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

The George Wright Society

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On the Cover: "Chesapeake Bay, Blue Crab" is award-winning artist Kathleen Noffsinger's first print and has proven to be quite popular in the Bay area. Noffsinger, a University of Maryland graduate, now resides in Deltaville, Virginia. She has had many gallery exhibits as well as solo shows. Prints and tee shirts of this print are available, and for every purchase as a result of the FORUM cover publication, $2.00 will be donated to the George Wright Society. For more information, please contact Bushel Basket Art, Ltd., 19093 Little Creek Lane, Rockville, VA 23146; 1-804-749-8900.

Society News, Notes & Mail

Nominations Open for Two GWS Board Seats, 2000-2002

The 1999 board election, which will take place this September, is for the seats of two incumbents, Bob Krumenaker and Laura Soullière. Both incumbents are eligible for re-election for a second three-year term, and both have indicated that they will run for re-election. We are accepting nominations from those who wish to challenge them for these seats. The term of office runs from 1 January 2000 through 31 December 2002. Nominations are open through 1 July 1999. To be eligible, the nominator and nominee must both be GWS members in good standing (and it's permissible to nominate one's self). The nominee 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. The procedure is: members make nominations for possible inclusion on the ballot to the board's nominating committee. The committee then, in its discretion, determines the ballot. Among the criteria the nominating committee considers when determining the ballot are the skills and experience of the potential nominees (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 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. All nominees will be contacted by the nominating committee to get background information before the final ballot is determined. Again, the deadline for nominations is 1 July 1999.

Erratum: "Close Cousins Consider Landscapes"

In the last issue, we published the article "Close Cousins Consider Landscapes: Comparative Notes on Cultural Landscape Work in Australia and the United States" (Vol. 15, No. 4, pp. 64-71). The article was by Jillian Cowley; unfortunately, we consistently misspelled her last name as "Crowley." Our sincere apologies to Jill for having made this error.

World Heritage Committee Adds 30 Sites To UNESCO List

UNESCO's World Heritage Committee, meeting in Kyoto last November and December, has added 30 new sites (27 cultural and 3 natural) and one extension to its World Heritage List of cultural and natural sites. This brings the number of listed sites of "exceptional universal value" to 582 in 114 countries. For the first time, the List includes sites located in Belgium and the Solomon Islands. Among this year's additions, the Committee added the archaeological site of Troy, in Turkey, the Summer Palace in Beijing, China, and the prehistoric rock-art Sites in Portugal's Coa Valley. The World Heritage Committee, an intergovernmental organization, is composed of 21 representatives of the 155 States Parties to the Convention Concerning the Protection of the World Cultural and Natural Heritage (completed November 16, 1972). It is responsible for the implementation of the Convention and determines the inclusion of sites on the World Heritage List on the recommendation of two consultative organizations: the International Council on Monuments and Sites (ICOMOS) for cultural sites; and the World Conservation Union (IUCN) for natural sites. Moreover, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) provides expert advice on monument restoration and organizes training for specialists. The decisions of the Committee and further information about the new sites may be found on the World Heritage's Centre Web site at: http://www.unesco.org/whc/kyoto.htm.

Source: posting by Peter Stott to US/ICOMOS List (<usicmos@world.std.com>,) — 2 December 1998

Box 65: Commentary from the GWS Office and Our Members

Fuzzy Logic and National Park Service Resource Management Policy

Fuzzy logic and its companion, fuzzy thinking, are concepts that grew out of the idea that statements of fact are not all true or all false. Rather, their essence can lie somewhere between total truth and total falsehood, or somewhere between 0 and 1, instead of being one or the other, as we commonly perceive. Statements of fact are thus multivalent, implying a range of optional answers for any question, answers that, as a result, can be imprecise, vague, or, in a word, fuzzy (Kosko 1993).

I think most scientists and resource managers are uncomfortable with the idea of fuzziness. They want to believe in the sanctity of certain facts. They have little tolerance for uncertainty. Yet most of the studies ecologists conduct are filled with uncertainty. Shrader-Frechette and McCoy (1993) have written about the uncertainty associated with various "ecological theories" and the role that value judgments play in interpreting observational data. They suggest, for example, that general ecological theory has been unable to provide the scientific support necessary for conservation decisions. They may be correct, particularly with respect to ungulate management in parks.

Our uncertainty in understanding natural ecosystems makes it difficult to know the extent to which resource managers should intervene to manage nature in parks. This has been a long-standing and contentious dispute. Stewart Udall, when secretary of interior, commissioned a high-powered group of wildlife biologists in 1963 to help resolve this dispute. The resulting Leopold Report (Leopold et al. 1963) is a good example of fuzzy logic, and its recommendations have since been used by NPS administrators to support resource management policies that seek to minimize human intervention with the natural ecological processes of parks. Yet some scientists dispute that interpretation, and have asserted that the report actually articulated a very different message, i.e., it recommended active intervention in the management of park resources when necessary (Wagner et al. 1995). What these opposing viewpoints have meant in practice is that the extent to which NPS managers have intervened in natural processes in a given park has been a matter of degree, depending on the situation and type of resource, and the social, political, and scientific pressures that have been applied. Depending on which side one is on, NPS resource management actions (or non-actions) with respect to any

resource problem have been characterized as either enlightened or scientifically flawed. However, in my opinion, such attitudes may be a necessary adjunct of an agency obligated to make management decisions in the multivalent world of ecological science.

Fuzzy thinking was probably embedded in NPS culture as a result of the 1916 establishing legislation, or Organic Act, which founded the agency. The legislation directs the agency to both preserve park resources and provide for public enjoyment of the same. Note that the act does not say "preserve *or* provide." Much has been written about the paradoxical nature of this mandate, most of it critical. For example, Foresta (1984) wrote that "if use destroys, how can a management policy both accommodate use and preserve a natural area? A mandate which is inherently contradictory must, by logical extension, become a management dilemma—a problem for which there is no solution that does not violate a restraint."

In spite of such criticisms, historians assert that there was, however, a real purpose behind the way the Organic Act was written by the environmental leaders of the day (Sellars 1997). These leaders sought to create legislation that provided the first NPS administrators with as much freedom as possible to manage the resources in the way they judged best. The ambiguous nature of the mandate maximized flexibility and meant that almost any management action could be justified as long as it either aided resource preservation or public enjoyment. In general, however, the authors of the Organic Act recognized that management would require a balance between the two extremes, and they trusted the discretion of agency personnel to find the appropriate balance. Thus the agency started out with a fuzzy mandate, and given the unique problems it encountered, this mandate probably served the agency well.

In recent years, there are many instances where the fuzzy nature of the mandate has been used by critics to fight various NPS policies. There has been a tremendous growth in the number and power of special-interest groups who do not trust agencies in general and who don't want to see resource managers left to manage according to their own discretion. As these groups vie to influence the direction of NPS policy, battles which once took place almost exclusively within agency ranks or occasionally in Congress now take place in federal court, state court, before county commissioners, and governor's commissions. Equally as important, all groups use the ambiguous wording of the Organic Act to project their own values on how nature should be preserved or manipulated in parks (Cheever 1997).

