac River.* This report, prepared at the request of Congress, identified a number of concerns, including:

- Acid mine drainage from abandoned coal mines on the North Branch;
- Runoff from farms that carried nutrients, sediments and pesticides;
- Increasing residential development and accumulated impacts of suburbanization;
- Toxic hot-spots and combined sewer and stormwater flows on the Anacostia River;
- Water quantity concerns related to droughts and withdrawals;
- Fishery declines in the lower Potomac;

- Population increases and a disturbing pattern of land, energy, and water use.

Third, let's look at a business perspective. In 2001, "The Potomac Index," a joint project of the Potomac Conference, was prepared by a research team from the Brookings Greater Washington Research Program. The index was designed to help citizens and leaders of the Washington metropolitan area understand how the region is changing and to measure the region's progress on key economic, social, and environmental issues. Several of the concerns identified in the index are:

- The Greater Washington region continues to face challenges in reducing the ozone levels in the air and in improving the water quality of the Anacostia River.
- The region is consuming land at a faster rate than population growth (between 1982 and 1997, the region's population grew by 30% while the land developed to accommodate that growth increased by 47% and density decreased by 12%).
- Metropolitan Washington has one of the worst traffic congestion problems in the country.

Fourth, let's look at a local government and a regional perspective. In 2004, the Metropolitan Washington Council of Governments looked at the issue of land consumption from another view. The results of the Metropolitan Washington Green Infrastructure Demonstration Project revealed that the metropolitan area will lose 28 to 43 acres of open space every day from 1997 to 2020 to various types of development. Although more than 311,000 acres of open space will be developed between 1990 and 2020, there is no major public or private green space protection initiative in the region.

What are other threats to the future of the Potomac?

Invasive species. Potomacians are now seeing and hearing news about alien species. There are alien plant and animal species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. News accounts carry stories of zebra mussels, bullhead and blue catfish, carp, hydrilla grass, and snakeheads. In 2000, the U.S. Department of the Interior indicated that invasive species cost the nation's economy approximately $123 billion annually and are second only to habitat destruction in threatening extinction of native species. At that time, invasive plants and weeds were spreading on federal lands at a rate of 4,600 acres per day.

America's disdain for the old. In the late Laurance S. Rockefeller's office (at what is now the Marsh–Billings–Rockefeller National Historical Park) in Woodstock, Vermont, there is a small picture with the inscription: "Use it up, wear it out, make it do, or do without." Unfortunately, people who embrace these principles are becoming a minority in America. Despite the significant strides that Americans have made in recycling, adaptive reuse, energy conservation, and sustainable development, we continue to discard the old for the new. Peggy Loar of the Smithsonian Institution has said that "as forward-looking people, we Americans have fervently welcomed technology and invention into every aspect of our lives, disdaining the old."

"Tyranny of small solutions." Most environmental quality efforts are site-specific in focus, opportunity-based, and fre-

quently duplicative or inefficient. All too often government and private-sector programs are not landscape focused or integrated across organizational or jurisdictional boundaries. Although each independent effort is well-intentioned and creates some positive contribution to the Potomac region, the overall net effect is fragmented, disconnected, and does not often address priority needs. Single-purpose approaches often result in a "tyranny of small solutions"—too often creating patchworks of unintegrated planning and case-by-case reactions.

Exclusion. By assuming that planning is the business of professionals, we often leave people out of the process of designing a future for the Potomac region. By leaving "grown-up" decisions to grown-ups, we are leaving our youth out of the process of planning their future. We also tend to exclude recently arrived residents and certain other groups not commonly thought to have a legitimate interest in the future.

Bad water. The water of the Potomac is being robbed by algae of its dissolved oxygen, which fish and crabs need to breathe. Many Potomacians are responsible for these "takings"—animal manure from farms, suburban lawn care products, air pollution from cars and power plants, and treated sewage all contribute. These all act like underwater fertilizers and stimulate algae blooms that choke the very light and air so essential to life for other ecosystem inhabitants.

Land, growth, and stewardship traditions. Traditional approaches to environmental quality in the Potomac have great momentum. It is human nature to apply familiar solutions to problems. Unfortunately, past engineering, land use, growth management, and stewardship approaches often are unable to meet environmental and economic goals simultaneously. Part of the problem is that the judicial and legislative systems are often "stuck" in accepted methodologies and not adaptable to current practices and new knowledge.

What alternatives are possible?

Ten things individuals, organizations, businesses or governments can do to improve the Potomac Region are as follows.

1. Use heritage as the bridge. A heritage approach can be used as a way to organize a host of formerly unrelated activities as part of a larger integrated whole. It's not something technical in itself, but rather it is a way of looking at the world and ourselves. What is heritage?

- Something transmitted or acquired from a predecessor.
- Our collective features, traditions, and culture, signifying or illustrating the evolution of human settlement and resource use.
- It's about "places" and "people."

Heritage is a unifying theme! It reveals who we are, were, and will be; where we are and how we got here; why we are who we are; what makes us unique; our identity; and what brings us together and what divides and keeps us apart.

2. Build an integrated database. The leaders of the Potomac are blessed with a vast array of information about the region, its people, and its living resources. Unfortunately, there is no coherent and comprehensive summary of data about the Potomac. Modern technologies employing all kinds of multimedia are now available to bring to life formerly flat and technical-looking maps and charts. Using these new

techniques, we can simulate outcomes of potential decisions, and, by accounting for myriad relationships, experience the outcomes of a virtual future. We can have the opportunity to correct a poor decision before we carry it out—or, to the contrary, move forward with new confidence in a new approach because we can see the direct and indirect benefits of it.

Great Falls Park in Virginia provides visitors the chance to learn about the Potomac and the story of water. *Photo courtesy of Brent O'Neill, George Washington Memorial Parkway*

3. Identify success. Part of our vision of the future is embedded in the question: What does success look like individually and collectively? One way that we can help clarify what we hope to achieve is to agree on and establish locally relevant and people-friendly indicators for the Potomac region to describe and measure environmental quality gains and loses. A good example of this is the "Sneaker Index," which raises awareness and measures progress. Former Maryland State Senator Bernie Fowler has led people to the Patuxent River since 1988 in an effort to bring attention to water quality. He and others wade into the river, wearing white sneakers, until they lose sight of their sneakers—or the water gets chest high.

4. Demonstrate success! Presenting problems without solutions creates frustration and confusion. Many leaders have an interest in learning more about conservation approaches being used in the Potomac region. Close-to-home success stories are a way to demonstrate the benefits of protecting and improving the Potomac and highlight the implementation process. The Metropolitan Washington Council of Governments, ICPRB, and Environmental Protection Agency's Chesapeake Bay Program have published various examples of existing best practices that are being used by local communities, governments, and businesses. These serve as models to help protect and prosper.

5. Eat the view! Our decisions as consumers can have a big influence on the way the Potomac region is managed because the character of the landscape and the quality of the environment are directly linked to the way the land is used to produce food and other goods. Products processed and marketed locally can provide income and improve employment opportunities, help to strengthen the links between land managers and the local community, and reduce the unnecessary transportation of food and other goods. The Local Food Project at Airlie, Virginia—a successful example of this idea—works to link food buyers and producers in the same geographic region.

6. Get involved! Citizens, community and business leaders, corporations, and governments in the region regularly donate their time, in-kind services, and money to support many public and private Potomac

efforts. This type of civic engagement, such as is practiced by the Mount Vernon Ladies' Association, the oldest national historic preservation organization, continues to be an important way to help protect and maintain the environmental quality of the Potomac.

7. Provide quiet, enabling leadership. The future of the landscapes of the Potomac depends on people. Knowing who the key decision-makers, practitioners, community advocates, subject-matter experts, public land managers, and civic association leaders are can help people to protect and prosper. One way to build a network of these practitioners would be to create a Potomac region directory. The directory would list the names, addresses, telephone and fax numbers, and e-mails for the most important contacts in the region.

Another approach would be to create a Potomac-based, public–private "Potomac Region Alliance." The alliance would be formed to link the leaders of groups and agencies who share responsibility for the Potomac region. This action is not to create another organization or agency but rather a federation of groups and governments that would meet periodically, share information, and take appropriate action when it is in the interests of the members.

8. Communicate! Communication is one of the keys to the future. One way to improve communication is to establish a voice for the Potomac. Area writers, as well as artists, painters, storytellers, and performing artists, could use their skills in "evocative communication" to creatively share the values of specific places and encourage people to work to protect them.

Information about the region can also be shared through the Potomac Heritage National Scenic Trail corridor, which runs from Point Lookout, Maryland, to Pittsburgh. The trail is intended "to connect people with places, providing opportunities to explore connections and contrasts among landscapes, history and communities." The trail corridor offers Potomacians the opportunity to tell their story—past, present, and future—to residents and visitors, and to strengthen regional identity.

Another way to improve communication is to create an open and non-judgmental platform to discuss the existing quality of the region and alternatives for protection and prosperity. Regular and open "Potomac Forums" are an important way for residents and experts to come together to discuss issues, concerns, opportunities, and solutions.

9. Practice stewardship at home and regionally. Residents of the region can do his or her own part to protect the Potomac by planting native species, using "soft surfaces," and managing runoff. However, if the region is more than a collection of unrelated sites, activities, and individuals, then it makes sense to look at our communities, watersheds, and component landscapes as a region and manage the essential values and functions as a system.

In his book *The Potomac,* Fritz Gutheim wrote about the end of the third quarter of the eighteenth century, saying: "After nearly one hundred and fifty years of growth and change, the valley had filled up, equilibrium had been achieved. It was a practical society these Potomac people had created." Although there may have been a stable, balanced, or unchanging system at that time, today the Potomac region is changing. As it changes, residents are increasingly expressing concern about the need to balance the building of housing, roads, and other development to accommo-

date population growth with the desire to protect forest, farmlands, and pastures and preserve the existing character of communities.

In 1970, Eugene Odum, one of the most influential figures in the history of ecology, looked at this concept of equilibrium. Odum attempted to determine the total environmental requirements for an individual as a basis for estimating the optimum population density for humans. Using the state of Georgia as an input–output model for estimating minimum per capita acreage requirements, Odum found that a quality environment required that a certain amount of land be set aside for food, fiber, natural use areas, and urban–industrial systems. The stakeholders of the Potomac region could refine and apply Odum's formula to meet local food, water, and fiber needs using close-to-home resources that support local economies, save energy, and achieve environmental quality.

10. Celebrate the Potomac. Articles, meetings, reports, and resolutions don't mean anything unless they lead to meaningful action. Creating opportunities to celebrate the many varied values of the Potomac region is essential to the environmental quality movement. It creates a connection with the places that need protection and management and the people who care about them.

In summary

Potomacians have made impressive efforts to protect and restore the region. However, it is important to note that we have taken the Potomac from the state of equilibrium that Gutheim spoke of, to a region whose reputation was a "national disgrace," and back again. So our work is never done because this is a dynamic and changing natural, cultural, and economic place, and values and commitments change.

So let us be clear. We know:

- What the conditions and trends are in the Potomac region;
- The alternatives to improve environmental quality—for landowners, private groups, businesses and governments;
- The tools available to achieve environmental protection and improvement and how to apply them to be successful; and
- How the tools have to be applied to fit our social and political context.

Interestingly, more than 35 years ago the strategy for how action should be taken was clear.

> A new generation of social inventions is vital to the people of the Potomac basin and to the people of the nation. Some inventions will be large-scale, requiring inter-basin agreements or Federal laws. Many, however, will be small-scale and neighborly; they will be informal and voluntary agreements growing out of necessities of everyday life. The two must complement each other. Public laws and government agencies must form a framework within which private actions can flourish and bring a better life and environment to the Potomac region and its people.
>
> — Potomac Planning Task Force, 1967 in "The Potomac"

What is unknown about the future of the Potomac region is what we, as individuals, organizations and governments, are prepared to do to improve the environmental quality for future generations. The vision continues and we need only to commit to it. The choice and the future are ours.

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From Conservation Diplomacy to Transborder Landscapes: The Protection of Biodiversity Across North America's Borders

Charles C. Chester

Two special borders

EACH OF NORTH AMERICA'S TWO MAJOR BORDERS HAS ITS RESPECTIVE CLAIM TO FAME. To the north, the Canada–U.S. border is commonly described as the longest undefended border in the world. To the south, it is often said that the U.S.–Mexico border separates a discrepancy in average income levels greater than any other border on the planet. Yet in contrast to their differences, both borders can claim war, diplomacy, and surficial hydrology as their common origins. And while these hardly constitute original facets in the world history of territorial demarcation, the two borders also share another common characteristic—one that might come as a surprise even to many experienced North American conservationists. This commonality is that both borders are chock full of transborder conservation initiatives.

Run your finger back and forth along the two borders; you have touched on no less than 35 transborder conservation initiatives. Just look at the four "ends" of the two borders: to the northeast, there is Gulf of Maine Council for the Marine Environment; the southeast is home to the Laguna Madre Binational Initiative on the Gulf of Mexico; to the southwest lies the Tijuana River Watershed Project; and the northwest has the International Porcupine Caribou Board working across the Yukon–Alaska border. None of them are big-name initiatives located in the familiar contentious geographies of, for example, British Columbia's Clayoquot Sound, Florida's Everglades, or Michoacán's Oyamel fir trees (wintering home of the Monarch butterflies)—and yet all are working toward the similar goal of biodiversity conservation.

Why are a growing number of North American conservationists spending their working lives thinking "across borders"? It is a fair question. Within their borders, many governments and conservation organizations have in many instances made significant headway in responding to the threat of biodiversity loss through the implementation of conservation initiatives—all this despite increasing consumption, human population growth, and the rapidly evolving face of technology. Yet biodiversity protection in the domestic realm has repeatedly proven to be contentious, strife-ridden, and in countless cases, seemingly unresolvable. Given such difficulties surrounding biodiversity protection on a *domestic* front, it is eminently reasonable to wonder why one would choose to focus on the more difficult problem of *transborder* biodiversity protec-

tion. As Westing (1998, 91) asked in a comprehensive summary of transborder conservation, trying to bring about conservation "with two (or occasionally even three) sovereign states involved would seem to add a gratuitous layer of complexity that spells almost certain failure. So why try?"

The principal response is obvious: biodiversity knows no political boundaries. Transborder conservation cannot await the Holy Grail of "problem resolution" at the domestic level for the simple reason that biodiversity has evolved *not* in conformance to the dictates of political geography—but rather in accordance with natural selection, chance, and the resultant biogeographic patterns. If Westing (1993, 5; 1998, 91) is correct that "approximately one-third of all terrestrial high-biodiversity sites straddle national borders,"[1] then effective conservation must take into account this inherent apolitical nature of biodiversity. Ultimately, waiting for conservation issues to be fully resolved in a purely national context would mean *never* addressing them in a bilateral or international context.

A much-abbreviated history of transborder conservation in North America

North American governments have widely responded to the need for regional and transborder approaches to the problem of biodiversity loss. Even across the chasm of the "real, hard, and physical fence" of the Mexico–U.S. border (Laird 1994), the two countries have entered into "at least 15 different resource conservation agreements" (Hogan 1999). But it is the northern border of the U.S. where lies the historical "dawn of conservation diplomacy" (Dorsey 1998). As Tabor (1996) has noted, cooperation over conservation has been a "cornerstone" of the relationship between the U.S. and Canada. Yet unprecedented as this relative absence of strife may be, it is equally fair to argue that the history of bilateral cooperation lies rooted in a rich history of diplomatic conflict over natural resource issues, most of which took place during the two decades before and after 1900.

As Dorsey (1998) extensively demonstrates, early diplomatic efforts at conservation revealed significant disagreement between the two countries over how to share and protect transborder resources. For example, in the early 1890s, the U.S. and Canada began a combined diplomatic and scientific effort to protect a broad spectrum of inland fisheries ranging from the saltwater fisheries of Puget Sound to the freshwater fisheries of the Great Lakes. Although both countries approved a procedural treaty in 1908, development and implementation of regulations proved impossible. Dorsey argues that the treaty failed largely due to its broad geographic application: had the diplomats and scientists focused on Lake Erie and the Fraser River salmon fisheries—the two areas that were suffering from true international competition as opposed to simple national overexploitation—the treaty might have successfully laid the groundwork for further international cooperation (Dorsey 1998, 101).

Yet even as the U.S. and Canada could not come to agreement over shared fisheries resources, they were able to come to effective agreements to protect the north Pacific fur seal and birds migrating between the U.S. and Canada. The former treaty addressed a significant binational conflict by bringing seal fisheries back to a sustainable rate of exploitation. And to the degree that the U.S.–Canada Migratory Bird Treaty is still in force and enforced, public opinion appeared to be a powerful impetus

for the application of domestic forces on international affairs.

Dorsey is making a powerful point here. He ascribes the failure of the Inland Fisheries Treaty to the still inchoate conservation movement—a movement that actively neglected the "uncharismatic minifauna" of fish (Dorsey 1998, 16; Cronon 1998, xiii). Dorsey emphasizes that in contrast, civil society actors played a critical role as advocates and educators in the Pacific fur seal negotiations and the passage of the Migratory Bird Treaty, and furthermore that "conservationists in the two countries were in close contact with each other" (Dorsey 1998, 11). The broader lesson is that civil society actors—meaning, in this context, conservationists—can be highly influential in international diplomacy. Interestingly enough, it took decades for mainstream scholars of international affairs to recognize it. Yet even as the significant role of civil society has become widely accepted, what is only beginning to become clear is that civil society is now acting not only as an influential actor in transborder activities, but in some cases as the central one.

Inspiration from a landscapes across the border

Some of the better-recognized transborder initiatives in North America occur just above the familiar geographic scale of large governmental land management units. The Glacier–Waterton International Peace Park is one such example, as is the initiative reaching across the border from Texas's Big Bend National Park. Other initiatives are taking a much different approach by looking at a larger landscape scale—and here none stand out more than the Yellowstone to Yukon Conservation Initiative (Y2Y).

Widely described as the "brainchild" of Canadian conservationist Harvey Locke, Y2Y descends from a long history of efforts to protect wildlife in the "Northern Rockies"[2] dating to the last quarter of the 19th century. These efforts have resulted in hunting laws and the restoration of endangered species, for example "the first successful effort to save a jeopardized species—the bison" (Wuerthner 2001, 14). Most importantly, the establishment of protected areas—mostly consisting of parks, wildlife refuges, wilderness areas, and forest reserves—has played the most visible role in protecting the region's wildlife. Famous national parks in the region include Yellowstone in the United States (the world's first national park, established 1872), Banff in Canada (established 1885), and the world's first international "peace park" between Canada's Waterton National Park and Glacier National Park in the U.S. (1932).[3] The region was also home to the 1891 Yellowstone Park Timber Land Reserve, now considered to be the earliest predecessor of the U.S. Forest System (Haines 1977, 95; Reiger 1997, 42-44), and today claims four of the six largest U.S. wilderness areas outside of Alaska (Figure 1).

The Yellowstone to Yukon Conservation Initiative stands on top of—and indeed, because of—these deep historical foundations. Indeed, it is the very cachet of the terms "Yellowstone" and "Yukon" that have helped to propel Y2Y into the conservation limelight (Chester 2003b). "Given its place in environmental history," as conservationist George Wuerthner (2001, 14) noted of Y2Y, "it's not surprising that the Rockies would be one of the first areas in the country where a bold new vision for large-scale conservation would be born."

So what exactly is Y2Y? By far its most important characteristic is its multifarious-

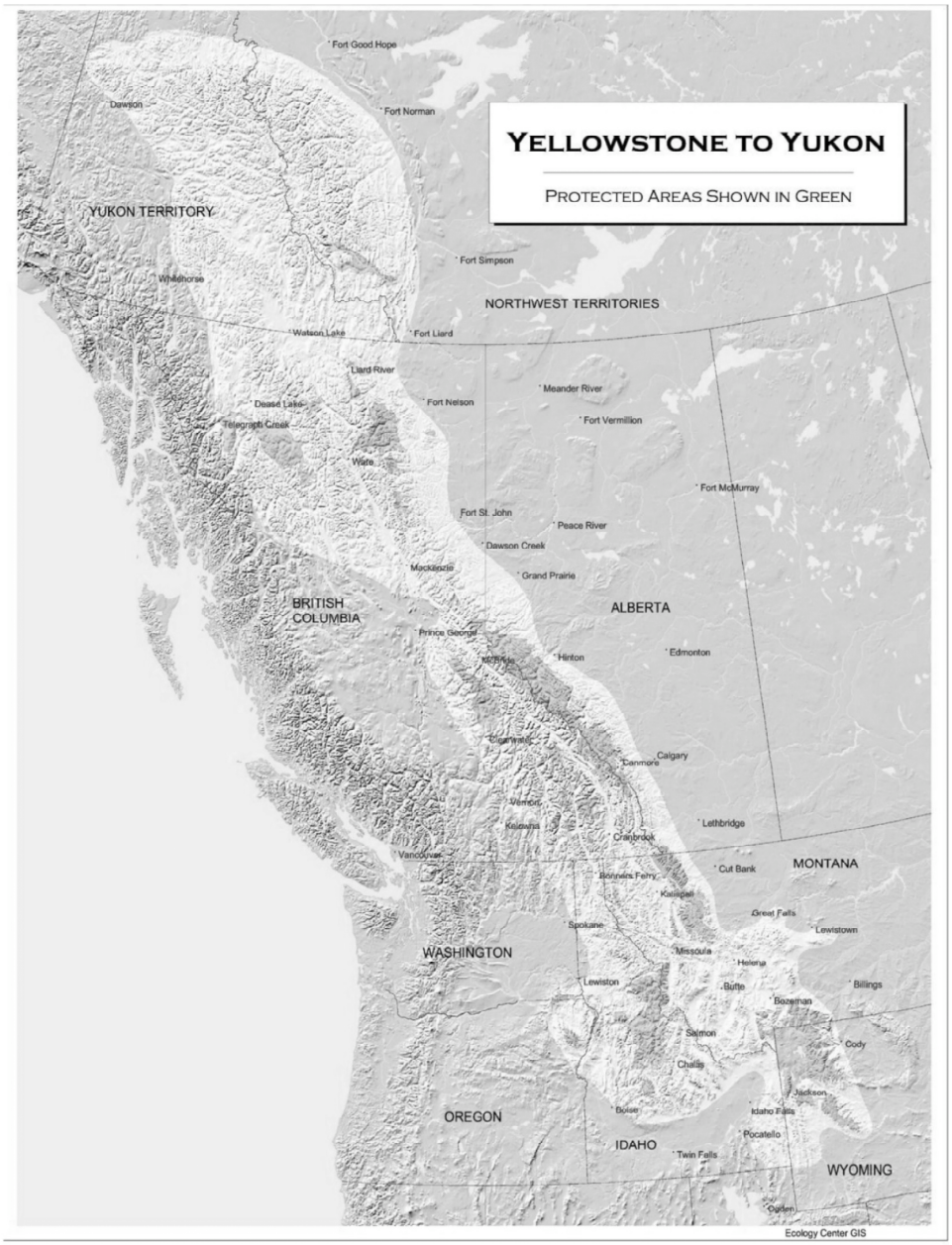

Figure 1. The Y2Y region. In this rendering, the boundary of the region is shown in light gray, with protected areas shown as medium gray within. *Photo courtesy of Yellowstone to Yukon Conservation Initiative*

ness—the fact that Y2Y has many parallel lives. For Y2Y is a *region* of biogeographic and cultural similarities extending over an area greater than the size of Texas and California combined. It is a *network* of over 300 conservation groups, constituting an organized movement to protect the land, its character, and its wildlife. It is a *conserva* -

tion organization with a fully functioning staff and board located in Canmore, Alberta. It is a *meta-icon*, composed of the geographical bedrock of U.S. conservationist philosophy and the proving ground of Canadian grit and national identity. And most importantly, Y2Y is a broad *reconceptualization* of how to protect a relatively unaltered landscape, as revealed in this "vision statement":

> Combining science and stewardship, we seek to ensure that the world-renowned wilderness, wildlife, native plants, and natural processes of the Yellowstone to Yukon region continue to function as an interconnected web of life, capable of supporting all of the natural and human communities that reside within it, for now and for future generations (Yellowstone to Yukon Conservation Initiative 2001).

This all adds up to the fact that there's a lot to say about Y2Y. Indeed, I spent a good deal of time simply trying to track down and organize how conservationists, the media, and skeptics have reacted to Y2Y (and while the recent review I finally churned out is useful for historic purposes, it is already quite dated; see Chester 2003b). I have also given a lot of thought to what lessons Y2Y holds for other transborder initiatives in North America. One of these was the tremendous success of Y2Y in networking conservationists together throughout the region. Y2Y's "coming out party" in 1997 occurred just as the average conservationist in the Y2Y region was figuring out how to use email—and for many of them, the Y2Y listserv was their first substantive introduction to the on-line world. But as I have noted elsewhere (Chester 2003a), Y2Y's initial success at building an on-line community now sounds almost quaint, or at least not very helpful ever since the novelty of Internet communications devolved into an info-glut of listserv and website backlogs that can mire down even the most ardent of conservation know-it-alls. This is not to say that Y2Y's networking role has disappeared, but that it has become a standard operational facet—the importance of which will unlikely come as divine revelation to other conservationists working across borders in North America.

Are there other lessons emanating out of Y2Y? The answer is a loud "yes," and two of the most important have been the fostering of transborder learning and inspiration.[4] In terms of the former, the Bozeman-based conservationist Ed Lewis pointed out that Y2Y had "begun the process of getting Canadians and U.S. folks to think and work across the border." Locke echoed this point, arguing that before Y2Y "people weren't thinking across the border—they just weren't. [At] Waterton and Glacier a little bit, but not in a way where they felt that their ideas and interests were legitimate and accepted as legitimate in a transboundary sense."

For many participants, Y2Y had subsequently opened that intellectual border, providing a critical international learning forum for U.S. conservationists to learn about Canada, and vice-versa—although the latter to a lesser degree, since Canadians generally have a comparatively stronger understanding of their southerly neighbor. For example, Michael Scott of the Greater Yellowstone Coalition recalled that Y2Y had taught him "a lot about Canada and about how folks operate, and about how the

Canadians work," while Louisa Willcox of the Natural Resources Defense Council said that Y2Y has made it easier for her to understand "what's happening on the Canadian side" and to "navigate my way around some of the information and the knowledgeable experts." Canadian Wendy Francis, a former interim executive director of Y2Y, noted that Y2Y had enabled "acceptance of the different political realities" between U.S. and Canadian participants. "We weren't even talking to each other across the 49th parallel before Y2Y," she said, "and now we sit down and meet two or three times a year, we know what each other is doing, and we know the different political realities of each country."

Several participants described Y2Y as a complementary north–south arrangement, a theme I had heard often repeated at several meetings. As Willcox put it, "we [in the U.S.] need the inspiration from the stories of the north. And they in turn need to learn the lessons of how we lost so much wild country to development, so they don't repeat that path. So it seemed obvious that there were some reciprocal relationships which if developed, would result in mutual benefit." But at the same time, she emphasized, Y2Y has taught U.S. conservationists that, contrary to widespread belief, "all is not secure" for wildlife in Canada—that Canada cannot be seen as an endless source population for the U.S. As conservationist Rob Ament of the nongovernmental organization American Wildlands has similarly noted, Y2Y has helped to dispel the "myth of abundance in Canada" and has helped alert U.S. conservationists "that they've got serious problems in southern Alberta and southern British Columbia."

The transborder learning fostered by Y2Y also exposed participating conservationists to an expanded universe of conservation strategies and tactics. "The most important thing about Y2Y," said Wayne Sawchuk of northern British Columbia's Chetwynd Environmental Society, is the ability "to see people up and down the Rockies and how they're doing their work." Many others expressed a similar point of view. In addition to the informal learning that takes place at Y2Y meetings, Y2Y has continually sponsored numerous training workshops on practical skills, such as media and messaging, fundraising, organizational effectiveness, board management, and negotiations. Y2Y has also sponsored several more issue-oriented workshops, including one on "Managing Roads for Wildlife" and another on "Understanding Western Canada's Changing Economy."

In addition to transborder learning, Y2Y—or more specifically, the Y2Y vision—has constituted a wellspring of inspiration to conservationists. Several Y2Y participants noted that to no small degree the inspiration came from the strong sense of camaraderie Y2Y had engendered between conservationists. But most Y2Y participants pointed directly to the inspirational effect of the Y2Y vision. "It's captured people's imagination that there is still one place that is so wild," said economist Ray Rasker of the Sonoran Institute, "that you can think of this scale and dream of it as a possibility. It's huge, it's enormous—nobody has come up with anything of this scale ever." Paraphrasing Wallace Stegner, conservationist Stephen Legault said that the power of the Y2Y vision was to provide a "landscape of hope" where conservationists could see where they wanted to go. Y2Y has given people a reason to "wake up in the morning to sit down and get on the phone for 11 or 12 hours a day and be on the com-

puters for 11, 12 hours a day, fighting what can be at times a very boring, mundane, and routine battle. Y2Y has contributed significantly to that landscape of hope by giving a lot of us something to hold on to; it's given us a vision beyond the boundaries of the valley that we live in or the campaign that we're currently working on."

Similarly, Willcox pointed to the role of Y2Y in keeping her inspired:

> It's the right scale to work on, it's the right thing to do, and that's what drives me. I'm personally inspired—which is sometimes hard to feel in some of the day-to-day work, which is much more trench warfare. We're entangled in a long slog, a siege mentality, trying to protect grizzly bear and other wildlife habitat in a place where every acre is fought over.

The quotidian effect of Y2Y, noted Ament tongue-in-cheek, was that it had kept people coming to Y2Y meetings forengaged for "seven years of meetings—that's a lot to ask of anybody."

Transborder lessons

Y2Y is about protecting a vast transborder region, and the way it goes about doing that is by empowering the individual. Yes, in addition to the intangibles of transborder learning and inspiration, Y2Y has benefited biodiversity in the region by bringing in new conservation funding, fostering innovative scientific research, and implementing other on-the-ground tactics. But it is likely to be its intangible services to individual conservationists working in the region that will have the most lasting effects. For even if we fully accept the notion of biodiversity's intrinsic value, conservation is ultimately about people doing what they can to save what they think is important. "Doing what they can" will be difficult in any context, but almost always more difficult when there's an international border involved. Fortunately, even beyond its focal region of the Northern Rockies, conservationists working on the borders of North America can look to Y2Y for an innovative approach to surmounting these challenges.

Endnotes

1. And these are often on highly contested borders; for example, nearly one-third of the existing or proposed 76 bilateral parks in continental Europe lie across the former iron curtain (Sochaczewski 1999, 36).
2. In the United States, the "Northern Rockies" generally refers to the portion of the Rocky Mountains situated in Montana, Idaho, and Wyoming, whereas Canadians use the term to refer to the mountainous stretch of the Canadian Rockies in northern British Columbia. Many, including myself, have come to use the term synonymously with the Y2Y region.
3. Not to be confused with Canada's Glacier National Park, which is also located in the Y2Y region west of Banff and Yoho National Parks.
4. There are many more, which will be discussed in my forthcoming book on transborder conservation, to be published by Island Press.

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Two Countries, One Forest — Deux Pays, Une Forêt: Launching a Landscape-Scale Conservation Collaborative in the Northern Appalachian Region of the United States and Canada

Emily M. Bateson

Introduction

THE FINDINGS OF CONSERVATION SCIENCE OVER THE PAST TWENTY YEARS are slowly influencing people to think beyond political boundaries, endangered species, traditional partners, and other artificial constraints in the urgent battle to save biodiversity rather than merely slow the rate of ecological decline. With the conservation goal posts shifting, all and sundry are scrambling to protect and restore native biodiversity at the necessary landscape scale. Science notwithstanding, the sheer scope and scale of landscape-scale conservation is daunting. In practical terms, how—and why—does one attempt to achieve conservation at such ambitious levels? Where does one even *begin*? This article examines how 50 scientists, conservationists, and funders have picked up the landscape-scale conservation gauntlet and worked together over the past three years to launch a transborder conservation collaborative in the 80-million-acre Northern Appalachian region of the eastern United States and Canada. Although this particular initiative —Two Countries, One Forest (2C1Forest, or "to see one forest")—remains in relative infancy, an examination of this preliminary period offers insights into the value of the landscape-scale approach, and the first steps toward a shared and compelling conservation vision.

The Northern Appalachian region: from New York to Nova Scotia

Northern New York, northern New England, and southeastern Canada share a vast, interconnected forested region and rich ecological system. Perched on the eastern edge of the continent, the Northern Appalachian region is also one of the most populated areas in North America, with a long history of human settlement and habitat alteration. Today it is a region that remains predominantly in private land ownership, particularly on the U.S. side of the border. Paradoxically, it is here, in this settled, threatened land, that some of the greatest potential exists on the continent for biodiversity protection and restoration—coupled with a great need for creative, collaborative conservation.

The heart of the region is the rugged chain of the Appalachian Mountains stretching down from the Gaspé Peninsula in Québec to the Berkshire Plateau in Massachusetts, with craggy, high peaks safe-

guarding fragile alpine species and high sedge meadows. This ancient mountain range is flanked on either side by spectacular forests. To the east are the Acadian forests of the Canadian Maritimes with their characteristic mix of maple, birch, spruce, and fir covered with lush moss, stretching down to a meandering coastline and safeguarding an incredible mix of coastal birds and other species, including Atlantic salmon and Arctic terns. To the west, the region encompasses the fabled Adirondack Mountains of New York, with their rare alpine vegetation and the region's largest wilderness areas and old-growth forests. The forests that blanket the Northern Appalachian region are an equal mix of deciduous northern hardwoods, high-elevation and lowland spruce–fir forest, and hardwood–spruce forest. This combination creates a spectacular display of fall foliage that has been called one of the most stunningly beautiful natural events in the world. Shaped by the retreat of glaciers 12,000 years ago and the mineral-rich soils they left behind, the region is also characterized by an endless web of ecologically rich bogs, wetlands, fens, rivers, lakes and streams that are home to numerous freshwater and wetland species—some globally unique.[1]

An impressive array of migratory songbirds—including Blackburnian, Canada, and black-throated blue warblers—flies each year from the tropics to raise their young in the Northern Appalachian forests. Many mammal species also call these forests home, including bear, moose, deer, American marten, and Canada lynx (Figure 1). The region also supports a number of species of concern because they are rare and sensitive to ecological change, such as the Bicknell's thrush, the woodland caribou, and alpine potentilla. Wolf, elk, wolverine, and cougar are other native species that

Figure 1. Prime moose habitat in the Adirondacks. Moose are currently repopulating the region, where they have not been seen for 100 years, because of habitat connectivity north to Canada and east to Vermont. *Photo courtesy of Emily M. Bateson*

were pushed out long ago; for some a return will be possible if land is suitably protected and connected.

Collectively, this broad sweep of forests cleans the region's air and water, and provides the densely populated Eastern seaboard with breathtaking beauty and extensive areas that offer protection for wildlife and opportunities for human recreation and wilderness solitude. Ecologically, this region represents a key transition zone between the boreal forests of the North and the temperate forests of the South—a vital ecological melting pot that melds the two together and enriches them both.

Conservation threats and opportunities: backdrop to collaboration at the landscape scale

The forests of the Northern Appalachian region are recovering from the extensive deforestation that occurred during the region's agricultural era, and overall forest cover today is far more extensive than 100 years ago (Trombulak 1994; Daniel and Hanson 2001). Moreover, over the last 15 years more than 6 million acres of forestland owned by forest products companies on the U.S. side of the border have come on the market because of the changing economics of the industry.[2] All this has led to opportunities for habitat and biodiversity protection not seen since the turn of the last century when the Adirondack State Park, Baxter State Park, and the Green and White Mountain national forests were created. In spite of the lengthy history of human influence since European settlement, the Northern Appalachian region currently offers enormous potential for conservation of its rich natural heritage.

At the same time, the ecological integrity of the region is increasingly endangered by a new suite of threats: human development, forest ownership fragmentation, airborne pollutants, and climate change (Daniel and Hanson 2001). Many native species are under stress while invasive species are on the rise. The region's forests today are much younger, more fragmented, and far less resilient to such ecological bombardment. As Mark Anderson, director of conservation science for the eastern region of The Nature Conservancy (TNC), explained: "Our forests are growing back, but the average size of trees is shrinking and harvesting methods are more intense. If a forest is full of coarse woody debris and old plants and root systems and fungi in the soil, then the forest can perform its traditional ecological role, be more resilient to stress, and recover faster." According to Anderson, "Restoring these components to our ecosystems is critical."[3]

In addition, the Northern Appalachian region does not have enough land set aside in conservation to protect biodiversity from the rising tide of human threats. In a region with 50 million people within a day's drive, the protected areas are not uniformly large enough, connected enough, or ecologically representative enough to maintain native biodiversity. Habitat corridors remain mostly unidentified and unprotected, despite their vital importance if the region is to remain one interconnected and healthy ecological system.[4]

The region overall has only 7% of its habitat designated as protected or "core" areas (lands preserved for ecological or habitat values with compatible recreational and other uses), and these lands are disproportionately clustered at high elevations. An additional 19.5% of the region is in buffer lands (The Nature Conservancy 2005) or "stewardship lands" (Figure 2). Generally,

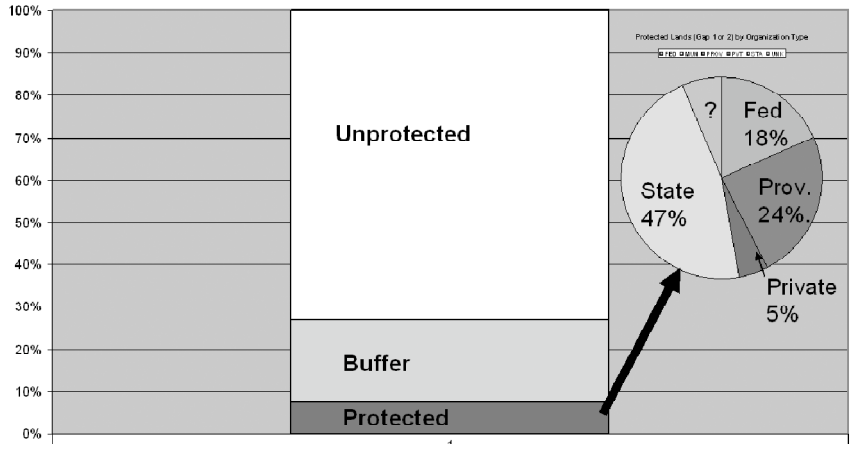

Figure 2. Summary of land protection in the Northern Appalachian region. Approximately 5,962,000 acres are in protected status, 15,799,000 acres are in buffer zones, and 59,198,000 acres are unprotected. Source: The Nature Conservancy Eastern Science Office. Data as of February 2004.

these are lands conserved through conservation easement that allows timber harvesting but no further subdivision or development; the extent to which such easements include additional ecological provisions varies widely, although the recent trend is promising. Although complementary and interdependent, protected areas and stewardship lands provide different ecological benefits (Trombulak 2001). Yet another barrier to conservation in the region has been a tendency to blur the distinction between the two in both word choice and map colors, thus diluting the ecological message that the region needs more areas in strict ecological protection—as the cornerstone of nature protection (Margules 2000)—as well as the more multi-purpose stewardship lands.