This situation has caused one legal scholar to suggest that the greatest risk to the NPS is the incremental or piecemeal erosion of long-standing resource management policies as a result of local political pressure and scientific criticism. And it has led some scholars to ask if the agency could benefit from new

congressionally passed organic legislation telling it exactly what to do, i.e., a less fuzzy mandate (Cheever 1997). The fact that the agency benefited from vagueness in the past does not necessarily mean it does so today. Advocates of that viewpoint argue that it would be useful to have an agency mission statement that was more than a mirror, reflecting back the values of each interest group itself. They feel a clearer mission statement, conveying the same message to all interested parties, would not guarantee enhanced agency stature and discretion but would at least make it possible.

Another criticism of the NPS has been that it has used the ambiguities inherent in the Organic Act to emphasize the development of facilities for visitor use at the expense of resource protection. Again, this is a fuzzy issue, and such comments simplify a complex problem. Almost all parks, from the time of their establishment, have recognized the importance of accommodating tourism and providing for public enjoyment. This was the primary reason most of them were established (Wright 1992). Historians affirm that tourism and public enjoyment have long provided a viable rationale for the national park movement and provided the political support the NPS desperately needed in its early years. The agency learned very early that the best way to enhance tourism and to ensure public enjoyment was to have natural resource management actions serve tourism purposes (Sellars 1997). Little has changed over the years, although actions today are clearly more ecologically sensitive. And given the importance of public support and the power of public opinion, it is difficult to see how things can change today.

Currently, the increase in numbers of various species of ungulates has brought on one of the strongest challenges to the policy of minimal human intervention. There are now increasing demands that park managers actively intervene to control or reduce certain populations (Wagner et al. 1995). Do these demands conflict with policy? In general, it seems clear that active intervention can certainly be supported by the Organic Act. Whether it can be supported by ecological science is another issue. It can be argued that in many cases, ecological science does not have the necessary understanding to provide confident answers to important resource management questions, including how many animals a specific habitat can support.

Are there advantages for the NPS to maintain policies that are fuzzy? One would probably say "yes" only if one trusted the agency's ability to manage its resources properly. For a wide variety of resource issues ranging from facility development to endangered species management to ungulate population control, there are many people who do not want to leave the agency to its own discretion. However, the alternative of potentially having Congress impose its values and mandates in new laws could be equally frightening. I feel that there is a value to the NPS in retaining a fuzzy mandate. Yet in doing so the agency

needs to recognize that it must have a strong foundation of sound scientific knowledge to support fuzzy management policies. In many cases in the past, NPS policies were not supported by strong science. We now look back to those days with wonderment. In some cases the agency was criticized, but usually it still managed to muddle through. That luxury no longer exists today (Wright, in press). The NPS now faces much greater scrutiny and persistent criticism. Some individuals criticize the agency because of its fuzzy policy. I feel fuzzy policy can be acceptable if it is supported by sound scientific knowledge. The converse—fuzzy policy underlain by uncertain science—is, on the other hand, probably not tenable. In my opinion, if the NPS hopes to maintain support for its unique, if fuzzy, resource management policies, these policies must by supported by a strong foundation of scientific knowledge.

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Reminder: this column is open to all GWS members. We welcome lively, provocative, informed opinion on anything in the world of parks and protected areas. The submission guidelines are the same as for other GEORGE WRIGHT FORUM articles—please refer to the inside back cover of any issue. The views in "Box 65" are those of the author(s) and do not necessarily reflect the official position of The George Wright Society.

David Harmon

The New Research Mandate

for America's National Park System: Where It Came From and What It Could Mean

Easily the most significant parks legislation to pass the 105th U.S. Congress was the National Parks Omnibus Management Act of 1998, which was signed into law (Public Law 105-391) by President Clinton on November 13, 1998. Omnibus bills have been used since the 1970s by Congress to combine disparate park-related legislation into one large package. The main concern of the 1998 omnibus is revamping the concessions policy of the National Park Service, and most of what was said about the bill in committee and on the floor of Congress had to do with this part of the law. However, buried within the law is a section which is potentially more far-reaching than the concessions reforms. In fact, this section—passed with no fanfare whatsoever—could fundamentally change the way NPS manages the National Park System.

The section is Title II of the act. Its disarmingly dry heading, "National Park System Resource Inventory and Monitoring," gives no hint of the significance to follow. Yet contained within Title II is something that no less than a dozen blue-ribbon panels (going back to the Leopold Committee of 1963) have called for: an explicit legal mandate for research within the National Park System—research that is to be used to guide and support the management of the parks. The need for a mandate runs long and deep. As Richard West Sellars showed in *Preserving Nature in the National Parks: A History* (Sellars 1997), the Park Service consistently has failed to use ecological science in managing the natural areas of the System, despite much rhetoric—and some genuine good intentions—to the contrary.[1] Whether the Park Service has done any better on the cultural resource side remains an open question, for there is as yet no parallel critique to go with *Preserving Nature* to establish or refute this in a systematic and thorough manner. Regardless, in Title II Congress has spoken forcefully of the need for sound information to be used to manage the National Park System, and one of the considerable strengths of the new law is that it applies equally to all types of resources within the parks.

Senator Craig Thomas of Wyoming, chair of the Subcommittee on National Parks, introduced the legislation which led to Title II in February 1998; it was co-sponsored by Senator Spencer Abraham of Michigan.[2] These two legislators deserve much credit for seeing the bill through Congress, and for having the vision to include the research mandate in the first place.

This paper briefly explores the historical context of Title II by reviewing what previous laws relating to the national parks have had to say about research and its relationship to resource management. Following that is a detailed, section-by-section analysis of Title II. This is less onerous than it sounds, because Title II is pithy, weighing in at just under 20 short paragraphs. Although knowing the historical background is helpful in understanding Title II, it is by no means a prerequisite, so readers who are primarily interested in the practical implications of the law can skip right to the sectional analysis. The paper concludes with a short summary of Title II's possible overall effect on the National Park System.

Research Directives in Previous Park-Related Laws

In almost every law concerning the National Park System, there are provisions that can be interpreted as implying the need for some kind of research-based management.[3] For instance, the earliest legislation, the 1872 Yellowstone park act, gave the secretary of the interior the duty of making "such rules and regulations as he may deem necessary or proper for the care and management" of the park, specifically to preserve from injury or spoliation the "timber, mineral deposits, natural curiosities, or wonders within said park" and to ensure "their retention in their natural condition" (Dilsaver 1997, 28). In modern parlance, this is a non-degradation clause, and it implies the establishment of some kind of baseline scientific information to use as a "natural condition" benchmark. But obviously this is reading much too much into the law, for certainly Congress in 1872 intended no such scientific program. Similarly, in the Organic Act itself research and resource management activities are implied in the critical passage, which directs NPS to conserve the parks' natural and historic objects and wildlife "unimpaired for the enjoyment of future generations." Today, the Organic Act is increasingly given a modern science-oriented interpretation by people both within and outside NPS, but, as Sellars has documented, in 1916 the agency had a very different idea of what constitutes "unimpaired." In any event, the wording of the Organic Act is far from an explicit directive for research-based management.

The research implications of the Antiquities Act of 1906 are more substantial. In the key section which gives the president the power to set aside national monuments, the scope of such proclamations is limited to "historic landmarks, historic or prehistoric structures, and other objects of historic or scientific interest," with the national monuments so created "confined to the smallest area compatible with the proper care and management of the objects to be protected" (Dilsaver 1997, 40). Obviously, some kind of preparatory evaluation of historic or scientific value is implied here, along with studies of the minimum extent of land needed for proper preservation. The act goes on to give the secretaries of the interior, agriculture, and war the power to issue permits for re-

search ("examination" is the word used), excavation, and collecting to "institutions which they may deem properly qualified," provided that these activities "are undertaken for the benefit of reputable museums, universities, colleges, or other recognized scientific or educational institutions, with a view to increasing the knowledge of such objects, and that the gathering shall be made for permanent preservation in public museums" (Dilsaver 1997, 40). Here we have an early example of Congress encouraging a partnership between the federal government and academia, as well as a mandate for professional, perpetual curatorial care of cultural and natural objects. But again, no standards are set forth and so presumably the proclamations and permits could be based on virtually any kind of information.

Perhaps the most explicit research mandate is contained in the Historic Sites Act of 1935, where the secretary of the interior is directed to gather drawings, plans, photographs, and other data on historic sites; to survey those sites; and to "make necessary investigations and researches" into the sites and their associated objects (Dilsaver 1997, 132). More recent cultural resource laws treat research more narrowly. In the National Historic Preservation Act (1966), the research burden is shifted to the states, with the federal government authorized (but not required) to fund statewide surveys (Dilsaver 1997, 302). The Archaeological Resources Protection Act (1979) aims to foster cooperation and exchange of information among agencies, outside professionals, and private individuals, thereby enabling the secretary of the interior to "expand the archaeological database" (Dilsaver 1997, 404). Section 5 of the Native American Graves Protection and Repatriation (1992) requires all federal agencies to inventory their collections for Native American human remains and funerary objects and identify the geographical and cultural affiliation of each item (Dilsaver 1997, 425).

In the natural resource laws of recent years, there is even less that can be construed as a mandate to do ecological or biological research within the National Park System. In the Wilderness Act (1964), the only explicit mention of research in designated wilderness areas is under the guise of "gathering and dissemination of information regarding their use and enjoyment as wilderness." This is, if anything, a directive to do social science. Nor does the National Environmental Policy Act (1969) really come closer to filling the ecological gap. Section 102(b) of NEPA requires federal agencies to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decisionmaking" (Dilsaver 1997, 365)—laudable, but hardly a clarion call to park management. Even the anti-derogation language of the Redwood Expansion Act of 1978 (section 101(6)(b); Dilsaver 1997, 392), which is widely considered to reinforce the ambiguous preservation provisions of the Organic

Act, only implies the necessity of knowing baseline conditions; it doesn't specifically direct that they be established through research.[4]

Another implied directive is contained in the National Park System General Authorities Act of 1970. There, under Section 8, "General Authorities," the secretary of the interior "is directed to investigate, study, and continually monitor the welfare of areas whose resources exhibit qualities of national significance and which may have potential for inclusion in the National Park System" and provide an annual listing of these areas to Congress, which is to be accompanied by "a synopsis ... of the current and changed condition of the resource integrity of the area and other relevant factors, compiled as a result of continual periodic monitoring..." (U.S. House Committee on Resources 1998). But these reviews apply only to potential new additions to the National Park System, not to existing units.

Reviewing all these laws makes it evident that the whole approach to park research has been piecemeal. The Historic Sites Act does not apply to archaeology, nor ARPA to history, nor the Wilderness Act to frontcountry, and so on. The result was a patchwork where the necessity of research was implied over and over again in a variety of situations, but there was nothing to tie it all together, no clear statement of the importance of research to managing *all* the resources of *all* the parks.

Title II: A Section-by-Section Analysis

This is the gap Title II has now filled, clearly and concisely. It provides an explicit, incontrovertible mandate for doing research in every unit of the National Park System, no matter how large or small, whether primarily "cultural" or "natural." Most importantly, Title II directs that the results of such research will be used to guide management.

What follows is a section-by-section analysis. It makes no claim to being a definitive interpretation. It is not the work of a legal scholar, and in any case the interpretation and implementation of Title II will develop over time within the public policy arena, just as with every other law. However, a close analysis is warranted because the language of Title II was obviously crafted very carefully, and future court interpretations of the law will be decided on a scrupulous reading of the text. In what follows, the actual text of Title II is in italics; the commentary follows each section in plain type, as a series of bullet points.

Sec. 201. PURPOSES.

The purposes of this title are—

(1) to more effectively achieve the mission of the National Park Service;

- Note at the outset that Title II is not an attempt to resolve or even reinterpret the oft-noted preservation-versus-use dilemma of the National

Park Service Organic Act of 1916. That mission—contradictory though many think it to be—remains unchanged.[5]

- Significantly, the mandate (as stated below in section 202) is being given to the secretary of the interior on behalf of the National Park System, and is not exclusively aimed at the National Park Service. Obviously, NPS is expected to be central to the research effort, but the first purpose of Title II is to benefit the *mission* of the National Park Service, not NPS *per se.* This is a vital distinction, for, as we shall see, other parts of Title II specifically direct NPS to establish partnerships with other federal agencies (an example would be the U.S. Geological Survey Biological Resources Division). It is clear that Title II is not intended to be a vehicle for NPS to take back the natural-science research capacity that was transferred to the National Biological Service (the predecessor to USGS-BRD).

(2) to enhance management and protection of national park resources by providing clear authority and direction for the conduct of scientific study in the National Park System and to use the information gathered for management purposes;

- The second purpose of Title II is to explicitly link scientific research as a necessary prerequisite for resource management that is not only professionally defensible, but now, with the passage of this law, legally defensible as well. To do this, Congress felt that it was necessary to go beyond the science directives that were merely hinted at or scattered among previous laws. Instead, this section recognizes that clear legal authority and direction need to be given to all entities (not just NPS) that are engaged in research in the National Park System.
- The science to be carried out must be usable science, science that has management applicability, science that will "enhance management and protection" of resources, not just purely speculative or theoretical research. This is obviously a potential gray area, because many studies that seem to have no immediate applicability to current resource management issues may prove crucial in the future. (This is recognized in the next two sections of the law.)
- In case there are any lingering doubts about this, Congress specifically extended its "clear authority and direction" not just to conducting scientific study, but to using "the information gathered for management purposes." All in all, this subsection is an elegant and forceful directive to do science-based park management.

(3) to ensure appropriate documentation of resource conditions in the National Park System;

- Here Congress makes a very important recognition that links with subsection 2 above: namely, that without baseline studies of resource conditions, park management objectives cannot be legally met. This is an obvious, but often overlooked, point. Baseline inventory and ongoing monitoring are vital components of park management, but are all too easy to put off in the face of more immediate concerns. By inserting the documentation of resource conditions as the third purpose of Title II, Congress has elevated this function to an appropriate level of importance.
- The further implication of this section is that proper adaptive management, based on strategic, problem-solving research, is not the same as "brush fire" management. The baseline documentation mandate suggests that Congress means NPS resource management to be primarily proactive, not reactive.