These facts and perceptions are important because of the growing scientific consensus that one of the most important tools for protecting native biodiversity is science-based conservation that protects large core areas *and* buffers them through well-managed stewardship lands *and* ensures functional habitat connectivity between the protected areas and across the ecological region. Only in this way will a region maximize its chances of protecting and restoring the key elements of biodiversity: (1) representative natural communities; (2) viable population of all native species; (3) natural and evolutionary ecological processes; and (4) the ecosystem's responsiveness to change (Noss and Cooperrider 1994; Trombulak 2001).

Yet another regional challenge is the international political boundary between Canada and the United States. Despite the 20-year history of marine collaboration through the Gulf of Maine Council, conservationists and agencies on the two sides of the border have little history of working on terrestrial habitat protection together, or even considering the Northern Appalachians as one ecological region. Stakeholders are not fully aware of the others' conservation history, regulatory differences, or priority concerns. The French-speaking worlds of the Canadian provinces pose an additional challenge to English-only speakers.

In order to achieve the new ecological triumvirate of conservation, practitioners must understand as never before what habitat, species, and ecological processes to protect and at what level of protection. They must build public support for and implement a broad range of private and public land management strategies as well as for new land acquisition: a multifaceted conservation arsenal both complex and expensive. Cultural and economic issues must be firmly woven into the equation on this settled landscape, but somehow without sacrificing the ecological bottom line. With large public lands few and far between, and conservation opportunities dramatically outpacing available funds, the Northern Appalachian region represents conservation in the trenches, and an ecosystem in a race against time.

A transborder collaborative is born

The volume of land for sale over the past decade and a half, coupled with increased biodiversity understanding, have combined to form a sense of conservation urgency. New public–private partnerships have formed, and creative financing and protection mechanisms have emerged. On the U.S. side of the border alone, approximately 2.5 million acres have been placed in some level of conservation, with roughly 2 million acres of new stewardship lands under conservation easement and 325,000 acres of new protected core areas (The Nature Conservancy 2004). Public land management gains include 335,000 acres of Crown land in New Brunswick that have been designated as protected natural areas, where industrial activities such as forest harvesting and mining are prohibited in perpetuity.[5]

Despite the number of impressive conservation alliances and initiatives, there was no unifying vision for the ecological health of the region as of 2001. There was no clear ecological framework or understanding of how each piece of conservation must contribute to the larger biodiversity puzzle, and there was no network sharing vital information and strategies across the international border. The conservation pace was rapid, but the framework across the region remained muddled and somehow incomplete. As Kathleen Fitzgerald, executive director of the Northeast Wilderness Trust explained: "There has been a barrage of conflicting economic and ecological messages out there. If we are to succeed in preserving ecological integrity, we must work across the entire ecological region and tackle the hard questions. For example, is conserving timberland and core reserves in a ratio of 10 to 1 sufficient? What has been notably lacking is a diverse, bi-national network to put biodiversity front and center and address these challenging issues."

In the fall of 2001, the EJLB Foundation and the Henry P. Kendall Foundation hosted a half-day meeting in Montréal of key conservationists and scientists involved in Northern Appalachian conservation and biodiversity protection. "We had worked for the past several years to help build the Y2Y Conservation Initiative," explained Ted Smith, executive director of the Kendall Foundation, "and saw the ecological imperative and strategic need to promote landscape-scale conservation in the Northern Appalachians as well." This need was highlighted as attending organizations presented information and maps that stopped at the boundaries of their immediate conservation concern, and most notably at the international boundary. By the end of the gathering, participants agreed on the

value of meeting again the following year, and an informal cross-border conservation network called ANEW volunteered to take the organizational lead.[6]

With support from the Fine Family Foundation, the Henry P. Kendall Foundation, the EJLB Foundation, and the George Cedric Metcalf Foundation, a second meeting was convened in the fall of 2002. The participation list of the earlier meeting (23 participants) was expanded to an invitee list of approximately 65 scientists, conservationists, and funders; roughly 50 ultimately attended the meeting. This began a series of strategic two-day meetings with increasing momentum and collaboration since that time.

At the 2002 gathering, participants adopted a preliminary vision and mission statement, after readily agreeing that a transborder collaborative was the optimal way to achieve their shared conservation missions. "The Nature Conservancy has considerable science and conservation resources invested in the Northern Appalachians," explained William Ginn, 2C1Forest chair and TNC representative. "But we recognized that it will take many, many partners to protect and restore biodiversity here. 2C1Forest promised to be the glue that holds us all together through inspiration, collaboration, perspiration, and implementation." Smaller organizations recognized that their local missions must be achieved within a framework of regional ecological integrity to be successful. Scientists applauded a forum where scientists and conservationists could come together around collective strategies for biodiversity protection.

Over the course of that first year, participants crafted four goals for 2C1Forest:

- Vision and network: Provide a compelling vision for regional ecological integrity and a network—a "watering hole" —for all to share their work around this vision;
- Conservation science: Help infuse regional conservation decision-making with credible science by improving communication and coordination between conservationists and scientists, and by synthesizing and disseminating ecological information to build public understanding and influence conservation policy;
- Education and outreach: Increase public awareness and support of the Northern Appalachians as a vibrant ecological region and landscape-scale conservation as a vital regional goal; and
- Strategy and implementation: Work with partner organizations to design and implement specific, "value-added" conservation strategies.

In addition to clarifying its mission and goals, 2C1Forest and participating organizations crafted by-laws, and adopted a formal steering committee, executive committee, and science and communications working groups. 2C1Forest also completed a number of strategic analyses, including a detailed communications framework, an analysis of regional science and policy needs, and an evaluation of the potential value-added purposes of 2C1Forest that included review of landscape-scale conservation initiatives elsewhere.

In the second year, starting in the fall of 2003, 2C1Forest and its partner organizations began crafting major initiatives in all four priority goal areas, and the executive committee created a five-year plan for the collaborative. A "branding" exercise helped

refine the communications framework, and gave the group its current name. 2C1Forest launched its cornerstone science initiative, the Ecological Status and Trends ("EcoTrends") Initiative (see below), and began scoping a Key Connections Initiative on regional habitat connectivity.

The Human Footprint Project

The most advanced and illustrative 2C1Forest initiative to date is the Human Footprint Project, part of the larger EcoTrends Series, based on the 2C1Forest science working group's identification of seven key ecological issues affecting biodiversity and wilderness quality across the Northern Appalachians: land use change, invasive species, native species status and trends, forest condition, pollution, natural disturbance, and global climate change. The Human Footprint Project will specifically address the issue of land use change by analyzing and mapping the current human activities that affect the natural landscape of the region. This collaborative project is being led by the Wildlife Conservation Society (WCS), the organization that developed the human footprint methodology at a global scale (Sanderson et al. 2002).

The Northern Appalachian human footprint analysis will be published as a peer-reviewed article with a background technical document detailing the analytical process. In addition, 2C1Forest will prepare a companion policy report that "translates" the scientific findings and connects conclusions to on-going regional conservation initiatives, releasing the report with a major media push and public outreach strategy. This approach of journal article and policy report will ensure scientific credibility while maximizing public education and policy influence. A second project in the EcoTrends Series will provide a "future build-out" analysis that models biodiversity health under alternative future conservation scenarios—a methodology that has been very effective in combating urban sprawl. These projects are emblematic of 2C1Forest: they are collaborative, science-based, and biodiversity-focused, but also rooted in the world of policy and conservation implementation.

Evaluating Two Countries, One Forest

2C1Forest is now in its third year, and strategic planning is giving way to outreach and implementation. To paraphrase Winston Churchill, 2C1Forest now stands poised at the "end of the beginning." The listserv has grown to more than 125 people, the website and electronic newsletter will be launched in early 2005, and the EcoTrends Series is underway. 2C1Forest will host a regional landscape-scale conservation conference and "coming out party" for the organization next winter. A full-time executive director will be hired and a science fellow is coming on board. Momentum continues to build. As the preliminary dust settles, interviewed participants cite values of this collaborative effort that mirror to a promising extent the experience of the Y2Y Conservation Initiative after seven years of operation (Chester, this issue).

First, the regional perspective and networking championed by 2C1Forest and partners have served as a catalyst for trans-border conservation thinking, planning, and action. Participants have started participating in major conservation debates across the border,[7] have worked to educate each other on key issues, and are starting to initiate projects that will help "float all boats." As set out in Chester's article in this issue, the Canadian and U.S. conservation

experience is different in terms of how much wild habitat and native species remain or have been lost, and each side can learn fundamental lessons from the other. Reconnecting the two countries in order "to see one forest" is both an inspiring vision and an ecological necessity.

Second, 2C1Forest puts ecological health and integrity front and center—and what else could possibly be the end game for conservation? This vision and message will enhance and invigorate the many ongoing conservation initiatives that must battle every day with competing issues of politics, short-term economics, intensive recreation, cultural biases, and so on. This will be achieved by providing not only a powerful science-based message, but providing it with clarity and consistency to new and traditional constituencies. "Messages must be clear and consistent to get into the public water supply," articulated Wildlands Project Northern Appalachians Director Conrad Reining. "2C1Forest will provide laser-like focus on the biodiversity message, and this will help build new support for conservation and change the regional conservation paradigm."

Third, 2C1Forest promises to bring new vigor to the regional biodiversity initiative, not only through transborder collaboration, but through bringing scientists and conservationists together. As noted by WCS Canada Director Justina Ray, "2C1Forest provides a rare forum where those of us who care about biodiversity can put our heads together and implement credible, science-based projects that will make a real difference in the real world."

Finally, 2C1Forest provides a big picture vision that resonates because it is both ecologically necessary and fundamentally inspirational to people in conservation practice across the region. As Vermont-based Forest Watch Executive Director (and first 2C1Forest Chair) Jim Northup explained: "The Green Mountains are the ecological heart of Vermont, but also a major corridor connecting habitat and species from Massachusetts to Québec. The 2C1Forest vision inspires us to do our part not only for Vermont, but for the whole Northern Appalachian region." The New Brunswick executive director for the Canadian Parks and Wilderness Society (CPAWS), Roberta Clowater, concurred: "We are working on an initiative to protect natural areas in the Restigouche River watershed. This watershed and its major salmon rivers are ecologically significant in their own right, and as part of a corridor connecting Maine to the Gaspé. Working with 2C1Forest has given me a powerful message about the Restigouche's international significance which will help encourage increased nature conservation in that corner of our province."

The 2C1Forest vision is powerful in both its simplicity and its logic: protecting nature is the right thing to do, and implementing science-based regional conservation is the only way to succeed. Three years of collaboration have laid a solid foundation for implementing that vision, and now the hard work begins. The experience to date has only deepened the collective commitment of 2C1Forest participants to build a broad-based regional collaborative—through an ever-expanding circle of regional partners—and succeed in protecting and restoring the region's biological wealth. The end of the 2C1Forest vision statement, crafted at the first meeting, continues to resonate, now more than ever: "On a satellite image of the continent at night, an impressive part of the Northern Appalachians is

still bathed in darkness—it is still wild. We see a vast and effective network of people across the region that care enough, and know enough, to protect and restore our priceless ecological heritage for future generations of wildlife and people while we still have this spectacular chance."

Acknowledgments

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Endnotes

1. The ecological description of the Northern Appalachians is taken from Trombulak 1994; Davis et al. 2001; a presentation by Mark Anderson of The Nature Conservancy at the November 5–6, 2002, 2C1Forest meeting in Montréal, entitled "An ecological overview of the northern Appalachians"; and from 2C1Forest partner information.
2. A number of organizations have tracked the extent of land turnover over the past 10–15 years, including The Nature Conservancy (The Nature Conservancy 2005) and the Northern Forest Alliance (Northern Forest Alliance 2003).
3. Presentation by Mark Anderson of The Nature Conservancy, entitled "Restoring ecological systems and processes in the northern Appalachians." 2C1Forest Meeting, Montréal, May 21–22, 2003.
4. Habitat connectivity—only intermittently on the regional conservation radar screen—is ecologically vital, particularly for mammals that have extensive habitat requirements and need to travel long distances to disperse, find food and mates, and maintain long-term genetic viability. Scientists predict that north–south connectivity will be increasingly important for both plant and animal species in an era of climate change. Today, the northern reaches of the Northern Appalachians provide the last bastion of many key species, including the eastern caribou and Canada lynx. Analyses of lynx and wolf indicate the need for increased protection and connection of regional habitat for successful reintroduction and conservation efforts (Carroll 2005). Moose from Québec and Vermont are currently repopulating the Adirondack Mountains, where they have not been seen since the turn of the last century, and yet few of the travel corridors being used are protected. What will happen if such connectivity and ecological richness is lost over time? Connecting habitat across the region is necessary to ensure that individual parks, refuges, and other protected areas do not become "habitat islands" that lose biodiversity over time, but that instead are woven together into one robust and enduring ecological system.
5. Background on New Brunswick protected natural areas may be found at the website for the Canadian Parks and Wilderness Society (CPAWS) New Brunswick at

www.cpawsnb.org/NBprotected.htm and that of the New Brunswick Department of Natural Resources, www.gnb.ca/0399/index-e.asp.

6. The author stepped forward at the 2001 meeting to organize the 2002 gathering, acting in a pro bono capacity for an incipient and informal U.S.–Canadian network, A Network for Eastern Wilderness (ANEW), which was to become the predecessor of 2C1Forest. Jim Northup, executive director of Vermont-based Forest Watch; Roberta Clowater, executive director of what is now CPAWS New Brunswick; and Conrad Reining, Northeast regional director of the Wildlands Project, constituted the remainder of the ANEW executive committee that worked with science and conservation partners to convene these early seminal meetings.
7. Two examples of cross-border participation in 2004 are American comments submitted to the province of New Brunswick on an ecologically ill-advised proposed doubling of timber harvesting on Crown lands, and Canadian comments submitted to the U.S. Forest Service on draft regulations that would have reduced biodiversity protection on national forests, including the region's ecologically significant White and Green Mountain national forests.

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On Defying Nature's End: The Case for Landscape-Scale Conservation

Gustavo A. B. da Fonseca, Aaron Bruner, Russell A. Mittermeier, Keith Alger, Claude Gascon, and Richard E. Rice

Introduction

TODAY, SOME OF THE EARTH'S LAST REMAINING BIODIVERSITY "HOTSPOTS" appear headed for a cataclysm due to widespread loss of native habitat, particularly in the species-rich tropics (Myers et al. 2000). Even where forests still remain, in many areas inadequate protection has resulted in the elimination of most medium- and large-bodied wildlife species, resulting in the so-called "empty forest syndrome" (Redford 1992). It has become clear that humans have the power to eliminate a broad spectrum of species, not just large game, and to destroy entire biological communities.

Fortunately, scientists studying these changes have now accumulated enough information to provide strong predictions of what can be expected if we do not intervene. Recent analyses suggest that in the next five years, for example, Mesoamerica (Mexico to Panama) is likely to lose 10% of its remaining natural vegetation, with the resulting extinction of at least 22 species of vertebrates and 93 species of plants (Brooks et al. 2002). Even the major tropical wilderness areas (MTWAs) (Myers et al. 2000; Mittermeier et al., in press)—which, unlike the hotspots, still retain 70% or more of their native vegetation cover—are rapidly changing with the advancement of agriculture frontiers. Anticipated loss of habitat in these areas will result in a far greater number of species at risk of extinction (Pimm and Raven 2000).

Awareness of this impending crisis gives us early warning that if we do not act, it will soon be too late; the question is what actions are necessary. The challenges faced by conservationists in the past offer some important lessons. Parks and reserves, despite widespread pressure, have shown themselves to be the only areas where the full complement of biodiversity persists in contexts of serious threats. On the other hand, ecological and economic dynamics have also made it clear that the *status quo* approach to conservation, highly site-specific and largely reactive, is barely holding the line in a sort of environmental "trench warfare," and is not adequate to protect biodiversity in the long run. Despite increased conservation efforts, many critical areas are still lost each year.

If we are to avert a massive crisis, there is an urgent need to both drastically increase the scale of conservation work, and, equally important, to adjust our strategies to address large-scale ecological, social, and economic realities. This article describes some of the principal results aris-

ing from a broad portfolio of scientific investigation conducted by the Center for Applied Biodiversity Science (CABS) at Conservation International (CI). Since its creation in 1999, CABS has functioned as a strategic research unit closely linked to CI's needs in the field. The strategy presented here, like those also under development by many conservation organizations on a worldwide scale, begins with the need for strict definition of biodiversity conservation priorities, followed by focused action at both site and regional scales, seeking to achieve concrete, measurable, and time-bound conservation outcomes. This article also examines working at the landscape scale to successfully integrate biodiversity conservation with sustainable development.

Where to work: setting biological priorities

The world is far too big and resources too limited for conservationists to be active everywhere. Setting priorities for investment and action is therefore vital. Biodiversity loss is arguably the only major global environmental problem that is truly irreversible, and facing this challenge requires immediate and targeted action.

If we are to minimize loss of biodiversity, as measured at the level of species, identifying areas with concentrations of endemic (restricted-range) plants and animals becomes paramount. A number of regions stand out globally as centers of terrestrial species richness and endemism. A pioneering approach to identifying these regions is represented by the global biodiversity hotspots, areas featuring exceptional concentrations of endemic species, and experiencing exceptionally rapid loss of habitat. Myers (1988, 1990) was the first to highlight the extreme value of these few terrestrial habitats that account for a significant portion of Earth's biodiversity represented by endemic species.

A recent re-analysis of this framework (Mittermeier et al. 1998, 1999; Myers et al. 2000) defined 25 hotspots (Figure 1), currently covering only 1.4% of the land surface of the Earth, which provide the only remaining habitat for an estimated 44% of all species of vascular plants and 35% of all of mammals, birds, reptiles, and amphibians. All of the hotspots have already lost more than 70% of their original vegetation. Many species in the hotspots are also extremely vulnerable, with diminished populations, highly fragmented habitat, and pressures from numerous sources. Since 1800, close to 80% of all bird species that have gone extinct were lost from the biodiversity hotspots (Myers et al. 2000).

A complementary approach to priority setting is to select regions that are exceptionally species-rich, but still largely intact. These regions offer the opportunity to protect large, relatively pristine areas and intact faunal assemblages, a strategy that may prove vital in the long term. The biological importance of the three MTWAs (Figure 1) has been recognized by a range of groups for over a decade. Covering only 4.8% of the Earth's land surface, they provide the only habitat for over 14% of the world's vascular plant species, and for over 7% of all non-fish vertebrate species (Mittermeier et al., in press). A re-analysis of important wilderness areas, considering 37 regions in a range of ecosystems, is being finalized at the time of writing, and suggests that at least two new wilderness areas should be considered highest priority for conservation (Mittermeier et al., in press).