(4) to encourage others to use the National Park System for study to the benefit of park management as well as broader scientific value, where such study is consistent with the Act of August 25, 1916 (commonly known as the National Park Service Organic Act, 16 U.S.C. 1 et seq.); and

- The fourth purpose of Title II is essentially a partnership directive. Congress is recognizing that NPS and its sister federal agencies will never have the wherewithal to carry out all the needed research on their own. This is nothing new, but by officially acknowledging it Congress is directing NPS to seek out research partners in academia, among nongovernmental organizations, and elsewhere.
- Note again the explicit and primary linkage of study to "benefit" park management. However, the rest of sentence also makes it clear that research in the parks which is carried out by nonfederal partners (the "others" referred to in the sentence) does not necessarily need to be management-oriented—in contrast to research carried out by federal agencies. (This division of roles expands on the guidance contained in subsection 2.) Here, Congress recognizes that parks are important venues of scientific endeavor, apart from their other roles. However, any such "broader scientific" research cannot conflict with the mission laid out in the NPS Organic Act and its amendments. This is an important legal proviso that will enable park managers to disallow proposed research projects that are deemed to be damaging to park resource preservation or public enjoyment. (This point is taken up again in Section 205(b) and even more explicitly in Section 207.)

(5) to encourage the publication and dissemination of information derived from studies in the National Park System.

- The final purpose of Title II is an information-sharing and public education directive. Congress is saying that it is important for NPS to communicate the resource conditions in the parks to policy-makers, professionals, and the public at large. To the extent that traditional park interpretation has focused on "telling the stories" of the parks, rather than on exploring their contemporaneous role as protected natural and cultural areas interacting with present-day society, then this section expands the scope of what ought to be interpreted to visitors and the general public.

Sec. 202. RESEARCH MANDATE.

The Secretary [of the Interior] is authorized and directed to assure that management of units of the National Park System is enhanced by the availability and utilization of a broad program of the highest quality science and information.

- This is the heart of Title II, as simply and directly stated a research mandate as one could hope for. The secretary of the interior is not merely authorized to institute research, he or she is "directed to assure" that it *will* happen. No discretion is given, no "to the extent practical" fudge phrase is included. This is key language, since it is intended to shelter park research programs from shifting political winds as administrations and interior secretaries come and go.
- The last two words of the phrase "broad program of the highest quality science *and information"* further implies that Congress intends for Title II to apply to both natural and cultural resource management in the National Park System. (The applicability of the word "science" to cultural resources is discussed in more detail below.)
- It will be interesting to see how the term "highest quality" comes to be defined and interpreted. Does this mean that the traditional publication of resource management findings in the "gray literature" will give way to more and more to peer-reviewed studies? If so, what changes within NPS will be required to encourage park managers to participate in peer review?

Sec. 203. COOPERATIVE AGREEMENTS.

(a) COOPERATIVE STUDY UNITS.—The Secretary is authorized and directed to enter into cooperative agreements with colleges and universities, including but not limited to land grant schools, in partnership with other Federal and State agencies, to establish cooperative study units to conduct multidisciplinary research and develop integrated information products on the re-

sources of the National Park System, or the larger region of which parks are a part.

- This section enshrines in law the cooperative program between NPS / USGS-BRD and academia (variously called Cooperative Parks Studies Units, CPSUs, or Cooperative Ecosystem Studies Units, CESUs). These campus-based units have traditionally been used for all kinds of needed research in parks. By placing the units on campus rather than in individual parks, various economies of scale are realized, as are the benefits of having the researchers being in close contact with the academic community at large.
- Congress here again recognizes that NPS cannot go it alone. The agency is directed to enter into partnerships with kindred federal and state agencies in establishing cooperative units. This would seem to have special applicability to USGS-BRD, many of whose members were transferred over from cooperative research units run by NPS and the U.S. Fish and Wildlife Service.
- The research is specified to be multidisciplinary. This is an important congressional recognition of the complexity of the problems facing the National Park System. Whether the issue is brucellosis and bison in Yellowstone, or the scope of off-reservation tribal consultation that must be done to carry out the National Historic Preservation Act amendments, almost any problem facing the parks requires a wide array of information if it is to be solved.
- It follows then, that the information produced must be integrated—which is to say that the disparate assumptions, methods, and jargon from the various disciplines must be melded into a comprehensible whole, for the use of resource managers, elected officials, and the general public. This requires resource managers and researchers to work together cooperatively.
- In line with all this, Congress also states specifically that research can apply to the larger regional matrix in which parks function. This too is an important official recognition that, in the now-familiar phrase, "no park is an island."

(b) REPORT.—Within one year of the date of enactment of this title, the Secretary shall report to the Committee on Energy and Natural Resources of the United States Senate and the Committee on Resources of the House of Representatives on progress in the establishment of a comprehensive network of such college and university based cooperative study units as will provide full geographic and topical coverage for research on the resources contained in units of the National Park System and their larger regions.

- This section directs the secretary of the interior to issue a status report on cooperative study units by November 1999. The ultimate goal, a system of study units providing "full geographic and topical coverage" of the resources of the National Park System, is extremely ambitious. Because the phrasing is not qualified, it applies to both cultural and natural resources in the parks. To achieve full coverage of both will be a tall order, though not without precedent: the National Park System Plan of 1972 attempted something similar.

Sec. 204. INVENTORY AND MONITORING PROGRAM.

The Secretary shall undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends in the condition of National Park System resources. The monitoring program shall be developed in cooperation with other Federal monitoring and information collection efforts to ensure a cost-effective approach.

- The mandate under Section 201(3) to document baseline resource conditions is here restated explicitly as an I&M program. Again, the establishment of the program is not discretionary—the secretary "shall" do it. The last sentence of this section mandates partnerships between federal agencies, in contrast to previous language in Title II where partnerships are "encouraged" and are not limited to federal agencies.
- One might read in this section echoes of the original intent of the National Biological Survey (later the National Biological Service, now metamorphosed into the USGS-BRD), which was to do nothing less than a biotic inventory of the entire nation. Here, the inventory is scaled back to (if "scaled back" is the appropriate term!) to the National Park System.
- Taken literally, this section mandates a complete accounting of System resources—both natural and cultural, since neither one alone is specified. This is obviously an enormous chore, but the language is unequivocal.

Sec. 205. AVAILABILITY FOR SCIENTIFIC STUDY.

(a) IN GENERAL.—The Secretary may solicit, receive, and consider requests from Federal or non-Federal public or private agencies, organizations, individuals, or other entities for the use of any unit of the National Park System for purposes of scientific study.

- The secretary is not limited in any respect to the source of research proposals, nor are any units of the National Park System excluded from the research mandate—another clear indication that both natural and cultural areas are covered by the law.

(b) CRITERIA.—A request for use of a unit of the National Park System under subsection (a) may only be approved if the Secretary determines that the proposed study—

(1) is consistent with applicable laws and National Park Service management policies; and

(2) will be conducted in a manner as to pose no threat to park resources or public enjoyment derived from those resources.