Cumulatively, the hotspots and the three MTWAs contain, *as endemics*, almost

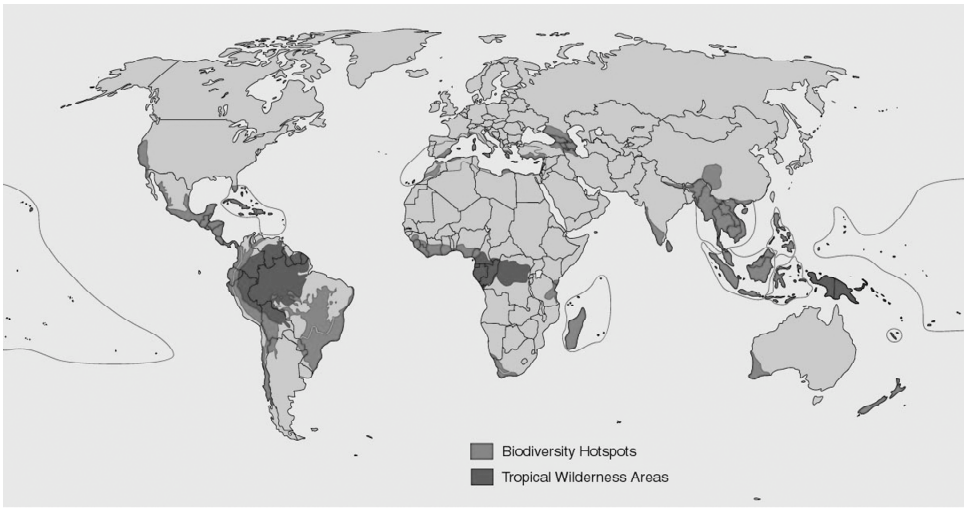


Figure 1. Global biodiversity hotspots and major tropical wilderness areas (adapted from Myers et al. 2000).

59% of the world's vascular plants, and just over 42% of the world's non-fish vertebrates in just over 6% of the land surface. With the addition of the two new high-biodiversity wilderness areas, the hotspots and wilderness areas contain an even greater share of the world's biodiversity. Focusing on these two types of areas, representing extremes of extinction threat and intact functioning ecosystems, offers an unparalleled opportunity to save great numbers of species by concentrating conservation activities in a geographically restricted area.

The identification of a global priority agenda is a critical first step in achieving much-needed consensus on priority areas. To a large extent, the results of different approaches to setting priorities at a global scale, led by different conservation organizations, are beginning to converge (Fonseca et al. 2000; see Figure 2). Moving to finer scales, where specific regions and sites can be selected for action, represents the next challenge, one which can only be accomplished with detailed, spatially explicit, species-level data. Progress is being made on this front as well: a number of research groups and organizations are collaborating in compiling such data and making them available to the global conservation community (Brooks et al. 2001). These data make it possible for the first time to identify with precision where we need to work to protect specific species.

Site conservation tools

Species conservation objectives are made more manageable by defining geographical focus areas. But once we decide *where* to work, the challenge becomes *how* to do effective conservation there. In this section, we discuss conservation tools for protecting specific areas. We review evidence on the effectiveness of protected areas and draw conclusions for what strategies are likely to be most effective in the future. We also present *conservation corridors* as a means to combine site conservation tools into an integrated strategy at a scale sufficient to address ecological and economic needs.

Beginning with the model of Yellow-

stone National Park in the United States, the creation of protected areas to restrict direct use of biological resources became the predominant strategy to ensure the persistence of representative samples of native habitat and their associated biodiversity in many parts of the world. Other forms of protected areas, such as game reserves or national forests, also sought to prohibit public use of specific resources (in these cases, large game species and timber, respectively). In the last two decades, however, protection by means of reserves, or activities traditionally associated with parks, such as border demarcation and enforcement, have been criticized as both inappropriate and ineffective in many cases (Wilshusen et al. 2002; Ghmire and Pimbert 1997; Brown and Wyckoff-Baird 1995; IUCN et al. 1991). Furthermore, the often-stated goal of placing 10% of national territory in protected areas has come to be viewed by many groups as a limit to the acceptable amount of protection, rather than an important short-term objective (Soulé and Sanjayan 1998; Schwartzman et al. 2000).

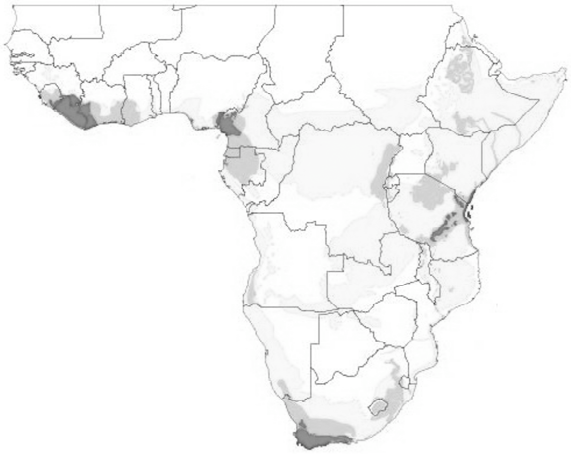


Figure 2. Overlay of conservation priority regions in Sub-Saharan Africa identified using different priority-setting approaches (biodiversity hotspots, World Wildlife Fund's Global 200 most important ecoregions, and Birdlife International's endemic bird areas). Darkest shading indicates intersection for all three approaches, and medium shading indicates intersection for two (from Fonseca et al. 2000).

These criticisms have combined with the appealing possibility of jointly promoting conservation and development, to bring about a major change in conservation strategies. A large portion of conservation effort is now dedicated to promoting, frequently as a direct substitute for parks, the rather vague concept of "sustainable development" (IUCN et al. 1991). Instead of seeking to separate areas for conservation from areas for resource use, sustainable development attempts to integrate them in the same place by promoting types and intensities of use that are profitable but compatible with conservation goals. This strategy is based on an appealing premise: successful sustainable development-based conservation projects should create a win–win situation in which relevant stakeholders benefit from, and therefore try to promote, conservation. Sustainable development can therefore ideally create a situation in which pressure on natural resources decreases, constituencies for conservation increase, and effective conservation becomes possible in a range of difficult contexts.

What does recent experience tell us about these strategies? In regard to parks, there is evidence of both successful areas as well as those that have become heavily degraded. It is also clear that, in many cases, park management is far from ideal. Studies detail a myriad of problems such as Ghana's "empty" forests (Oates 1999), oil spills in

parks in Ecuador (van Schaik et al. 1997) and illegal logging and clearing of Indonesia's parks (EIA/Telepak 1999). In a review of rainforest parks across the tropics, van Schaik et al. (1997, 64) write: "Protected nature reserves are in a state of crisis. A number of tropical parks have already been degraded almost beyond redemption; others face severe threats of many kinds with little capacity to resist. The final bulwark erected to shield tropical nature from extinction is collapsing." They go on to detail numerous cases of degradation from causes such as illegal hunting, grazing, logging, and land clearing. More fundamentally, there is a widespread perception that traditional parks cannot protect the resources within their borders against ever-increasing human pressures.

In contrast, ample evidence suggests that protected areas have had a significant impact even with relatively low levels of investment. In large areas across Latin America that are completely cleared, parks often stand out as the only remaining natural habitat (Dourojeanni 1999). Even highly degraded parks often harbor the last remaining species in otherwise devastated ecosystems (van Schaik et al. 1997). A growing body of literature from various disciplines offers convincing support for parks. Statistical analyses have found strong protective effects of parks in Belize and Mexico (Chomitz and Gray 1996; Deininger and Minten 1997). A study in Costa Rica, using satellite imagery, similarly found that while the country as a whole lost approximately 10% of its remaining forest between 1987 and 1997, national parks lost only 0.4% (CCT/CIEDES 1998). A regional study in Costa Rica found similar trends over a twenty-year period starting in 1975 (Sanchez-Azofeifa et al. 1999).

A study of 22 tropical countries (Bruner et al. 2001) attempted to quantify effectiveness in parks under high levels of threat. They used a sample of 93 parks to assess effectiveness by both calculating land clearing over time and comparing the condition of parks with the condition of their surroundings. They found that 83% of the parks in the sample experienced no net clearing since they were established (median age 21 years), and that a full 40% permitted the regeneration of native vegetation on land that was cleared at the time of park establishment. Only 17% had a net loss of native vegetation to land clearing. In comparing parks with their surroundings, although they found instances of serious degradation, most often from hunting, overall the parks were in significantly better condition than their surrounding areas for all impacts tested (land clearing, logging, hunting, grazing, and fire). These findings suggest that the perception that parks cannot resist high levels of pressure is inaccurate, and that on the contrary, with relatively modest support, parks can be highly effective.

Finally, challenging some common claims, the rate of creation of new protected areas has not slowed in recent years (WCPA 1999), demonstrating that opportunities still exist, and may even be expanding, to create and support more protected areas in key ecosystems around the world. A wealth of data from countries such as Brazil (Ayres et al. 1997) and India (Kutti and Kothari 2001) indicate a burst of creation of additional parks and reserves during the last decade.

What about the track record of sustainable development? A look at the effects on biodiversity conservation of a range of sustainable development projects suggests that

the reality has not lived up to original expectations. For instance, despite years of effort and hundreds of millions of dollars spent to support sustainable forest management (SFM), there is still very little natural forest in the tropics actually under SFM. As of 2001, the Forest Stewardship Council (FSC) had certified only 2 million hectares of natural forest in the tropics (FSC 2001). In broader terms, the International Tropical Timber Organization (ITTO) notes that "while policy successes have been many and awareness ... of the need for sustainable forest management is growing, the review of progress (Poore and Chiew 2000) reports far less evidence of the implementation of good management in the forest itself" (ITTO 2002).

Related limitations also exist for conserving areas via forestry as well as other types of sustainable development projects, such as sustainable harvest and marketing of non-timber forest products, development of non-destructive means of income generation (e.g., bee-keeping), and organic or low-impact agriculture. Frequently, some of the most important of these limitations are inadequate market value or difficulty in marketing many forest products, and limited markets for green agricultural products. These factors make it difficult in many cases for sustainably harvested forest resources to generate sufficient income to compete with land conversion, and also mean that the majority of agricultural production will not be able to take advantage of the demand for green products (Hardner and Rice 2002; Dourojeanni 1999).

Finally, even where projects succeed in creating profitable enterprises, conservation has largely been promoted only as an indirect by-product of development activities. Abundant literature suggests that the result of this strategy has been that most sustainable development projects have failed to shift people's behaviors towards helping to conserve biodiversity (Robinson 1993; Kramer and van Schaik 1997; Southgate 1998; Simpson 1995). Indeed, reviews of integrated conservation and development programs (ICDPs) have found that sustainable development as a stand-alone conservation strategy has been widely unsuccessful (Wells et al. 1999; Terborgh 1999; CIFOR et al. 1999).

These limitations suggest that substituting sustainable use schemes for protected areas is unlikely to result in effective species conservation, and that support for protected areas should be the top priority for conservation funds. On the other hand, ensuring that production supports conservation goals in key areas, and that conservation and development are mutually reinforcing, remains a fundamental goal: well-designed development-based conservation projects have an important role to play supporting protected areas in this context. Among other important needs, these projects can provide connectivity across fragmented landscapes, as well as local benefits and increased support for conservation.

The limits of site-based action: bringing conservation to the landscape scale

Where does this leave us? If parks can work for species conservation and there are serious limitations to sustainable development as a substitute, then it appears that conservation must come primarily from setting resources aside from human use, while enabling a supporting role for sustainable use projects. Still, many critical biodiversity areas are located in regions where economic development needs are a reality, and park creation may not be a viable option due to

population, social, or political pressures. Even where parks exist, many are too small to maintain ecological processes and allow for global change dynamics. In particular, changes driven by human-induced global warming may cause such serious shifts in habitat locations that protected areas that do not contain an altitudinal gradient may lose all suitable habitat for the species they are designed to protect (Peters and Lovejoy 1992; Hannah et al. 2002). Finally, with millions of people living in poverty, highly indebted governments, massive and growing levels of consumption in developed countries, and with world population expected to increase by another 3 billion in the next 50 years (United Nations 1998), development needs and pressures on protected areas are only expected to increase (see Figure 3). In this context , the aim of reconciling poverty alleviation with conservation objectives seems largely unattainable at the site scale, particularly when dealing with small and fragmented parks.

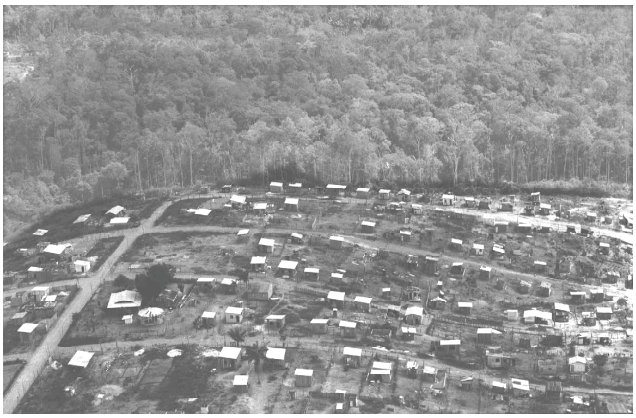


Figure 3. Hard edge around the Adolpho Ducke Forest Reserve, Manaus, Brazil. Photograph taken in 2000. *Photo courtesy of the authors*

To face these challenges, we must find a way to implement conservation strategies that address development needs, but still put effective conservation tools in place at a scale commensurate with ecological processes. A key issue in finding the solution to this challenge is *scale*.

Traditionally, conservationists have focused only on individual pieces of the landscape. We believe that past efforts to combine conservation and development objectives in this context have often failed because the planning and implementation scales were geographically so limited that they placed conservation and development goals in direct competition with each other, resulting in frequent conflict and mutual loss. In reality, biologically important landscapes are often highly varied, with a wide range of actors, ecosystem types, and economic activities. Embracing all land uses by broadening the focus of conservation planning to the landscape level greatly increases opportunities to coordinate and promote conservation and development goals together, addressing both ecological and economic dynamics.

We call conservation planning units at this scale *landscape-level biodiversity corridors*, a concept first articulated in the connection with a major project designed to stimulate the creation of additional protected areas in the Brazilian Amazon and the Atlantic forest, financed by the Brazilian government and the World Bank's Pilot Project to Conserve the Brazilian Rain Forest (Ayres et al. 1997). Landscape corridors are distinct from biological corridors in that their purpose is not simply to permit demographic and genetic flow of animal and plant populations. A

landscape corridor is a biologically and strategically defined sub-regional space selected as an unit for large-scale conservation planning and implementation purposes, in which conservation action can be reconciled with inevitable economic development, in this case freed from the constraints of competing land use claims over very small-sized areas. Within landscape corridors, planners can seek to place critical biodiversity areas under strict protection, important areas can be allocated to economic development, and others with mixed goals with can also be defined. A landscape corridor therefore comprises a network of parks, reserves, and other areas of less-intensive use whose management is integrated into the landscape matrix to ensure the survival of the largest possible spectrum of species, while avoiding direct conflict with unavoidable economic development needs.

Using landscape-level corridors as planning units can accomplish what planning at the scale of individual parks and buffer zones cannot: the optimum allocation of resources to conserve biodiversity at the least economic cost to society. Furthermore, planning at this scale enables conservation planning to address long-term trends and changes in ecological and economic dynamics. Large landscape-level corridors can even go a step further in designing mosaics that are mutually beneficial to both conservation and development goals (e.g., protected areas to conserve watersheds and tourism resources, and compatible development to promote species movement between protected areas or to provide important buffers).

Corridor planning in Brazil's Atlantic forest serves as a useful example of how the corridor strategy can work in practice. The Atlantic forest is among the top five "hottest" hotspots in the world. With only 7.5% of its original forest cover remaining, it is home to 11,000 endemic plant species, and is among the top areas in the world in numbers of arboreal plants, reaching 454 species in a single hectare (Thomas et al. 1998). The area is also densely populated by over 60% of the entire Brazilian human population. Only 2.7% of original forest is in protected areas, far too little to conserve its vast diversity of species.

Because the Atlantic forest is highly fragmented, populations of plants and animals are highly vulnerable and isolated. The few parks and reserves that existed up to the mid-1990s were being progressively encroached and opportunities for the expansion of the reserve network were perceived as diminishing, if not altogether vanished. In this context, site-by-site conservation was not a viable strategy for long-term species protection. For species to persist, it was necessary to maintain and restore connectivity across the landscape. In the heavily populated context of the Atlantic forest, this required both core zones of protection and mosaics of multiple land uses in a managed landscape to allow populations to move among proximate, intact forest blocks (Ayres et al. 1997), while at the same time addressing existing socioeconomic needs. Thus, in order to design a functional mosaic of land uses (see Figure 4), corridor planning took account of a number of major socioeconomic and biological factors, including (1) land ownership and major uses, (2) location of remaining forest, (3) location of key species, (4) location of current and proposed roads, and (5) land values.

Priority actions under the corridor plan were, first, to consolidate existing pro-

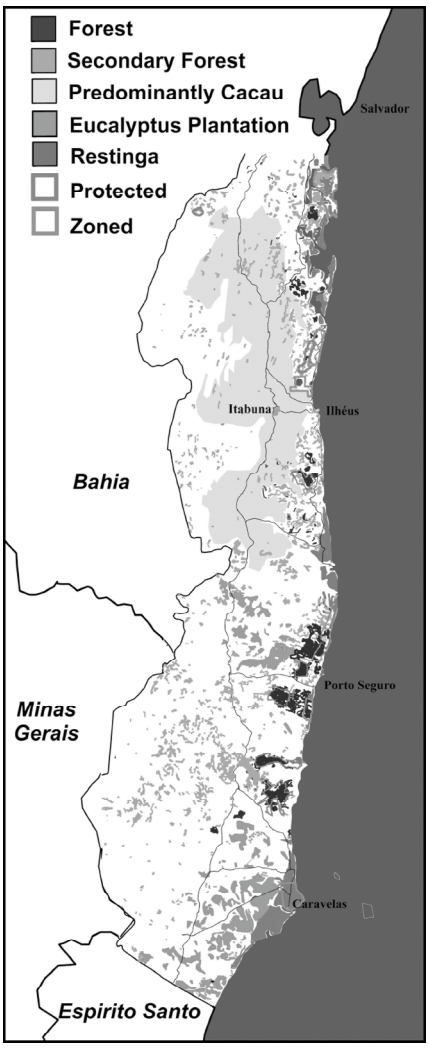


Figure 4. Southern Bahia portion of the central Atlantic forest corridor, indicating major land uses, remaining forests, and protected areas.

tected areas and create new ones, to form critical corridor nuclei. These nuclei also needed to be supported by links across private properties by providing economic incentives for key private landowners to shift to compatible land uses. In the case of the Atlantic forest, these uses included shade cocoa and the creation of private reserves. The final corridor design, spanning over 50,000 sq km, includes conservation nuclei and linkages as well as areas for both high- and low-intensity economic activities, creating a plan that is increasingly being met with broad public approval (CABS, 2000; Figure 5). A multi-stakeholder management committee to oversee the implementation of corridor-scale activities is now operational, orienting the investment of financial resources from the World Bank and the Brazilian government.