- These criteria align Title II not only with the Organic Act (note the dual preservation-use language in subsection b-2), but with other park-related laws and NPS management policies. Subsection b-2 further recognizes that research activities can themselves have a substantial resource impact, and that conducting research in national parks therefore carries with it extra responsibilities on the part of the researchers themselves. Or, to put it another way, park managers have the obligation under Title II to turn down research proposals that don't meet its criteria.

(c) FEE WAIVER.—The Secretary may waive any park admission or recreational use fee in order to facilitate the conduct of scientific study under this section.

- This section is self-explanatory.

(d) NEGOTIATIONS.—The Secretary may enter into negotiations with the research community and private industry for equitable, efficient benefits-sharing arrangements.

- This section apparently refers to the burgeoning interest in bioprospecting within the National Park System, of which the gathering of microbial samples from the geothermal pools in Yellowstone is the most controversial example to date. This section anticipates that the government may wish to capture some of the profits gained by private biotechnology companies for resources taken from the parks. It does not address the ethics or legality of bioprospecting, nor the issue of patenting. And it does not require the secretary to enter into benefits-sharing agreements—the operative word is "may," not "shall."

Sec. 206. INTEGRATION OF STUDY RESULTS INTO MANAGEMENT DECISIONS.

The Secretary shall take such measures as are necessary to assure the full and proper utilization of the results of scientific study for park management decisions. In each case in which an action undertaken by the National Park

Service may cause a significant adverse effect on a park resource, the administrative record shall reflect the manner in which unit resource studies have been considered. The trend in the condition of resources of the National Park System shall be a significant factor in the annual performance evaluation of each superintendent of a unit of the National Park System.

- Section 206 is perhaps the most far-reaching part of Title II, because it addresses some key internal workings of the NPS. Sellars demonstrated in *Preserving Nature in the National Parks* that the Park Service traditionally has resisted giving scientific resource management a prominent place in park operations, even while the agency has nominally embraced the notion. The first sentence of Section 206 directs the secretary to *assure* that park management is based on sound scientific research. There are no hedge words here: studies are to be fully used in making management decisions. This gives a belated legal validation to the many recommendations calling for more and better science going back at least to the Leopold Report in 1963. (See Table 1, below.)
- The second sentence of this section is a very specific, affirmative mandate for science-based resource management. NPS managers must demonstrate how significant decisions have been supported by scientific study. Presumably, if the administrative record fails to show the link to sound research, the NPS can be held accountable in court.
- However, this second sentence is not to be interpreted as a congressional go-ahead for a new legal pry bar that can be used to force parks to do NEPA-style environmental impact statements for every management decision. The House Committee on Resources report accompanying the legislation states that "it is the intent of the Committee that this section is not to be construed as an additional administrative requirement to produce an environmental assessment, environmental impact statement, or any other additional documentation like that required for the National Environmental Policy Act (NEPA) or other authorities akin to NEPA. Further, this section does not create any other environmental standard that is to be met by the NPS" (House Committee on Resources 1998). This was the only substantive comment in the report's analysis of Title II, so it is apparent that the House wanted to give it special prominence.[6]
- The last sentence of Section 206 cuts to the heart of the NPS institutional culture. Superintendents have always been, and will no doubt continue to be, the centers of power within the agency. Now, for the first time, they will be held directly accountable for the resource condition of parks under their charge. The fact that the criterion will be the *trend* in resource conditions speaks once again to the crucialness of establishing a baseline through in-

ventory studies, and of monitoring changes to that baseline on an annual basis. For natural areas of the System, "condition of resources" may be interpreted as being analogous to the "ecological integrity" criterion used by Parks Canada; for predominantly cultural areas, the criterion could be the cultural integrity of their sites, objects, and resource values. In any event, some kind of integrity yardstick is implied by Section 206, if this annual evaluation of superintendents is to have meaning.

Sec. 207. CONFIDENTIALITY OF INFORMATION.

Information concerning the nature and specific location of a National Park System resource which is endangered, threatened, rare, or commercially valuable, of mineral or paleontological objects within units of the National Park System, or of objects of cultural patrimony within units of the National Park System, may be withheld from the public in response to a request under section 552 of title 5, United States Code, unless the Secretary determines that—

(1) disclosure of the information would further the purposes of the unit of the National Park System in which the resource or object is located and would not create an unreasonable risk of harm, theft, or destruction of the resource or object, including individual organic or inorganic specimens; and

(2) disclosure is consistent with other applicable laws protecting the resource or object.

- This is, potentially, an extremely powerful section of the law because it gives park managers the authority to deny requests made pursuant to the Freedom of Information Act (FOIA) for sensitive information about natural and cultural resources. Previously, Section 9 of ARPA gave park managers the right to keep the nature and location of archaeological resources confidential (Dilsaver 1997, 402), and Section 5 of the Federal Cave Resources Protection Act of 1988 does the same for the location of caves. But Section 207 significantly expands the scope of permissible FOIA exemptions to animals, plants, mineral and paleontological specimens, and objects of cultural patrimony in general.
- Moreover, the cloak of protection is defined so as to cover any organism or specimen that is deemed to be endangered, threatened, rare, or—and this is a vital addition—commercially valuable. Therefore, not only are listed species covered, but so is any abundant species or object that might be of interest to poachers. Section 207 is an excellent safeguard because it could prevent the release of (for example) radio-collar frequencies of collared wildlife, the locations of fossil formations, the locations of valuable plants (e.g., ginseng, rare cacti), and culturally sensitive information such as the sites of former summer camps of Natives—or perhaps even clan structure

information collected by anthropologists. Of course it remains to be seen how courts will determine what constitutes an "unreasonable risk of harm," but Section 207 appears to be a very powerful tool to prevent those who would use sensitive resource information for their own financial gain—or who wish, for their own perverse reasons, to undermine efforts to protect park resources.

The Potential Impact of Title II

It is obvious that Title II is a turning point in the long struggle to achieve recognition of the scientific and heritage research values of the parks. Students of Park Service management history know that a whole series of panels, beginning with the Leopold Committee in 1963, have called for major changes in the research and resource management functions of the agency. The most recent panel was convened by the National Academy of Science in 1992. Its report (National Research Council 1992) summarized the major recommendations of its predecessors, going back to Leopold, and published a tabular synopsis of the major recommendations of four of the most prominent previous reports. Table 1 reproduces this synopsis, and adds a new column showing which recommendations are addressed in Title II.[7]

One of Title II's real strengths is that it applies to both natural and cultural resources. As we have seen, authority to conduct cultural resource research in the System has always been stronger, but Title II is much more than an "equalizer" for the natural resource side. It is significant that the word "natural" does not appear anywhere in the final text.[8] Title II consistently speaks of "resources," not "natural resources"; "conditions," not "natural conditions" or "biotic conditions"; "science," not "ecological science," "biology," or anything else that would constrain the meaning to one type of resource only.