Several important lessons can be drawn from work in the Atlantic forest and other corridor projects to date. First, the value of biodiversity (both market and non-market) is often not recognized in local economies; planning at a regional scale can provide a format for ensuring that these values are considered. Second, there are always trade-offs in conservation planning. Given limited funding and competing interests, conservation of some areas will need to take priority over others. Finally, corridors, like all conservation strategies, are no "silver bullet": they simply increase the scope for cooperation and grant some breathing room to promote both conservation and development objectives without attempting to put them both in the same place. Experience suggests that there will be winners and losers in almost every possible outcome, even those that are optimal for society as a whole. What corridors offer is an opportunity to more effectively design combinations of site conservation tools and integrate them with development plans.

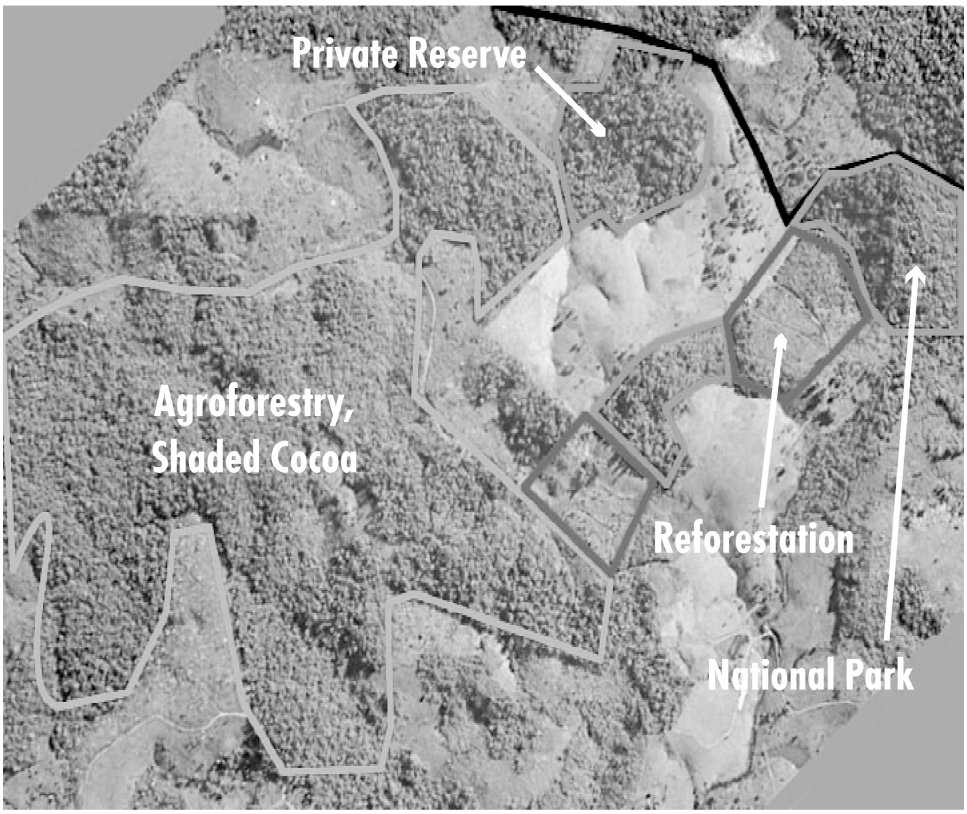
Defying Nature's End: a practical plan of action

As part of a major effort to transform these ideas into a concrete plan of action, in August 2000 over 50 scientists and 17 private-sector representatives met in California

at a conference entitled "Defying Nature's End: A Practical Agenda for Saving Life on the Planet." The objective was to pull together current scientific thinking to develop a plan for the fundamental components of a conservation strategy to save the most threatened portion of global biodiversity (Pimm et al. 2001; www.defyingnaturesend.org). The conference concluded that acting rapidly and strategically in key places in the tropics, particularly targeting the protection of habitat in the global biodiversity hotspots and the MTWAs, could have a major impact in stemming many looming extinction events (see Pimm and Raven 2000; Brooks et al. 2002).

For the hotspots, the agenda calls for a focus on 60% of the remaining intact habitat by improving management of 800,000 sq km of existing protected areas and by bringing an additional 400,000 sq km of land under protection. For the wilderness areas, the agenda is to focus on 55% of the remaining intact habitat to more than double the area under park protection, in addition to improving management of existing protected areas and indigenous reserves. In contrast to the hotspots, a significant portion of remaining natural habitat in wilderness areas is under indigenous control. For instance, over 24% of the Brazilian Amazon has been demarcated for indigenous tribes (Ricardo 2001). Some tribes, like the Kayapo of Southern Para, are doing a remarkable job in resisting encroachment from agriculture and cattle ranching, but

Figure 5. Hypothetical land uses in a portion of a conservation or biodiversity corridor in the Brazilian Atlantic forest.



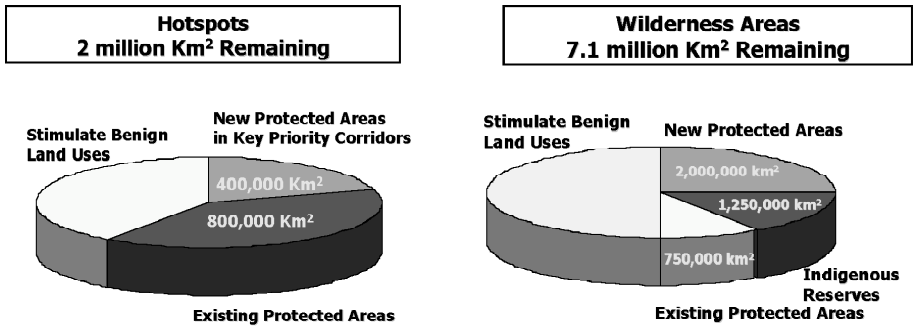
over time these efforts alone may not suffice. If resources can be secured so that these lands are better managed in perpetuity and incorporate biodiversity objectives that can be pursued by indigenous peoples themselves, the wilderness areas agenda will be greatly strengthened. Finally, in both hotspots and wilderness areas, direct protection must be complemented by additional investments to bring more compatible land use schemes to critical parts of the remainder of the landscape matrix (Figure 6).

Participants at Defying Nature's End also estimated the cost of implementing the direct protection components of this strategy. These included placing additional land under protection via land acquisition or compensation, long-term management of new protected areas, and improving management in existing protected areas. Data used for these estimates included published figures (e.g., James et al. 1999a), and unpublished data on the cost of acquisition, compensation, and management in specific sites. For the hotspots, needs were estimated at US$24 billion above current expenditure ($6 billion of private investment leveraging an additional $18 billion). For the wilderness areas, needs were estimated at US$4 billion above current expenditure ($1 billion leveraging $3 billion). Taken together, an estimated one-time investment of US$28 billion could take the world a long way towards conserving biodiversity (Pimm et al. 2001).

Conclusions

Over the course of the last few years conservation biologists, conservation economists, landscape planners and conservation practitioners are arriving at the general consensus that several of Earth's most altered ecosystems are headed for major catastrophes, the most noticeable consequence being a massive loss of species. Nonetheless, the analyses conducted at the Defying Nature's End Conference were optimistic: participants concluded that avoiding major extinctions in key areas is possible if we act urgently and at a scale commensurate with threats and ecological needs. Furthermore, the necessary actions are affordable—if funds are well spent, protecting a significant portion of Earth's biodiversity is within reach (also see James et

Figure 6. A plan of action for the hotspots and major tropical wilderness areas.



al. 1999b).

The strategy emerging from Defying Nature's End for meeting this challenge was straightforward. Based on the conclusion that protected areas are the most effective tool we have to protect biodiversity at the site level, parks and reserves were proposed as the centerpiece of a conservation strategy. This will mean that the priority use of conservation funds should be to bring more area under protection, and improve management of existing protected areas. Because working at the protected area scale is necessary but insufficient, conservation planning must also be increased in scale. Corridor-level planning offers a context in which conservation and development goals can both be effectively promoted, and become mutually reinforcing. In this context, there is an important supporting role for low-impact agricultural production, sustainable development projects, and new tools such as conservation concessions. Participants concluded that if we scale-up conservation activities along these lines, focused on the most critical areas, we still have a real opportunity to save much of the Earth's biodiversity.

Acknowledgments

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Protected Areas in 2023: Scenarios for an Uncertain Future

Jeffrey A. McNeely

Introduction: scenarios and protected areas

SOCIETIES IN ALL PARTS OF THE WORLD HAVE LONG GIVEN CERTAIN SITES a special status: places they would protect to conserve their natural and cultural heritage and to maintain ecological processes for the well-being of people and the rest of nature. Many believe that these protected areas should exist in perpetuity, but social, demographic, technological, economic, and environmental changes have inevitably posed many challenges for those concerned with managing the protected areas.

Protected area managers must constantly make decisions both on day-to-day site management and on strategic directions that may affect the long-term viability and survival of the site. Managers often are confronted with two particularly difficult obstacles when making these strategic decisions about the future: *uncertainty*, ranging from local politics to climate change to world economy to geopolitics; and *values*, guiding relations with neighbors, visitors, and decision-makers, compounded by the dilemma as to whose values should dominate. Neither of these obstacles can be overcome by scientific analysis. For example, how should protected area managers respond to:

- Human population growth and more land becoming "domesticated"?
- Threats to the unique diversity of individual protected areas through global trade and the spread of invasive alien species?
- The increasing demands for political decentralization, including changes in the roles state agencies play?
- New technologies, including in the biological and information sciences?
- Growing private-sector interest in protected areas?
- Significantly increased or reduced tourism?
- Changing perspectives on the links of certain ethnic groups to traditional lands?
- Shrinking protected areas budgets and growing demands on them?

The future inevitably is uncertain, but this paper provides a useful tool for helping answer such questions while engaging diverse sets of stakeholders: scenario planning.

Scenario planning

Scenario planning highlights the major forces that may push the future in different directions, and creates stories that stimulate

thinking of alternative possible futures. Good scenarios are plausible, internally consistent, and realistically include both perceived favorable and unfavorable elements. Scenario planning can "bound" the uncertainties by helping to understand the deeper trends and forces that affect protected areas, and to see the bigger picture. Strategic decisions can then be tested against several distinctly different but plausible future states. Scenario planning can also involve (jointly or in parallel) a wide community of different stakeholders, thereby helping to reveal expectations and values held by these different groups. Values can thus be made explicit, and their impacts on possible futures can be made clear. If several divergent scenarios all point toward the same or similar policy responses, then those policies are likely to be robust to a wide range of credible future conditions.

Conversely, those interested in the long-term future of protected areas need to ensure that the policies they advocate are robust across a wide range of possible futures, not simply a projection of recent trends. By enabling managers (defined broadly to include official agencies, local communities, non-governmental organizations (NGOs), indigenous peoples, or private parties, as relevant to each protected area) to consider different possible futures, new risks and opportunities will become apparent, and help lead to better decision-making. Scenarios for protected areas can also:

- Set the stage for productive discussions among the numerous stakeholders involved in protected area issues, even enabling debates on topics that might otherwise be threatening or provocative to certain groups;
- Help managers decide priorities for research, monitoring, and information management;
- Help managers be better prepared to cope with future emergency situations; and
- Make the future less threatening and chaotic, at least psychologically preparing people for surprises.

Scenarios are not predictions, forecasts, or projections, but contain elements of all of these. A *prediction* is the best possible estimate of future conditions ("My budget next year is highly likely to be 2% less than this year"), while a *forecast* is the best estimate from a particular method, model, or individual ("Based on this election, we are likely to receive a 10% budget increase next year"). And *projections* are estimates of future conditions based on the study of recent ones ("Looking at the budget trends over the past twenty years, we expect our budget to double over the next decade"). People may respond to predictions or projections, which adds surprises to the difficulty in making accurate forecasts of human behavior.

Predictions, forecasts, and projections help inform *scenarios,* which are simply *stories designed to stimulate new ways of thinking about the future* ("What happened to my budget when the tourists stopped coming?"). What will actually happen in the future remains unpredictable, but scenarios can help managers prepare for this uncertainty by helping them think about plausible, or even possible, options.

IUCN–The World Conservation Union (IUCN) decided to test this approach by preparing a set of twenty-year scenarios for protected areas, in part as a contribution to the World Parks Congress

(Durban, South Africa, September 2003). After reviewing the major events that have affected protected areas over the past three decades, the workshop identified the primary driving forces that are currently influencing protected areas. By identifying these driving forces, it was possible to look beyond the urgent crises that tend to occupy the minds of most protected area managers. This paper presents some of the major ideas resulting from the scenario planning process (see McNeely and Schutyser 2003 for a complete discussion of the scenarios).

A brief history of protected areas

The future is not always simply a continuation of the past; new developments often have defied projections premised on historical evidence. For example, new innovations, discoveries, substitutions, and technologies prevented, or at least postponed, the postulated economic depletion of many non-renewable natural resources. However, planning should not be carried out in isolation from history. Knowledge, events, and trends of the past must inevitably provide the basis for the predictions, projections, and forecasts that inform long-term planning, if not guide it.

It is not unreasonable to expect the trends that have shaped present-day protected areas to continue, with some slight ebbs and flows, for the coming few decades. Scenario planning, however, encourages also thinking about both positive and negative surprises that by definition were not predicted, projected, or forecast. As a means of demonstrating some past surprises and achievements that have affected how people think about protected areas today, consider the following key dates (among many that could have been chosen):

- 1864: Yosemite (California) established by U.S. Congress as effectively the first of a new national-level model of protected areas; Yellowstone (1872) was first to be called a "National Park."
- 1882: El Chico National Park established in Mexico, the first in Latin America.
- 1903: The Society for the Protection of the Wild Fauna of the Empire established in the United Kingdom, the first NGO devoted to international conservation. At its 100th anniversary, it is known as Fauna and Flora International. Hundreds of other civil-society conservation organizations now support protected areas in all parts of the world.
- 1925: First modern national park established in Asia (Angkor Wat, Cambodia).
- 1926: South Africa's Kruger National Park established.
- 1934: Argentina's Iguazu National Park established.
- 1948: IUCN founded as a means of promoting conservation worldwide, but especially in the former colonies gaining independence in the post-war world. Based on a prediction of significant habitat loss if nothing were done, IUCN immediately started working on protecting nature.
- 1961: World Wildlife Fund (WWF) started as a new international NGO to mobilize support for conservation, especially from the general public; marked the beginning of an era of growing funding for international conservation.
- 1962: First World Conference on National Parks, Seattle, Washington, USA, began a more formal worldwide movement in support of protected areas, called for a United Nations List of Protected Areas and recommends a cat-

egory system. Each country kept its own records, so nobody knew the extent of the world's protected area system.

- 1963: African College of Wildlife Management at Mweka, Tanzania, established. By 2003, over 4,200 Africans had graduated and many now manage protected areas throughout the continent.
- 1967: CAMPFIRE program began in Zimbabwe, showing how rural people can benefit economically from wildlife in a modern context, even through times of political turmoil; it is still going strong, demonstrating another form of protection.
- 1968: UNESCO Man and the Biosphere Program began, established biosphere reserves (now 440 biosphere reserves in 97 countries, exceeding 2.2 million sq km).
- 1970: School for Training of Wildlife Specialists, Garoua, Cameroon, established. Designed for francophone Africa, Garoua has now trained well over 3,000 people; they now run many of the protected areas in West and Central Africa and Madagascar.
- 1971: Ramsar Convention adopted. By August 2003, 1,308 sites covering over 1.1 million sq km in 138 countries had been designated.
- 1972: United Nations Conference on Environment and Development, Stockholm, Sweden, endorsed new conventions affecting protected areas, and led to establishment of United Nations Environment Program (UNEP), based in Nairobi, Kenya.
- 1972: World Heritage Convention adopted. By 2003, 149 natural World Heritage Sites and 23 mixed natural and cultural sites had been recognized, covering over 1.5 million sq km.
- 1972: Second World Conference on National Parks, Yellowstone and Grand Teton national parks, USA, promoted development assistance for protected areas in the tropics. Protected area coverage: 1,823 sites, 2.2 million sq km.
- 1977: Training program for protected area personnel established at CATIE, Turrialba, Costa Rica; continues until present and has trained staff for much of Central America.
- 1978: IUCN system of categories of protected areas published, set logical framework for worldwide assessment of protected area coverage. Latest revision in 1996, now being promoted for other management applications.
- 1981: *World Conservation Strategy* published by IUCN, WWF, and UNEP; popularized the concept of sustainable development and a partnership between conservation and development.
- 1981: Protected Areas Data Unit established by IUCN and its Commission on National Parks and Protected Areas, at the World Conservation Monitoring Centre, U.K.; provides first worldwide database on protected areas.
- 1982: Third World Congress on Protected Areas, Bali, Indonesia, emphasized the importance of protected areas as a key element in national development plans; set 10% protected area coverage of each biogeographic province as a target. Protected area coverage: 2,671 sites, nearly 4 million sq km.
- 1987: *Our Common Future* published, the report of the U.N. Commission on Sustainable Development (commonly known as the Brundtland Report, after its chair, Gro Harlem Brundtland), called for 12% of the land to be given

protected area status and advocated global action to conserve biodiversity.

- 1991: Global Environment Facility (GEF) created by the World Bank, U.N. Development Program, and UNEP, providing a major new intergovernmental funding mechanism for protected areas, especially through the Convention on Biological Diversity then under negotiation.
- 1992: Fourth World Congress on Protected Areas, Caracas, Venezuela, emphasized linkages between protected areas and other sectors of society. Protected area coverage: 8,641 sites, 7.9 million sq km.
- 1992: The Earth Summit, Rio de Janeiro, Brazil, produced *Agenda 21,* and approved Convention on Biological Diversity and Framework Convention on Climate Change, both highly relevant to protected areas.
- 2000: U.N. General Assembly approved Millennium Development Goals (MDGs), with Goal 7 calling for environmental sustainability.
- 2002: World Summit on Sustainable Development (WSSD), Johannesburg, South Africa, called for loss of biodiversity to be reversed by 2010, and for a system of marine protected areas to be established by 2012.

This list of key events could be extended considerably, and balanced by bad news and unpleasant surprises in some places. But it is sufficient to indicate a steady growth in protected area coverage and a growing understanding of the relevance of protected areas to larger sectors of society. From just a small handful of formal protected areas at the end of the 19th century, by the turn of the 20th century virtually all countries had established reasonably extensive systems of protected areas. Over the same century, the human population had quadrupled from about 1.6 billion in 1900 to 6 billion in 2000, advances in technology had transformed human society, consumption of resources had increased by a factor of 14, and millions of square kilometers of natural habitat had been domesticated.

The current forces affecting protected areas

Historically, protected areas have been valued for three main reasons: the services they provide to humans (their "utility"); their ecological significance, independent of their usefulness to humans; and their cultural and spiritual meaning. Typically, the utilitarian aspect has had the greatest influence on convincing local decision-makers to take an active interest in conservation. But abundant evidence has now demonstrated the close links between the conservation of healthy terrestrial and marine ecosystems and the provision of critical environmental services, such as providing a reliable water supply, supporting pollination systems, and building productivity of soils. Some local communities and urban dwellers show willingness to pay for such ecosystem services and to adopt land use and crop production systems that can support the protected areas; others are indifferent, or would prefer protected areas to be converted to "more productive" uses.