Still, many in the cultural resources community may feel that the frequent use of the word "science" means that Title II doesn't really apply to them. This would be an understandable, but erroneous, reading. The problem here is one of semantics, not substance. There is no convenient sister term to "science" that applies to the various fields involved in cultural resource management. The cultural resource analogues to ecological science are (1) scholarly historical research, which traditionally is classed under the humanities; and (2) the research methodologies of the various social sciences (sociology, psychology, archaeology, anthropology, ethnography, etc.), used in analyzing the human dimension of parks, both present and past. Underlying all of these (or interwoven with them, if you like) are the supporting curatorial professions. The boundaries between these fields are especially apt to become blurred in national park units because many have both cultural and natural resources of significance, and all of them engage concerns from both sides of the resource

Table 1. Major actions recommended in selected previous reviews, now addressed in Title II

Action recommended	Leopold Report (1963)	Robbins Report (1963)	NPCA Research Needs Assessment (1988)	Gordon Report (1989)	Addressed in Title II? (section reference)
Research					
Congressional mandate		x	x	x	201(2); 202
Independent research arm	x	x	x	x	See Note 1
Major expansion	x	x	x	x	201(4)
Basic & applied missions	x	x	x	x	201(2); 206
Coordination with other research programs	x	x	x	x	201(4); 203(a); 204; 205(a); 205(d)
Quality control improvements		x	x	x	201(1); 202
Establishment of science centers		x	x	x	203(a)
Internal restructuring for emphasis		x	x	x	No
Recruit & develop qualified personnel			x	x	See Note 2
Resource management					
Mandate			x		201(2); 202
Set objectives, develop plans	x		x	x	No
Apply ecosystem principles	x		x	x	203(a)
Inventory & monitoring		x	x	x	201(3); 204
Recruit & develop qualified personnel			x	x	See Note 2
Accountability with criteria			x	x	206
Cooperation with others in resource management				x	204

Note 1. The creation of USGS-BRD has, to some extent, addressed this recommendation, but not in the manner originally envisaged by the panels referenced above.

Note 2. Title I of P.L. 105-391 covers career development, training, and management within NPS. Section 101 of Title I reads: "Recognizing the ever increasing societal pressures being placed upon America's unique natural and cultural resources contained in the National Park System, the Secretary [of the Interior] shall continually improve the ability of the National Park Service to provide state-of-the-art-management, protection, and interpretation of and research on the resources of the National Park System."

Source: Adapted from National Research Council 1992. 55.

ledger. If "science" is interpreted to mean a systematic and intellectually defensible method of inquiry, then plainly there is such a thing as "cultural resource science," even if this is not a term widely used.

In summary, Title II is the legal mandate that many people have long wanted. It presents multidisciplinary research and resource management as linked endeavors that together lie at the very heart of the National Park System's purpose. It requires NPS to use resource information in its decision-making, and be accountable for the impact of those decisions upon resources under its care. It is not an exaggeration to say that it is brilliantly crafted legislation: highly focused, clearly stated, concisely expressed. But this in itself is not enough, as we all know. Laws are only as effective as the people who interpret and enforce them, and many questions remain wide open. Will NPS incorporate Title II into the current revisions of its management policies? Will the department of the interior seek the money needed to carry out Title II?[9] How will courts fit Title II into existing legal precedents? Will park pressure groups use Title II to sue for alleged mismanagement? It is far too early to do anything but guess at the answers. But one thing is already clear: Title II has the potential to fundamentally transform how NPS manages the resources of the National Park System.

Acknowledgments

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Endnotes

1 This was bluntly admitted in NPS's own 75th anniversary symposium report, the Vail Agenda: "... the National Park Service is extraordinarily deficient in its capacities to generate, acquire, synthesize, act upon and articulate to the public sound research and science information" (National Park Service 1992, 31).

2 The legislation was originally named the "Vision 2020 National Parks Restoration Act," S. 1693.

3 A few individual parks (e.g., Channel Islands, Glacier Bay) have a research mandate in their enabling legislation, but, as we shall see, there are very few such mandates that apply Systemwide.

4 Recently, the received view that there is indeed a contradiction within the Organic Act has been challenged strongly (Winks 1997; Keiter 1997).

5 Other parts of the Redwood law do explicitly call for the scientific restoration of the ecological conditions of the park, but the anti-derogation clause is the only one that applies to the whole National Park System.

6 No such language was included in the Senate report (U.S. Senate Committee on Energy and Natural Resources 1998).

7 Interestingly, the need for Title II was framed as a response to the recommendations of the Vail Agenda (U.S. House Committee on Resources 1998; U.S. Senate Committee on Energy and Natural Resources 1998). None of the other previous blue-ribbon reports are mentioned in the various committee documents and hearings associated with Title II.

8 The Senate committee with jurisdiction over the bill, the Committee on Energy and Natural Resources, did frame the need for Title II in terms of natural resources, as follows:

"The complex and technical nature of resource management in the National Park Service requires more specialized expertise than can be provided exclusively by generalist rangers or even natural resource generalists. This specialized experience is particularly required as the Park Service policies, actions, and proposal review comments are often challenged in courts and by outside experts where park resource preservation objectives conflict with commercial or other interests.

"Unfortunately, many National Park units are subject to a wide variety of natural resource impacts and threats. Air pollution has degraded the magnificent views in Grand Canyon and Shenandoah National Parks, while water quality and quantity problems threaten the delicate aquatic ecosystems in Everglades. Many parks today face urban encroachment and many more suffer from the impacts of excessive visitation. Left unchecked, these factors could threaten the very existence of many biotic communities within the parks.

"Recognizing the importance of this issue, the first strategic objective contained in the Vail Agenda report was a statement that 'the primary objective of the National Park Service must be protection of park resources from internal and external impairment.' To meet these resource stewardship responsibilities, the report recommended the park managers have solid natural resource information at their disposal.

"Title II of S. 1693 directs the Park Service to implement a broad scientific research mandate to ensure that park managers have the highest quality science and information available when making resource management decisions" (U.S. Senate Committee on Energy and Natural Resources 1998).

However, this report was issued in June when the legislation was still in its early stages, and quite different from its final format.

[9] The Congressional Budget Office estimated that, using its existing authority, NPS will need $160 million over the next 10 years to implement Title II (U.S. House Committee on Resources 1998).

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The Chesapeake Bay Program: Science, Politics, and Policy

Kent Mountford, Charles D. Rafkind, and John Donahue, Guest Editors

The Chesapeake Bay: Nature in the Cultural Environment and Cultural History in the Natural Environment

Along the East Coast of the United States, environmental advocates are fond of saying that the Chesapeake Bay is a resource of national significance. While this may be a subject of debate to observers elsewhere, the Bay *is* nonetheless this nation's largest estuary. Like all estuaries, it is a region where river flows and tides from the sea mix, but in the Chesapeake this occurs over thousands of square miles, mingling the particular signatures of nine major river systems and hundreds of small tributary creeks. The Chesapeake Bay basin, covering all or parts of six states and the District of Columbia, is also home to many federal, state, and local natural and cultural protected areas, each of which shares both a responsibility and an opportunity to interpret the Bay and its historic, economic, and cultural amenities to the public.

How did such a bay and its people come to be?