The increased recognition of protected areas as potential tools for economic development is another reason why more are being established. But this also means that more protected areas are competing for limited funds, as both official development assistance (ODA) and tourism income remain stagnant, if not declining in many

countries. Poverty may push people to invade protected areas to use wild products, possibly unsustainably, while greater wealth may lead to even more exploitation of natural resources; is wealth or poverty the greater negative impact?

Demographics remain a major driving force, with 80 million or so people being added to our planet each year, mostly in developing countries. Migration and urbanization are particular challenges. Today, about half of the world's 6.3 billion people live in cities, well insulated from the realities of nature (except, of course, from the climate). But one arguably positive result of expanding population is that tourism to protected areas continues to grow. China alone welcomes one billion visitors annually to its protected area system, and countries such as Australia, Botswana, Canada, Costa Rica, Ecuador, Kenya, Nepal, South Africa, and Tanzania have made nature-based tourism an important part of their national economies, and recognize the role of protected areas in supporting this industry.

Civil society is accelerating its contributions to protected areas. Non-governmental conservation organizations have become multinationals in their own right. Fauna and Flora International, WWF, The Nature Conservancy, Conservation International, BirdLife International, Wetlands International, the Wildlife Conservation Society, and numerous others are together spending hundreds of millions of dollars annually in both developed and developing countries in support of protected areas. At the national level, numerous other civil-society organizations are also having significant influences on protected areas, reflecting the interests of local people, indigenous groups, urban dwellers, farmers, students, and many others. Rural people still nibble at the edges of protected areas, and have even consumed some, while other rural people have been forcibly removed from what they consider their homelands.

The private sector continues to contribute to protected areas, running concessions, providing financial support, and seeking forms of sustainable development that will contribute to both conservation and corporate profits. Even though the world economy is struggling, new developments in information technology (IT) offer interesting potentials for protected areas. First, an enhanced and less-expensive Internet is strengthening knowledge and access to it, which in turn is contributing to building awareness and skills. Second, IT is promoting action by civil society, providing benefits to protected areas by way of support to co-management, political mobilization, and independent monitoring. Finally, some of the wealth generated by the IT sector is finding its way into various foundations which may also provide funding for protected areas. On the negative side, virtual reality has begun to replace nature as the source of experience; watching a flock of flamingos take wing from the floor of Ngorongoro Crater is very different from doing so vicariously through the miracles of modern IT.

Other technologies are also highly relevant to protected areas. Improvements in transportation bring more visitors to protected areas. Some of them are unwelcome, such as the invasive alien species of weeds that now infest many of the planet's most cherished "natural" sites. Biotechnology offers a powerful new tool for manipulating the genome of numerous species, beginning with agricultural plants but soon likely to affect many other life forms as well, with

unpredictable impacts on protected areas. The advances in biotechnology are leading to experiments to bring extinct species back from the dead, perhaps reducing the pressure to conserve those species we already have. Communications technology, too, is having profound influences, enabling people to be connected wherever they may be and fundamentally changing what for many was once a "wilderness experience". But having access to a cell phone in an emergency on a remote mountain top undeniably is a life-saving advance. Technological solutions to the hole in the ozone shield (a by-product of technology) have been developed and implemented, but climate change is a different story. Technology gives, and takes away.

Climate change remains a significant threat, and not only for island and coastal systems projected for flooding as icecaps and glaciers melt. Based on the projections prepared by the Intergovernmental Panel on Climate Change, we can forecast that many of the major vegetation types in various parts of the world will undergo significant biogeographical changes as they shift to follow patterns of rainfall and temperature. This is likely to be particularly dramatic in mountain areas and in highly distinctive but geographically restricted vegetation types, such as South Africa's succulent karoo and fynbos.

Thus the current forces affecting protected areas, of which the above are a small sample, are a complex combination of positive and negative influences, and involve diverse sets of interests and stakeholders. The overall picture is one of increasing demands for the goods and services of protected areas, against growing threats to the ecosystems that provide those goods and services on a sustainable basis. All of this is coupled with the pressure on many governments to expand their protected area systems at a time when many rural people are clamoring for their rights to occupy these same lands, often with considerable historical justification. Oil, gas, and mining companies also seek to harvest certain resources while minimizing their impact on others. It is against this complex background of chaos, change, and challenge that the scenarios for protected areas were created, as a means of promoting the best possible thinking about the most productive role for protected areas in what we predict will be a turbulent future.

The scenarios

The scenarios we developed are simply stories about possible futures over the next twenty years, not visions or calls for action that are being promoted by any particular interest group; nobody expects any of the scenarios to "come true," and what actually happens in twenty years may well contain some elements of them all, and much else besides. Twenty years may seem a long time to look into the future, but twenty years ago was when the 1982 Bali World Parks Congress was held, attended by many of today's leaders of the protected area movement. They had no laptops, Internet connections, or cell phones, but the issues they faced were not so different from those of today's protected area managers; but today has many more in addition, and more technological arrows in the manager's quiver. Twenty years from now, today's young leaders will be in positions of authority for safeguarding our planet's natural heritage. Developing these kinds of stories can help ensure that they have the best chance of doing so.

The scenario planning process can also

be an effective stakeholder engagement tool in its own right. We used scenario planning to engage very diverse groups, such as transnational corporations, international environmental organizations, academics, as well as government agencies. The point is that scenario planning can help create dialogue around contentious issues in an inclusive manner. The stories emerging from the scenario planning process can frame this dialogue while helping us to think constructively about the future.

The following is an abbreviated synthesis of the three scenarios developed recently by IUCN. Briefly described in Table 1, they were titled "The Triple Bottom Line," "The Rainbow," and "Buy Your Eden" (see McNeely and Schutyser 2003 for a complete discussion of the scenarios). This synthesis reveals some common predictions and open questions, while providing insight into the future of protected areas.

Human population dynamics will remain a major issue, though rates of change are highly variable in different parts of the world, and some places may experience population decreases. Human demands on the natural world will continue to increase. How well-being will evolve is uncertain, but all three scenarios identified *poverty* as a major factor that will influence protected areas. Will the gap between the rich and the poor continue to grow, and if so, what are the likely economic and social consequences for protected areas? And how should protected area managers respond?

National security is an issue that will not go away. Threats to governments are real, though they may take unexpected forms. Colombia, Ethiopia, India, and Central Africa provide examples of how protected areas can survive in stressful times, and protected areas are illustrating new means of cooperation across international borders. How will societies respond to increasing insecurity, whether real or perceived, and how will this influence protected areas?

The three scenarios have shown that *global trends affect regions, countries, and societies in different ways.* Because no one answer will address all protected areas problems, a mix of approaches is needed. Global connections may not last. Will the benefits from globalization outweigh its costs and will the benefits be equitably shared? Will the international community succeed in creating a viable governance structure to manage the global issues that affect protected areas? How can those concerned about protected areas best contribute to the debates?

Protected areas are profoundly affected by *what happens in the surrounding lands,* so agencies need to be increasingly knowledgeable about what is happening outside the protected area as part of their strategy to attract new supporters, mobilize new funding sources, and negotiate ecologically compatible land use practices with landowners in the surrounding lands.

Protected areas in the future will depend on *public opinion* and what are the perceived "benefits beyond boundaries." Public perception of protected areas, and even more broadly of "nature," will be shaped by a predominantly urbanized population, unless we slip into a Rainbow world.

Science and technology will continue to be a fundamental element in most societies, with scientific discoveries continuing to have significant influences on the technology that is applied to environmental manage-

Table 1. The three scenarios.

Scenario 1: The Triple Bottom Line
By 2023, the world community has finally concluded that its self-interest will best be served through considering the planet to be one world. The Triple Bottom Line world treats economic growth, social well-being, and environmental sustainability as three intertwined goals. Governance follows the principle of subsidiarity, with decision-making as close as possible to the citizen. The "Global Alliance," a tripartite international body of governments, the corporate sector, and civil society, has replaced the United Nations to become an international governance body, and the nation-state has become less important as a decision-maker. In the Triple Bottom Line world, protected areas are more financially sustainable, as their value for providing environmental and social services has become recognized and converted into policy. They still are constantly threatened by alternative land uses (McNeely and Schutyser 2003, 18).

Scenario 2: The Rainbow
In the year 2023, the Rainbow world has gone through tumultuous changes that essentially reversed the move toward globalization that seemed inevitable back in 2003. One result was that protected areas are no longer seen as worldwide, or even national, concerns, but are managed for the benefit of local communities. Inevitably, some protected areas that had been imposed by national interests have been converted to agriculture, and communities have sprung up in arable locations within former national parks. But in many cases, the local communities saw it as in their enlightened self-interest to maintain the protected areas, with some areas even attaining a sacred status. In the Rainbow world, local interest dominates, with profound implications for protected areas, both positive and negative (McNeely and Schutyser 2003, 26).

Scenario 3: Buy Your Eden
Economics is the dominant theme in the Buy Your Eden world, and the gap between the rich and the poor has widened in 2023. Many protected areas have been privatized, and new ecotourism mutlinationals are running the worldwide system of "The World's Greatest Nature," appealing to the prosperous international tourism market. These fortunate few outstanding protected areas (which were called World Heritage Sites until they were purchased by the consortium of private tourism multinationals) are very well managed for tourism objectives, which often include maintaining biodiversity, especially of the charismatic type. But the numerous other protected areas that are not deemed to be of sufficient profit potential are suffering from inadequate investment and many fall prey to the growing numbers of desperate rural poor (McNeely and Schutyser 2003, 34).

ment. While it is not clear in which direction and how fast scientific discoveries will evolve, and how the public will respond, those who are most successful in adopting useful new technologies will prosper more than those who do not, or those who adopt inappropriate new technologies.

And finally, *climate change* will remain a wild card, with unknown—but possibly profound—implications for many species and ecosystems. How can protected areas be best designed and managed today to enable them to adapt to possible future climate changes?

Many other lessons can be drawn from the scenarios and applied as appropriate to the many strategic issues affecting protected area agencies and their supporters.

Conclusions

Lessons derived from the three scenarios suggest some general conclusions about how protected areas should be managed in the future.

Understanding biodiversity. Irrespective of what may happen in the future, building a better understanding of biodiversity will be essential for ensuring appropriate human adaptation to changing conditions. A departure point for protected area planners has always been that protected areas should represent the biodiversity of the area adequately, and it should be protected from negative external influences. Which are the native ecosystems and species, how do they relate to each other, how are they changing, and how can they best be managed to provide the optimum mix of benefits?

Promoting social equity. The scenarios have revealed how difficult is the concept of social equity. The Rainbow scenario suggests that unbridled social equity can be chaotic, while Buy Your Eden makes the point that excessive social inequity carries many of its own problems. And even in a Triple Bottom Line world, social equity is an elusive goal, but one that is essential to seek if protected areas are to prosper in the face of multiple demands. The survival of many protected areas may well depend on greater equity: ensuring that the general public is able to benefit from the protected areas, rather than seeing them as playgrounds for the wealthy. The future of protected areas will also be affected by the balance between "power-based" rights and "interest" rights. Power-based rights flow from those in power imposing their will on what happens in protected areas. Interest-based rights acknowledge the rights of those whose livelihoods depend on the issues being discussed and their rights to be a part of the decision-making processes. For protected areas to survive and have relevance in this changing world, interest-based rights may need to become a more integral part of future decision-making processes.

Generating conservation incentives and finance. Under any scenario where protected areas survive, they will need financial support. This is a challenge that deserves our most creative thinking, but increasingly needs to be based on the principle of "user pays," including innovative sources such as payment for ecosystem services. And governments may need to embrace the user pays concept more enthusiastically, enabling protected areas to retain more of the income they generate. That said, some protected areas are unlikely to be able to generate sufficient income on their own, as their values are primarily in the form of public goods that benefit all people. They therefore will need to continue receiving public funding. Protected area agencies

need to see themselves much more as service providers to society, providing both income-generating (recreation, tourism, ecosystem functions) and non-income-generating (biodiversity conservation, cultural values) services. Agencies also need to become more businesslike in their operations, seeking appropriate ways of providing services compatible with their conservation objectives in order to mobilize additional income; at the same time they will need to monitor more effectively the achievement of conservation and management objectives, since society will hold them accountable for delivering tangible results. As in much else, diversity will be the key to success in financing protected areas.

Expanding international engagement. The structure of international conventions is already proving its value, but clearly much more can be done in this field, including protected areas in the open seas, transboundary protected areas, and improved cooperation in information exchange and capacity building. But the scenarios have also shown the volatility of such engagement.

Ensuring sustainable ecosystems and livelihoods. Protected areas have demonstrated their value for conserving biodiversity that otherwise might well be lost. Two of the scenarios have made the point that protected areas also provide the capacity to adapt to climate change when they are properly designed. More effort needs to be given to ensuring that protected areas are designed as part of a system, with appropriate connections between the different parts. But under any realistic scenario, protected areas will be insufficient for actually conserving the planet's biodiversity unless the land and waters outside the protected area system are managed in ways that are consistent with the objectives of the protected areas. This may require a much more sensible form of human relations with the land across the entire planet. To achieve this in the future, successful conservation will require working at a larger (landscape, seascape) scale, since the challenges facing protected areas are too complex and involve too many different interest groups to be solved at the level of individual sites.

Scenarios as a tool for protected area managers

The scenarios have indicated a wide range of possible trends or patterns of events, but whether these will have positive or negative impacts on protected areas depends very much on how the responsible agencies respond. Agency-level scenario planning can be a useful tool for helping managers deal proactively with such developments.

For managers, the key responsibility is to safeguard the values of protected areas while ensuring their long-term viability. Scenario planning could become a useful tool to help planning for these objectives in an uncertain world. Managers may find it useful to build their own possible stories of the future, with regard to the most important local uncertainties (e.g., financing, political support, land use pressure). This suggests that catalytic, free-thinking groups need to be formed that can look at different strategies and provide "risk-free" settings where protected area managers can meet with other interest groups to test new ideas and new approaches, helping to generate innovation and benefiting from discussions with others holding contrasting views.

Protected area managers can use scenario planning to lift themselves above short-term politics to develop strategies for

securing environmental integrity. This in turn suggests the creation of an international forum of protected area managers where different ideas and different approaches can be discussed and analyzed, leading to a range of approaches to fit local needs and political environments.

Protected area managers are facing a world that is changing rapidly, and where opinions and values range widely. Scenario planning is an important tool for coping more effectively with the risks and uncertainties faced by protected areas.

Acknowledgments

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What Should Protected Areas Managers Do in the Face of Climate Change?

David Welch

The face and pace of change, past and future

Climate change across geological time. Climate has always been changing, is changing, and will continue to change. Throughout geological deep time the Earth witnessed long warm phases interspersed with ice ages, with perhaps even a "snowball Earth" occurring as many as four times between 750 million and 580 million years ago (Hoffman and Schrag 2000). Surface temperatures across all latitudes rose by 6°C to 8°C at the start of the Eocene epoch 55 million years ago, corresponding to massive increases in atmospheric carbon triggered by large-scale igneous activity and hydrate melting under what is now the Norwegian Sea (Svensen et al. 2004). Over the past 4 million years, the Earth has gone from global surface temperatures about 3°C warmer than today, with smaller ice sheets and higher sea levels, to the current cooler conditions (Ravelo et al. 2004). The 1.8 million years of the Pleistocene and Holocene epochs were characterized by roller-coaster swings of many degrees Celsius, corresponding to glacial intervals and abrupt warming at the onset of interglacials (Folland et al. 2001; Figure 1). While driven by 100,000-year cycles in the shape of Earth's elliptical orbit and 40,000-year cycles in its rotational tilt, there has also been a close association between climate and greenhouse gases, such as carbon dioxide and methane, over as much as the last 740,000 years (EPICA 2004). Within historical times, our planet experienced several temperature shifts, such as the Medieval Warm Period and the late 19th century Little Ice Age (Figure 2). During the last century, average annual precipitation changed up to 50% in some regions (Figure 3).

Recent climate change. While rapid in terms of geological time scales, these changes were, well, geological in pace. Over the past 100 years, however, global average temperature has risen approximately 0.6°C, and the rate of warming has greatly accelerated since the 1970s (Figure 2). This change is ascribed mainly to rapid and large releases of greenhouse gases from the burning of fossil fuels for power generation and transportation (IPCC 2001a). It is even possible that were it not for increased releases of CO_2 and CH_4 due to the burning of forests to clear land for agriculture, starting around 8,000 years ago, and the invention of rice paddy cultivation about 6,000 years ago, the Earth would have already entered the next glacial interval (Ruddiman 2003).