Rising sea levels following the last great glaciation accompanied the movement of early Native Americans across the regional landscape. The sea slowly eroded its way into the ancestral Susquehanna River gorge, and, about 5,000 years ago, the estuary assumed much of its present shape and extent. Erosional change and intrusion by the sea has continued; in fact, it seems to be accelerating as humanity compounds its problems with global warming.

European visitors may have made excursions into the Bay during Viking times in the eleventh century, but certainly by the sixteenth century Portuguese and Spanish navigators explored its shores. The period of permanent European colonial contact (following 1607) is well-interpreted by the National Park Service's Jamestown-Yorktown program. In the first centuries of the post-contact period, ecologists estimate that between 300,000 and 600,000 acres of the Bay's shallows were carpeted with lush beds of submerged aquatic vegetation. They provided unimaginably rich habitat and superb protection for the Bay's living and commercially harvestable

Figure 1. The oyster skipjack "Lorraine Rose" in 1972. She is now long gone, and with her all but remnants of the large fleet which harvested the Bay's shellfish in the late 19th and early 20th centuries. Photo courtesy Kent Mountford.

resources.

By the late nineteenth century the Bay was the source for the lion's share of North American oysters. At one point, 13 railroad cars loaded with oysters left Baltimore for the West daily. The improvident harvest—in reality the mining—of tens of millions of bushels from this remarkable resource resulted in its virtual destruction. The once-massive oyster reefs delivered to the Bay a filtering and self-cleaning capacity that went unappreciated until its disappearance. Other human activities—including deforestation, agriculture, animal husbandry, industrial processes, urban development, mining, and modern energy consumption—have combined over time to stress the Bay. All these socially driven forces, in addition to releasing large quantities of toxic contaminants and pathogens, have vastly increased "leakage" of the natural nutrients nitrogen and phosphorus into the Bay's waters, resulting in overfertilization. The degradation of the Bay's natural resources helped stimulate public awareness and congressional action, including the creation of the U.S. Environmental Protection Agency's Chesapeake Bay Program. Despite many problems, the Bay still yields a significant part of North America's harvests of blue crab *(Callinectes sapidus)*, soft clam *(Mya arenaria)*, and commercial menhaden *(Brevoortia tyrranus)*. Recreational fishing and boating are huge industries, and they produce national economic impacts on the order of billions of dollars annually.

The articles in this issue of THE GEORGE WRIGHT FORUM touch two principal themes: the interaction of nature and culture in the Bay's environment, and the response to the

despoliation of that environment—a response exemplified by the Chesapeake Bay Program. One of my co-editors, John Donahue, begins by offering a perspective from his vantage point as superintendent of a national park unit that combines both natural and cultural elements. In his article, William Matuszeski reflects on the Chesapeake Bay Program's origin and significance to natural resources management. Peter J. Marx then discusses how cultural and natural resource issues combine with the complexity of the legislative—and political—process.

Within the Bay region, there are continual opportunities to work symbiotically with thousands of local communities, as Gary G. Allen and Susan N. Hall point out in their piece. It is on these local firing lines where decision-making in zoning and land use vitally affects the natural landscape. Next, Jack Greer discusses the elements of ecosystem decline, together with the destruction of most of the Bay's submerged aquatic grass meadows. Lowell Bahner's piece details how information about the Bay is managed and delivered to the public. Robert D. Campbell discusses how the Park Service has successfully interwoven its activities with program's management functions. Finally, my co-editor Charles D. Rafkind considers the elusive objective of making human constructs fit into the natural landscape.

There are natural and cultural elements everywhere along the Bay that can help us to maintain and interpret an appropriate perspective on the role of humans in their ecosystems. Many of these elements touch themes common to national parks throughout America—indeed, to reserves the world over. These protected areas have a tremendous opportunity and responsibility to sensitize the public to environmental damage and remediation.

The authors included here have provided a look at the Chesapeake Bay and its watershed from a diverse set of human and environmental perspectives. We, who have had a role in assembling this issue, are sure you'll find concepts here that will benefit natural resource and public-interest managers wherever they work. All of the individuals who have contributed to the massive efforts at revitalization of the Bay, from everyday volunteers to powerful politicians, should be lauded for their efforts. The Chesapeake Bay Program shows that we *can* correct our mistakes and leave the world a better place than we found it.

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John Donahue

George Washington Birthplace National Monument: A Chesapeake Bay Park; Or, Why Study Nature in the Cultural Environment?

In the past, interpretation of historic sites within the National Park System was often constrained by policies and philosophies that most of us today consider artificial. We may have been told to only discuss events that actually occurred on the grounds that we are using as a platform for educational purposes. We may have also felt that we could only discuss the period of a prominent figure's life that was actually lived within the boundaries of the historic site. Today, such parameters seem antiquated and erroneous. At George Washington Birthplace National Monument, should we limit our discussion of his life to only the first three years when he resided at the plantation where he was born? Should we ignore all of the accomplishments for which we honor him in American history? I certainly think not, and we do not artificially constrain our interpreters at the park any longer. Our newly published comprehensive interpretive plan recognizes that George Washington and his life are the most notable of all of the untold stories at our site.

In today's world of park management, many people are so focused on the use of strategic planning to direct available resources to appropriate needs that the big picture of our overall mandates sometimes becomes lost. A case in point is the development of primary themes and primary resources emanating only from the enabling legislation that established the park originally. While this may be acceptable in terms of determining how to distribute the available funding, it is an abrogation of the broad spectrum of National Park Service (NPS) legislative responsibilities to forget about the natural resources in a cultural park or the cultural resources in a natural area. The Redwood Act Amendments direct the NPS to manage all resources to the greatest degree of preservation possible. It should be anathema to all NPS employees to grade the importance of the resources according to the language of a single piece of legislation. For many parks, their organic legislation is as short as a sentence and was written fifty or more years ago before many of the laws which have enhanced the NPS Organic Act were even dreamed of. In addition, if there were no controversy regarding the park's creation there may be no congressional record to examine.

One of the truths that I believe should be self-evident is that all cul-

tural and historic sites are built on a foundation of natural resources of one type or another. When one stands on a battlefield of yore, the question often occurs: Why did the battle take place in this exact spot? When visiting seventeenth- and eighteenth-century sites such as tidewater plantations and Native American villages that were probably sited with more deliberation than the average battlefield, one always wonders, Why is this place the one that we revere and honor? Why do I want my children to bring their grandchildren here to contemplate the life and events memorialized on this spot?

More often than not the answer lies with the site's natural resources. Colonists built their homes on the river not for the view, but because the river was transportation and a source of food and communication with the outside world. Lands for battles are chosen because someone wanted to defend a hill or needed a plain or a valley to enact their strategy to defeat the enemy. The topography, the forests, the meadows, and most of all the watershed determine many of the choices that our ancestors made, just as they determine the parameters of the choices we make today. As a result they have also determined many of the places that we now consider hallowed ground and "sacred places."