Impacts of recent climate change. There is ample evidence of the physical and ecological impacts of recent climate change. Walther et al. (2002) summarize many of these observed changes, such as increased

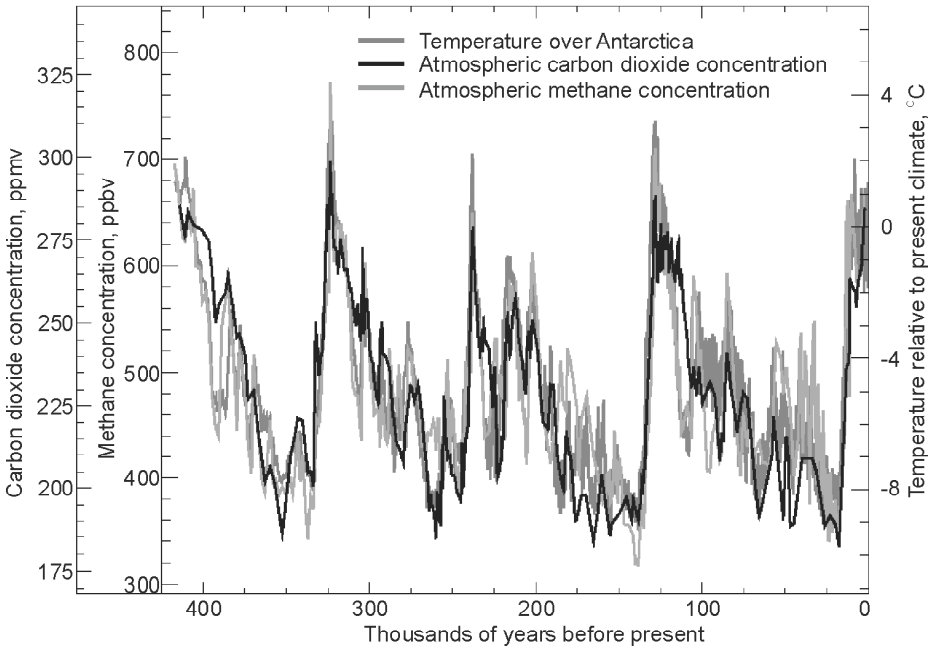

Figure 1. 400,000 years of temperature history. Source: Folland et al. 2001, Figure 2.22, page 137. *Reproduced courtesy of the Intergovernmental Panel on Climate Change*

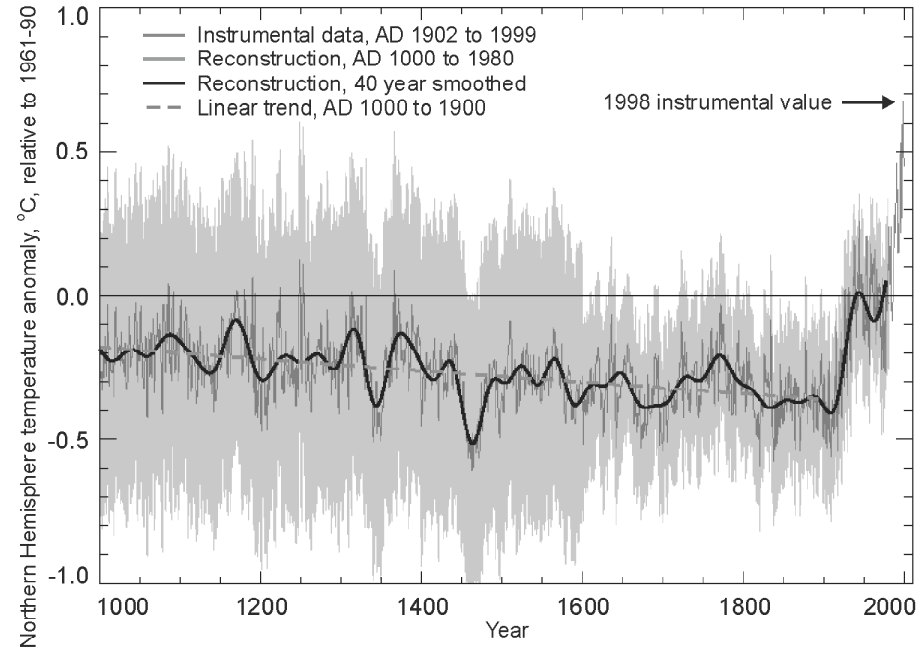

Figure 2. 1,000 years of temperature history. Source: Folland et al. 2001, Figure 2.20, page 134. *Reproduced courtesy of the Intergovernmental Panel on Climate Change*

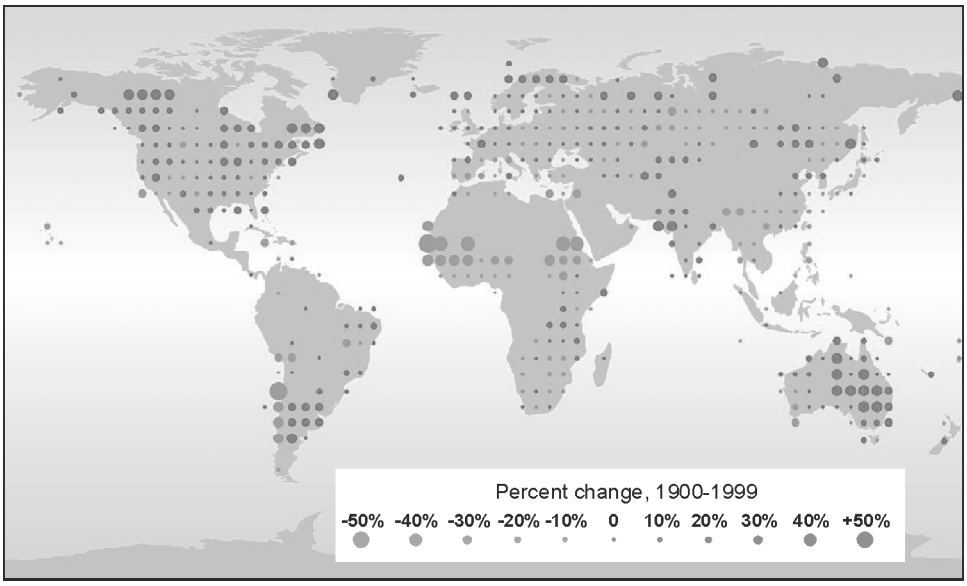

Figure 3. 100 years of precipitation history. Source: Folland et al. 2001, Figure 2.25(ii), page 144, and presentation graphic 2-6a. *Reproduced courtesy of the Intergovernmental Panel on Climate Change*

temperatures in North America and Europe leading to northward range shifts in 39 butterfly species of up to 200 km over 27 years. In a meta-analysis of over 1,700 species Parmesan and Yohe (2003) find average range shifts of 6.1 km/decade poleward and meters per decade upward, and spring event advances of 2.3 days/decade. In another meta-analysis of 143 studies of 1,473 species, Root et al. (2003, 57) say that "the balance of evidence from these studies strongly suggests that a significant impact of global warming is already discernible in animal and plant populations." McCarty (2001) cites numerous specific studies, and observes that in recent decades global change is apparent at all levels of ecological organization, and that this can be linked to climate change, among other stresses. The Geological Survey of Canada has compiled pollen, macrofossil, and buried mammal data to produce 1,000-year interval maps of the biomes of glaciated North America since 18,000 years before the present (Art Dyke, personal communication). The boreal forest, for example, first appeared in southern Iowa and Ohio and has since sought refuge in Canada. Its southern limit is now 1,000 km north of its former northern limit. Overland et al. (2004) conducted an integrated analysis of 86 time-series data types for the Arctic, including atmosphere, ocean, terrestrial, sea ice, fisheries, and other biological data. Their first three principal components show that the Arctic acts as a coherent system, tying the atmosphere to fisheries and other biota.

Future climate. Geological proxy records and historical and contemporary direct measures all show a strong correlation between global climate and the atmos-

phere's concentration of greenhouse gases. Our understanding of atmospheric physics also bears witness to this link. This connection is recognized by the United Nations Framework Convention on Climate Change and the Kyoto Protocol. The Intergovernmental Panel on Climate Change (IPCC 2001a) proposes several scenarios for anthropogenic emissions of carbon dioxide, methane, and other greenhouse gases over the next century. These have been factored into various general circulation models, yielding the alarming result that the annual average global temperature may rise between about 2°C and 6°C by 2100 (Figure 4). The range of projections is mostly related to the range of emission scenarios; that is to say, they are dependent upon the policies that humankind chooses to follow. Global averages, of course, hide regional trends, several of which show up in most models. Warming will be greater in continental interiors. Areas of high precipitation will get wetter. Arid zones will get dryer. Warming will increase towards the poles and will be greater in winter. For example, Figure 5 shows the scatter of annual temperature and precipitation projections for two Canadian national parks, Waterton Lakes on the Alberta–Montana border at 49°N and Quttinirpaaq at the north end of Ellesmere Island, 82°N.

Some caveats apply. While all models agree on a warmer planet, some show regional cooling, e.g., over the Labrador Sea. As well, the monthly pattern of warming varies considerably. In the example of Wapusk National Park, at 58°N on the shores of Hudson Bay in Manitoba, six model–emission scenario combinations give the peak warming month as either January or February, a secondary peak in

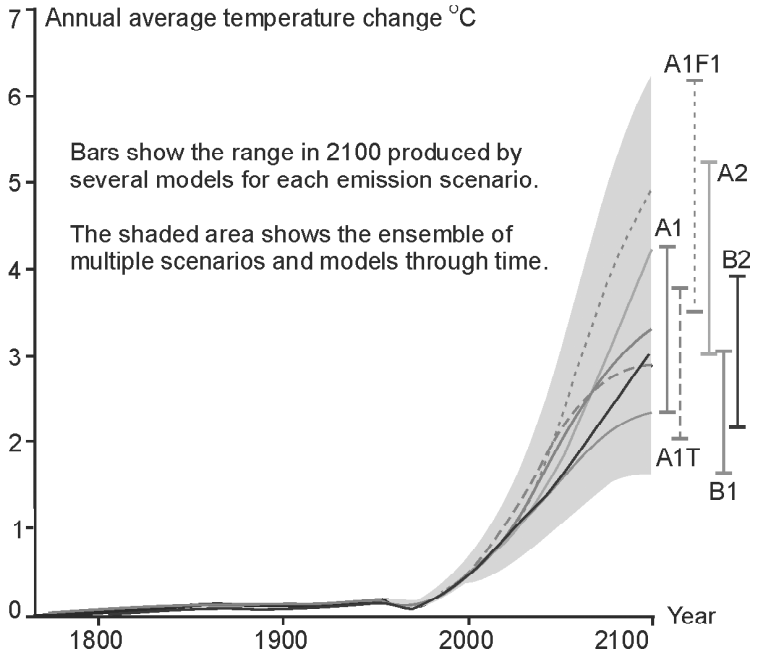

Figure 4. Global temperature projections for different emission scenarios. Source: Cubasch et al. 2001, Figure 9.13b, p. 554, and presentation graphic TS22. *Reproduced courtesy of the Intergovernmental Panel on Climate Change*

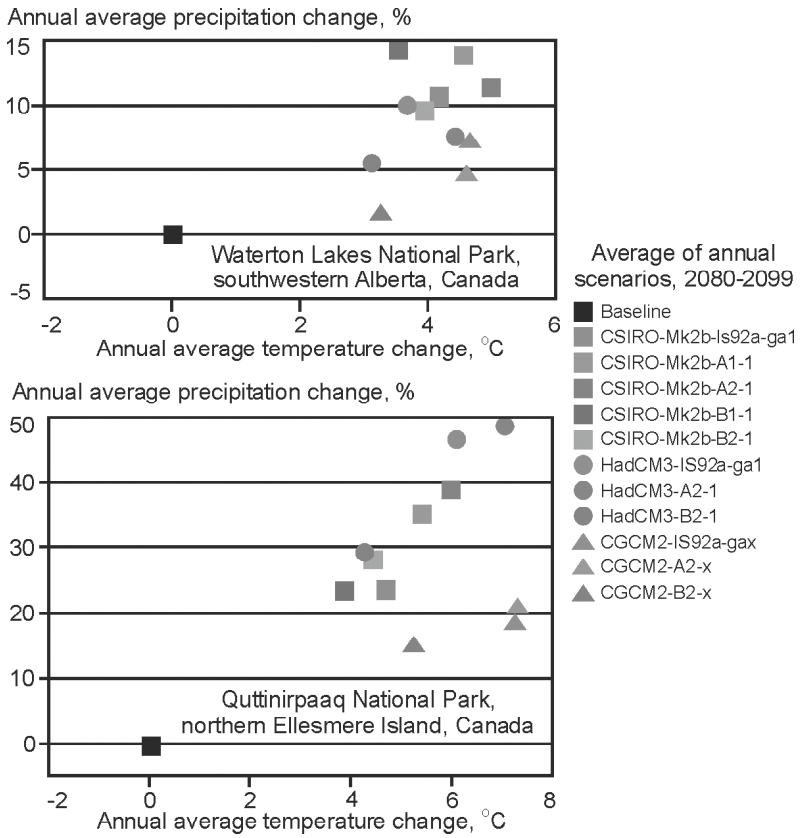

Figure 5. Temperature and precipitation ensembles for two Canadian national parks. Source: Scott 2003.

April or June, and a range of up 2°C to 7°C in the month-to-month degree of warming (Figure 6).

Impacts. Such climate changes will drive physical and biological changes on the Earth's surface at least as great as has been seen throughout the Holocene epoch, during which large parts of North America witnessed wholesale biome changes. A recent study for Parks Canada (Scott et al. 2002; Scott 2003) examined several vegetation change models matched to climate models. In five of six vegetation scenarios, the biome would change in more than half of Canadian national parks in a $2xCO_2$ world (i.e., one with doubled carbon dioxide concentrations). Of course, biomes won't actually move intact and in concert with climate. Most plants, many habitats, and all ecosystems cannot migrate in step with the regional shifts of climate patterns. Instead, we should expect many novel biomes and an increasing dominance of pioneer species. Ecosystems will develop into early successional stages and be net emitters of carbon dioxide (Walker and Steffen 1997). The distribution of ecosystem changes, as expressed through biome, biomass, net primary productivity, and leaf area index, will result primarily from changes in the hydrological cycle (Higgins and Vellinga 2004). There will be enormous hydrological

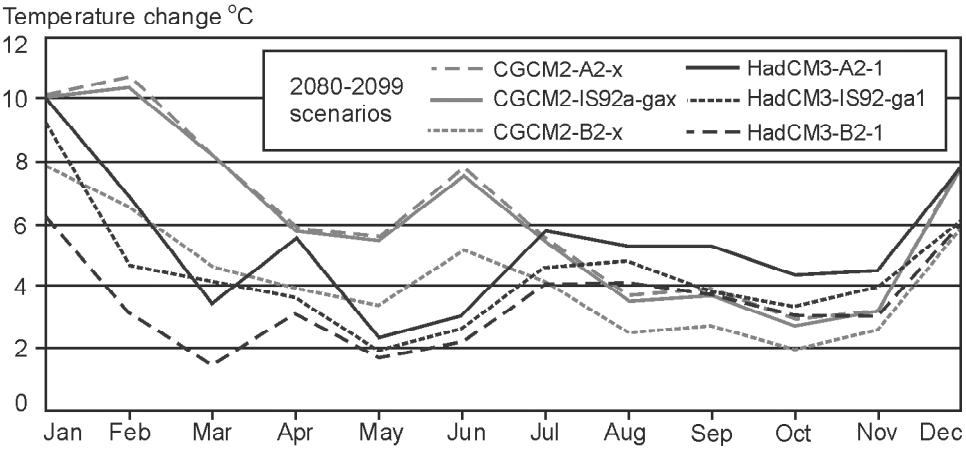

Figure 6. Monthly temperature scenarios for Wapusk National Park. Source: Scott 2003.

changes in areas currently dominated by snowfall and minimal evaporation or runoff during winter months. More precipitation will fall as rain rather than snow. Runoff will shift from spring peaks to a more even year-round flow, so that less water will be available during summer irrigation and navigation seasons. Warmer summers will evaporate more water. Even if total precipitation were to increase, the resulting combination will probably mean lower lake levels, dryer wetlands, and greater shortages of available water (Schindler 2001). These changes will be particularly acute in mountain regions (Beniston 2003).

Other potential impacts include the following:

- Increases in the frequency and magnitude of extreme events such as storms and floods.
- Rising global sea levels and the accelerated retreat of low-lying coastlines.
- Declining Arctic sea ice extent and duration, leading to changes in marine mammal distributions and navigation and greatly increased coastal erosion.
- Accelerated melting of permafrost, reducing trafficability and soil stability.
- The loss of glaciers in middle and equatorial latitudes. The expected disappearance of glaciers from Glacier National Park, Montana, has become a well-known poster child for climate change impacts (Hall and Fagre 2003).

As well as these immediate physical changes, new environmental conditions will foster profound changes in the biotic composition of ecosystems, not just due to changes of temperature and water regimes but also, for example, due to the increased ability for invasive pests, pathogens, and weeds to migrate into new regions.

In sum, the weight of scientific evidence shows that climate change anticipated in the 21st century will result in new vegetation successions, water regimes, wildlife habitat and survival conditions, permafrost and surface ice conditions, coastal erosion and sea-level change, and human responses, including tourism opportunities (IPCC 2001a; Hansen et al. 2003). Many countries recognize these threats through their ratifi-

cation of the Kyoto Protocol on climate change and through their national action plans and government programs that address the impacts of climate change and how their peoples may play a part in mitigating and adapting to it.

Why and when to adapt?

"Human and natural systems will to some degree adapt autonomously to climate change. Planned adaptation can supplement autonomous adaptation, though options and incentives are greater for adaptation of human systems than for adaptation to protect natural systems" (IPCC 2001b, 8). Protected areas will be affected by climate change at least as much as other lands and waters in their natural regions. Indeed, the impacts may be greater. Fewer mitigation and adaptation options exist than for lands and waters that are actively manipulated. Protected area custodians must therefore seek ways to adapt their management practices to help maintain biodiversity and natural processes, to assist nature through its inevitable transitions, and to participate fully in programs aimed at reducing greenhouse gas emissions.

Adaptation means adjustments in practices, processes, and structures. It can be spontaneous or planned, and can be carried out in response to or in anticipation of changes in conditions (Smit et al. 2001). Protected area agencies should plan their adaptation in anticipation of greater rates of change than have previously occurred. When something wicked this way comes, it is better to be prepared than to be surprised. Early adaptation is encouraged for a number of reasons:

- Climate change is already occurring and further changes cannot be prevented, so there is no justification for a wait-and-see policy.
- No regrets. Benefits can be obtained by removing or halting maladaptive policies and practices that may increase vulnerability.
- Risk management. Benefits can be obtained by adapting in anticipation, rather than reactively, particularly if other stressors are mitigated.
- Investment. Visitor activities are tied to the timing and duration of annual climatic cycles and phases. Long-term investment in infrastructure and marketing, by concessionaires and park management agencies alike, must take future climate into account.
- House in order. Effective government is abetted by leadership by example, particularly in free-market societies. In the present context, this means early achievement of greenhouse gas emission reductions from park operations and the adoption of adaptation policies.

How to adapt ... maybe

Social and policy adaptation. So what should protected area managers do in the face of climate change? A great deal has been written about vulnerability and adaptation. The Intergovernmental Panel on Climate Change provides a comprehensive summary organized around global-scale ecosystems and societal and governmental responses (IPCC 2001b). Many journal papers address this subject, but, again, from an economic, infrastructure, and social policy standpoint. One example is by Kelly and Adger (2000), who focus on reduction of vulnerability to climate change, economic equity, and well-being achieved through poverty reduction and spreading risk through income diversification. More

recently, Easterling et al. (2004) focus on the United States and responses in areas such as disaster management, regional and economic-sector disparities, and institutional reform. While very little can be gleaned for protected areas from such reports, two lessons stand out. One is that possibly the best tack for park managers is to reduce vulnerability to the effects of climate change by maintaining as many options as possible for resilience—the ability to recover quickly after a disturbance. The other lesson is the need to customize adaptation strategies to specific interest areas. For readers of this journal, this mean parks, reserves, and other managed natural landscapes.

Protected areas adaptation. Some papers do address conservation and biodiversity. Considering the conservation of biodiversity in a changing climate, Hannah et al. (2002) call for conservation strategies responsive to the changes that are inevitable. In their view, these conservation strategies require the following.

- Regional modeling of biodiversity response to climate change.
- Incorporation of climate change as a factor in the selection of protected areas.
- Regional management of biodiversity, including core protected areas and landscape connectivity.
- Local to international coordination of protected area management.

This theme was also taken up by Noss (2001). Although targeting forest managers, many of his recommendations can be adapted to all types of protected ecosystems. Here are examples.

- Represent vegetation types and diverse gene pools across environmental gradients in reserves.
- Protect climatic refugia at all scales.
- Avoid fragmentation and provide connectivity.
- Provide buffer zones for the adjustment of reserve boundaries.
- Maintain natural processes and successional regimes.
- Conduct research to identify sensitive biomes.
- Conduct long-term monitoring to seek causality between climate and biodiversity responses at several levels of organization (Noss 2001, 586).

Protection strategies for parks were specifically addressed in 1990 by Wein et al. Their management recommendations include the following.

- International exchanges of ideas between researchers and managers.
- Strengthen the research capacity of parks personnel.
- Involve local communities.
- Use parks as benchmarks for long-term monitoring.
- Determine the necessity to transplant species, or to control rapidly increasing species.
- Locate parks with climate change in mind, develop contingency plans to expand conservation areas, and protect or establish connecting corridors.

The World Wildlife Fund has published an on-line guide for natural area managers to build resistance and resilience to climate change (Hansen et al. 2003). It urges natural resource managers to build climate change adaptation strategies into their preservation philosophies and plans.

Most of its chapters are organized around environments such as forests, the Arctic, and tropical marine ecosystems. Its eighth chapter addresses protected areas. Some pertinent suggestions are contained in that and the overview chapter.

- Use active adaptive management and strategy testing.
- Integrate climate change threats into conservation plans.
- Plan protected areas with disaster mitigation in mind.

In sum, the limited literature on protected areas and climate change provides strong arguments as to why parks and reserves should be given enhanced protection, why there should be more of them, how they might be selected and what ecological services they may provide to society. However, it provides little guidance to the managers of already established protected areas.

What to do?

Parks Canada has completed a science assessment of climate change impacts and scenarios specific to each national park, and the time is now right to consider a climate change adaptation strategy. Parks Canada has received many recommendations for actions, in print, at workshops, at conferences, and informally. This document draws from this dialogue, and the operations and policy context of Parks Canada, to lay out a slate of actions that could reasonably be undertaken in relation to climate change. Clearly, not all will apply in all circumstances, but they may be of value elsewhere. At the time of writing these ideas do not constitute Parks Canada policy. They are, nevertheless, assembled along the lines of strategy documents such as Parks Canada's Environmental Management System framework (unpublished) and the Climate Change Action Plan of the New England Governors and Eastern Canadian Premiers (NEG/ECP 2001).

Core principles. The development of a policy or strategy is best founded on a set of core principles or values. I offer the following.

- *House in order and public communications.* A protected area agency cannot mitigate global climate change by itself, but it can contribute to mitigations by putting its own house in order with respect to Kyoto targets, and can use its outreach and presentation activities to demonstrate leadership by example. People who visit parks and reserves are generally ready to soak up information and listen to sound arguments. The indirect role of protected areas, through interpretation, education, and outreach can be far greater than its direct contribution to emission reduction, but credibility depends on such reductions.
- *Risk management.* Climate change will bring enormous changes to the environments and processes bearing upon natural organisms and ecosystems. To various degrees they have their own degree of resilience and in many cases may be able to accommodate climate change by migration or in situ adaptation. However, there are many other stresses impinging on the ecological integrity of natural systems, so I recommend a risk management approach whereby tractable stresses are reduced or eliminated through the collaborative efforts of park agencies and their interest groups and neighbors.
- *Focus on mandate, complement with*

partnerships. Parks and historic sites increasingly emphasize ecological and commemorative integrity as their prime mandates, superseding considerations of tourism development, park infrastructure, and regional economic development. The latter aspects are important to the success of heritage areas, but should not be put ahead of restoring and protecting natural and cultural heritage. As well, priority should be accorded to actions within the direct responsibility of the agency and its staff. A park agency should leave to others the leadership on activities that are the responsibility of other agencies, levels of government, academia, and industry. However, to the extent that internal resources allow, and to the extent that its prime mandate is favored, a park agency should cooperate in such activities. Education, emission reduction, and national climate change science programs are good examples.

- Porous landscapes. Parks should be part of networks of ecological areas within which biodiversity can survive, move, and be appreciated. Park agencies should promote the importance of regional ecosystems characterized by connectivity and porosity for wildlife movement. This means more than defining wildlife corridors, but removing physical and non-physical impediments to movement across all lands. Examples include policies to develop and maintain hedgerows and wood lots in the agricultural domain, to eliminate the cosmetic use of pesticides in urban areas, to foster dark sky preserves, and to installing wildlife crossing alert lights on major highways, as in a Newfoundland pilot project.

Goals. Action plans need time-bound and measurable targets against which to assess progress, and to redefine schedules and activities as appropriate. I propose three time frames.

- *Short-term.* The appropriate level of climate change information is available to all aspects of ecosystem and asset management.
- *Mid-term.* Climate change is factored into all aspects of ecosystem and asset management, and duly reflected in park management plans.
- *Long-term.* Natural areas are nested within regional landscapes that are porous for the movement of native species, and which are free of significant threats to ecological integrity.

"Short-term" means fewer than five years, covering annual work and budget planning cycles. "Mid-term" means spanning one or two management planning cycles, i.e., five to ten years. "Long-term" means beyond a decade and encompassing the time frames of most climate change scenarios.

Alarming actions. An extensive suite of specific actions can be conceived to help reach these goals in accordance with the proposed principles. To provide some structure, and to help see linkages between complementary activities, they can be grouped under five categories that form the acronym *ALARM.*

- *A*wareness, including staff, stakeholder and general public awareness.
- *L*eading by example, or "house in order" actions such as reduction of greenhouse gas emissions.
- *A*ctive management, such as minimizing other stresses to facilitate

autonomous adaptation.

- *R*esearch, such as assessment of values most at risk under a radically changed climate.
- *M*onitoring, such as reporting on indicators of the impacts of climate change.

Awareness

Staff awareness. Full engagement in any action depends on the knowledge and will of an agency's own staff. It is important that all staff have a level of understanding of climate change impacts and adaptation appropriate to their mission. Actions include disseminating information in summary documents, newsletters, and technical reports; giving seminar and workshop presentations; and including climate change overviews in basic training components.

Stakeholder awareness. Even in large North American parks, environmental protection depends heavily on the presence of a more extensive ecosystem, or buffer zone. Therefore the effectiveness of adaptation depends in like measure on the management of surrounding natural areas. A park should urge its regional ecosystem partners to respond to the need for climate change adaptations in their resource management plans. In particular this requires that they understand how climate change will influence the evolution and migration of biomes and habitats. Ideas can include promoting ecological connectivity and porosity between and around protected areas, cooperating to mitigate or eliminate all local and regional threats to ecological integrity, and communicating climate change impacts and adaptation strategies, particularly in relation to potential boundary changes.

General public awareness. Regional adaptations and national and international mitigation actions and policies ultimately depend on public support, expressed through politicians. Fortunately, most park agencies are well regarded by the public. They can use this esteem to promote and lobby for climate change mitigation and adaptation policies and actions, both by institutions and private individuals. The public should be made aware of the potential impacts of climate change upon park species, ecosystems, and features, and what adaptations may be required. Visitors should learn what they can do, in parks, at home, and at work, to assist in the mitigation of climate change through direct actions or by spreading the word to their friends and family. Actions by park agencies can encompass the inclusion of climate change messages in interpretation programs, posting a climate change summary document on Internet sites, and working with education authorities, other departments, governments, and non-governmental groups to develop and deliver climate change and protected area information to children and adults alike. Parks should collaborate with intergovernmental, non-governmental, and international bodies to promote national and global strategies for protected areas to adapt to climate change.

Leading by example

Reduce greenhouse gas emissions. Greenhouse gases (GHGs), including carbon dioxide, nitrous oxide, and methane, are generated primarily by the consumption of fossil fuels in the operation of vehicles and the heating of buildings. Many countries, including Canada, have agreed to reduce their GHG emissions under the Kyoto Protocol. Park agencies can use their favorable public presence to lead the way in minimizing building energy consumption through design and operational practices,

reducing their fleet and switching to more energy efficient vehicles, fuel switching and taking advantage of emerging technologies.

Promote personal action plans for staff. Employees and volunteers can play a vital role in the community through their personal actions at home and in their neighborhoods. Employers can help by providing public transit passes rather than subsidizing parking; extending incentives for car pooling, cycle commuting, and telecommuting; and promoting energy use reductions in homes and lifestyle choices.

Adapt natural region representation strategy. Many countries have followed Parks Canada's lead in using a natural region representation approach to the development of a network of national parks. Natural regions are typically based on a combination of physiography and dominant vegetation. While physiography remains largely constant in anything less then geological time, vegetation is dynamic and successions and processes have changed significantly even in living memory. Climate change will accelerate this process to the extent that natural successions at most parks will evolve over decades at most. Parks will no longer be able to truly represent a past biology.

Nevertheless, there is great value in a region-based approach to park establishment. It assures a distribution of parks across many landscapes and ecotones, itself one of the best ways to protect biodiversity under climate change. A rational network basis for a park system also deflects the strains of short- and mid-term demands for land protection when there is already a park representing a specific area. Therefore, existing polygons or map entities of natural regions should be retained, but their descriptions may have to be changed to reflect the dynamics of present and future climate. New park locations and boundaries should be established in ways that maximize site diversity and landscape porosity.

Address climate change adaptation in park management plans. Management plans encapsulate park objectives and the activities that help to achieve them. These plans are also an accountability tool for performance reporting. What is not in a plan tends to be considered unimportant. Given the enduring nature of parks and the long-term implications of climate change, adaptation should be addressed in management plans. For example, park purposes can be modified to protect processes and biodiversity rather than specific biomes and species, and management planning guidelines can direct that park purpose statements be tolerant of biotic changes resulting from natural and anthropogenic climate change. Boundaries can be reviewed to seek opportunities for changes that would favor the protection and maintenance of ecological integrity. An example might include seeking higher-elevation lands to protect Alpine tundra species. Management plans should endorse research and monitoring of ecosystem indicators sensitive to climate change. Ecosystem restoration projects can be directed to take future climates and vegetation successions into account.

Report on natural and management adaptations to climate change. Whether reactive or adaptive, an integral part of management is the monitoring of progress towards a goal, and then to assess results and modify future actions accordingly. Documenting these processes is essential to full debate and on-going support, be it by legislators, policy analysts, or the general public. The use of a regular report series is the best guarantee of systematic publishing,

dissemination, and readership. This does not have to be in a scientific journal or series. Annual reports, quintennial or decennial state-of-park reports, or in-house occasional papers are often more appropriate to the audience and purpose. Ecosystem managers should select indicators of climate change impact for their park and its natural region, develop protocols and implement monitoring, and collaborate with regional partners to report the ecological impacts of climate change to the public and to policymakers.

Active ecosystem management

Eliminate or mitigate non-climate *in situ* threats. The growing body of research on interactions between climate and non-climate stresses suggests that responses are synergistic (e.g., Schindler 2001). To maintain or rebuild ecosystem resilience, one must therefore reduce the number and/or magnitude of insults faced by an ecosystem. Fortunately, many stressors are more locally and regionally controllable than climate change. In a marine system, this may mean establishing no-take zones to reduce fishing pressure and associated habitat destruction. In a freshwater system, this may require limiting the concentration of toxic substances in effluent from an upstream industry. In a forest ecosystem, it may mean preventing fragmentation by access roads. It may mean protecting alpine tundra from ski resort development. It may mean limiting harmful grazing practices in grasslands. None of these tasks are easy, but they are approachable on a local level and they can increase the overall resilience of ecosystems (Hansen et al. 2003, 11). Many protected areas are already pursuing threat reduction and sustainable regional ecosystems through conservation partnerships with land management agencies. This is also the right thing to do to blunt the edge of climate change. As noted above under stakeholder awareness, parks should promote regional ecosystem conservation measures and partnerships that maintain or build porous landscapes through which assemblages of species can migrate in response to climate change. A good network of large protected areas at the core of biosphere reserves may be wild nature's best climate change "shock absorber."

Use adaptive management. Given uncertainty about the exact nature of ecosystem impacts of and responses to climate change, effective management will require a responsive and flexible approach. Adaptive management is a methodology in which one can proceed with only limited or uncertain knowledge. It is an approach whereby an intervention is conducted as if it were a scientific experiment (Nudds 1998), with measurable, time-bound targets set in advance (policy = hypotheses), careful measurement of results as things happen (intervention = experiment), and approaches adjusted as new information becomes available (reporting, analysis, re-setting hypotheses). Park agencies should follow adaptive management guidelines for impact abatements such as species protection, translocation of slow-spreading key species, or retardation of fast-spreading pioneers. An adaptive management approach is particularly important in ecosystem restoration in an uncertain, changeable climate.

Use climate change research results. There are many climate and vegetation change models, and many of their results are available on the web or in journals and government reports. However, most are global or national in scale. As well, there is a steep learning curve required to properly

interpret ensembles of climate change scenarios and the assumptions and uncertainties involved. It is not enough to have good primary science. There must be secondary, or derived, products that digest and customize this knowledge for interdisciplinary professionals. Without these, good science collects dust. Protected area agencies should commission secondary studies that translate this vast body of science to regional and park-specific data sets that place-relevant, user-friendly information into the hands of ecosystem managers. Parks Canada has done this through the work of Scott (2003), which resulted in spreadsheets of annual, seasonal, and monthly temperature and precipitation data for twelve general circulation model–emission scenario combinations for three periods in the 21st century for each Canadian national park. The work is accompanied by narrative projections of physical and biotic changes, again for each park. By having access to customized climate change and impacts information, park managers now recognize climate change as a major ecosystem stressor, and can build monitoring frameworks with climate change indicators in mind.

As well as providing scientific syntheses, park managers need the tools to use climate change information in their decision-making processes. Climate change guidelines for environmental assessment are now available in Canada, covering projects that either have the potential to emit greenhouse gases, or projects that will be impacted by climate change (CEAA 2003). Similarly, there is probably a need for guidelines for modeling ecosystem restorations and infrastructure development.

Adjust park boundaries as needed for climate change adaptation. Changes in climate will lead to changes in habitat and species survival. Some vegetation species would have to migrate hundreds of kilometers to follow climate, although this is unlikely to happen depending on factors such as seed dispersal method, topography, soil type, and fragmentation by land uses. Other species might find a new home a short distance away. For the latter it may be possible to adjust park boundaries to capture the anticipated movement of critical habitats and species. Park boundaries could be aligned to accommodate transition zones where large changes of climate, habitat, and species distribution are expected to occur over small distances in relation to park size.

Research

Understand the impact of past and future climate change. Decision-makers and park visitors alike will benefit from the lessons to be learned from a comprehensive knowledge of Holocene landscape changes. Such knowledge helps to provide an understanding of the changeable nature of climate even in historical times, and will provide some measure of nature's ability to adapt autonomously. The impacts of climate change on natural processes and visitor activities should also be researched thoroughly before committing to expensive and irreversible ecosystem restorations or visitor infrastructure development. Each park should be rated for its sensitivity to a $3xCO_2$ world. Of course, the development of a research agenda should not be an excuse for postponing early action on awareness, leadership, and active ecosystem management where the "no regrets" principle applies.

Identify values at risk of being significantly impacted by climate change. Ecosystems have too many components to understand and track them all, considering

our poor understanding of most ecosystems, budget constraints and the short time frames typically imposed on analysts and managers. The concept of valued ecosystem component (VEC) provides a means to set management goals without becoming bogged down in the minutiae of all species, all minerals, and so forth. A VEC is defined as an "environmental attribute considered to be important for decision-making" (Munn 2002). VECs are usually tangible things, like a keystone species or iconic vista, to which indicators for monitoring are closely tied.

Each park should identify a limited suite of VECs that are sensitive to climate change, such as species at the margins of their climatic range, species with limited or excessive abilities to migrate, and physical features such as permafrost environments and ombrotrophic wetlands. Barriers to migration should be identified, such as fragmented habitats and restricted vertical migration paths.

Support downscaled climate modeling. Current climate change scenarios use global models with very coarse resolution of major topographic features. Much research is in progress to develop climate change models that fit regional scales and take into account, for example, great lakes and bays. Ecosystem managers should be prepared to support such research where it would lead to more detailed scenarios for their region, and hopefully to scenarios that reflect local topography and vegetation with more certainty and precision.

Monitoring

Promote parks as long-term integrated monitoring sites. Climate change will bring unexpected combinations of direct impacts, secondary effects, and new associations of processes, features, and species. Hence national parks should be managed as integrated ecosystems, not for one particular VEC. Integrated monitoring is a complementary management and reporting tool that can reveal unexpected linkages between ecosystem components and the drivers of environmental change. The prime attraction of integrated monitoring is its ability to mine existing data to spot emerging influences and explain responses. Each stress does not need its own unique set of indicators. Often, several stresses can be tracked from a limited but well-selected ensemble of indicators. Integrated monitoring also fosters partnerships in which many agencies share costs while receiving benefits greater than the sum of the inputs.

Data gathering and reporting actions. Each park should have long-term climate and climate change indicator data. These data should be reported at the park level and regional or national levels.

What not to do?

Do not move parks to anticipated biomes. While some parks might benefit from local boundary adjustments to protect ecosystems and habitats at risk from climate change, as noted above the general notion of dynamic parks must be rejected on policy grounds, as opening the door to any other reason to move a park, e.g., to extract minerals or fiber. The notion must also be rejected on the pragmatic basis that few natural areas remain for new park establishment within existing or future regions that already have national park representation. Rather, the present parks are often all that is left to provide a haven for nature during a time of great change. Thirdly, park establishment is a lengthy process with no guarantee of success. In sum, the presence of a

well-distributed system of protected areas is one of society's best adaptations to climate change. Even if one protected area loses certain species and associations, species will have their best chance of finding new homes in a well-managed, well-distributed, well-connected, and properly sized network.

Do not use parks to buffer or mitigate other impacts. Parks are not an insurance policy against negligence or mismanagement of natural hazards and natural resource supply. The restoration, protection, and maintenance of natural systems precludes the manipulation of an ecosystem to an artificial condition in order to counter an artificial threat. Some of these ecosystem services may come about with the maintenance and restoration of ecological integrity, but parks should not be manipulated for flood protection, water supply, or carbon sequestration, for example. As with the idea of moving parks, this would open the door to the commercialization of natural resources in parks.

Do not modify natural region boundaries to fit future biomes. Many nations use, or are considering the use of, a natural region representation approach to park establishment. This system has served Canada well since its adoption by the federal cabinet in 1976. The constancy of the number of regions and their boundaries has been a cornerstone of the park system plan since that time. It has allowed Parks Canada to pursue a consistent course towards completing a pan-Canadian system of national parks without being sidetracked by interest groups or ministerial lobbying to add another park here or there to satisfy vested local interests. Upon the publication of the ecozone map of Canada in the early 1980s, the issue of natural region boundary change was addressed and rejected. Even though the ecozone map is a later product, is scientifically more defensible and was the product of federal, provincial, and territorial agreement, if the precedent were to be set that the natural regions policy could be changed, then there could be no end to further pragmatic modifications of regions.

All climate scenarios are based on a series of assumptions about future emissions, the physics and chemistry of the atmosphere, and geographical simplifications to allow world models to operate on today's supercomputers. Vegetation response is likewise based on a series of modeling and plant succession assumptions. While these collectively represent the best science today, and show a great deal of convergence in their general findings, the placement of region boundaries is by definition notional and subject to change as climate and vegetation models improve, and as the world moves forward into updated real emission inventories rather than scenarios. To change natural region boundaries on this basis would open up a never-ending process, and create a unrealistic setting for park feasibility studies and establishment negotiations that already can take years or decades.

Conclusions

However well protected areas are managed, they cannot by themselves have much direct effect on greenhouse gas levels. Rather, a good network of protected areas free of other stresses is one of society's and nature's best adaptations to climate change. They can also play a vital communications role in influencing visitors and the concerned public. These two—good parks and good communications—in turn require well-researched and -monitored climate

change impact indicators as the basis for adaptive ecosystem management, accountability, and reporting systems, and for interpretive, outreach, and education programs. House-in-order programs complement the messages that governments should be sending to their peoples. Research on the synergy between climate change and other stressors, such as habitat fragmentation and air pollution, can provide the knowledge to guide the mitigation of local and regional stressors, thereby restoring some of the natural resilience of ecosystems and wild species.

Regardless of the debate over climate-forcing mechanisms and who does what to whom, we are more aware than ever that we are entering an era of rapid climate change, recent and future, and we had better get used to it. Protected areas should play a leadership role to ensure that wild nature also enjoys the ride.

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