What better example of this phenomena is there than the great Chesapeake Bay and many of the lands that surround it? One of the sites I manage for the National Park Service, George Washington Birthplace National Monument, is located on the Potomac at a point where the river spans seven miles. There are few places where the artificial distinction between natural and cultural resources is so apparent. The home site was on a hill just above an estuary, protected from the river by a barrier beach. Was this ancestral home of the Washington family in America chosen at random or for some sociocultural reason? Not likely. The natural resources are the basis of all of our cultural conventions in one form or another.

Therefore, it is not unusual that we interpret the importance of the Chesapeake Bay here at an NPS site established to memorialize George Washington. It would be harder to comprehend if we did not provide the public with the tools to understand how important the Bay was to the creation of these Mid-Atlantic colonies—and indeed to the creation of America as we know it today. It would be unusual, I believe, if we did not stress the importance of natural resource stewardship at the home of the first American president, a man who recognized that wise use of national heritage is what differentiates a great nation from the ephemeral political entities that so many democracies have become.

The Chesapeake Bay also has its own history, and not just one of erosion and fishes. The plentitude of resources harvested from the Bay is

what drew and sustained the original English colonists here in America. The Bay itself, and the relationship of humans to this body of water, is what built the cities from Baltimore to Norfolk. The Bay was the lifeblood of our early American society.

And then it became a waste depository for our industrial society in the nineteenth and twentieth centuries. Everything from petrochemicals to sewage flowed into this holy and noble bay. Eventually our mistakes were recognized, however, and the changes that have occurred since then are an inspiration for all to emulate in other important and despoiled waters. The story of the Bay cleanup is one of people coming together for a common goal. Senators Charles "Mac" Mathias and Paul Sarbanes of Maryland and Senators John Warner and Charles Robb of Virginia have consistently worked to ensure steady progress on this massive undertaking. Recently, our own state delegate from the district that includes Washington's Birthplace National Monument, Tayloe Murphy, received the Sierra Club Environmental award for his lifetime of efforts on the Chesapeake Bay Program. Protecting the environment has been an American effort since George Washington first outlined the importance of environmental stewardship. Natural resources are an essential part of the ambience and story at every historic site. The Chesapeake Bay, the Potomac River, the estuaries and creeks, the night sky, the eagles and whistling swans—all contribute to helping the visitor understand what George Washington experienced when he stood on the banks of Popes Creek as a toddler, as a teenager, and, finally, as a man. At George Washington Birthplace National Monument, we will continue to honor the efforts at conservation that our first president recognized as the most important effort that any people can make.

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William Matuszeski

The Chesapeake Bay Program: Its Origins and Significance

The Chesapeake Bay is the largest estuary in the United States. Over 300 kilometers (nearly 200 miles) long, it is fed by a number of large river systems. The Susquehanna, for example, supplies 48% of its fresh water; the Potomac, 26%; and the James, 10%. A molecule of water entering from the Susquehanna at the top of the Bay takes an average of six months to reach the Atlantic Ocean. During this long journey, it will cycle with the tides twice daily, north to south and back, slowly blending with the salt waters entering from the Atlantic. This is a key feature of circulation because materials which enter the Bay with river runoff spend a considerable time in the estuary's complex chemical reactor, stirred by winds and cooked under summer sun.

Figure 2. The Bay Program's logo.

While Chesapeake Bay has axial channels 90 to 174 feet deep running north to south, overall this estuary is very shallow, with an average depth of about 7 meters (23 feet). About 10% of the area is less than a meter (39 inches) in depth and 20% is less than two meters (6.6 feet). This shallowness is directly related to the traditionally high productivity of the Bay: the ability of the light to penetrate the water column and reach the bottom creates ideal habitat for living things. In a good year, the Chesapeake produces half the blue crabs harvested in America, and its waters provide 90% of the spawning area on the East Coast for striped bass.

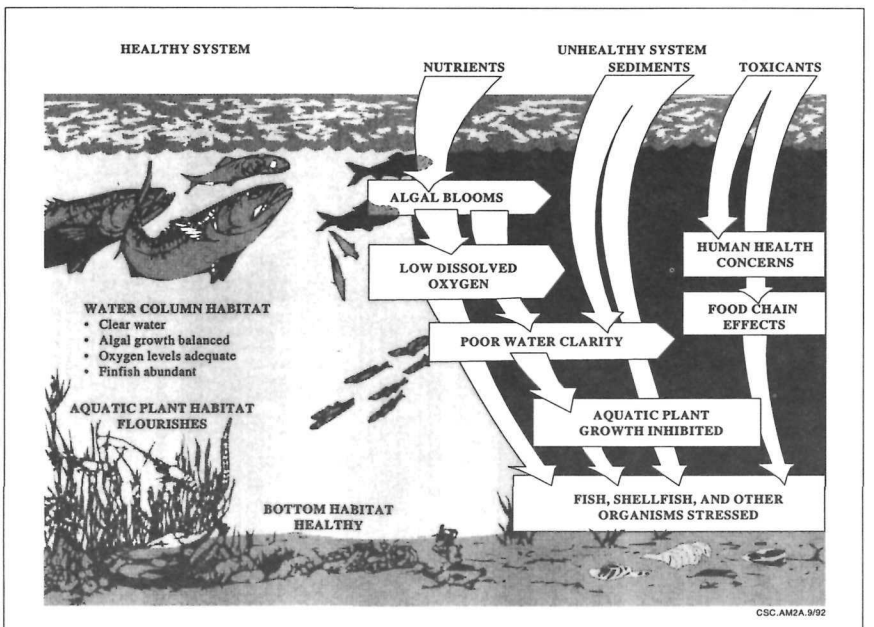


Figure 3. Effects of pollutants on Chesapeake Bay. Features of a balanced system are on the left and stressors are on the right. This schematic does not include some land-based effects, including deforestation, air pollution, or the wasteful exploitation of the region's water resources.

The major threat to the Bay comes from the oversupply of nutrients flowing down its nearly 200,000 kilometers (124,200 miles) of rivers and streams. These fertilizing compounds create classic conditions of over-enrichment, which lead to eutrophication—overproduction of algae and subsequent die-off, robbing the water column and much of the Bay bottom of oxygen. The loss of bottom oxygen, as algae decompose during hot Chesapeake summers, has been a major signal of the Bay's decline. The absence of oxygen in the water is hostile to life, and denies fish and bottom-dwelling organisms access to a large portion of the Bay each year.

Although the Bay has broad shallow areas along its flanks and tributaries, overabundant algae and high levels of sediment still combine to block light from reaching the bottom. Hundreds of thousands of acres in these underwater habitats were once carpeted with vast meadows of submerged aquatic vegetation (SAV), which were extraordinarily valuable nursery grounds for fish and shellfish. The decrease in light and overload of nutrients contributed to a precipitous decline in this acreage in the early 1970s. Restoring these SAV beds is a major focus for the Chesapeake Bay Program, and an interim goal of 114,000 acres has been set.

In the case of Chesapeake Bay, the overloading of nutrients is exacerbated by another salient characteristic: the immense drainage area of all the rivers feeding the Bay. The watershed extends over lands that total sixteen times the surface area of the Bay and its tidal rivers. This vast land area, reaching as far north as Cooperstown, New York, is nearly 60% forested. Over 30% is in farm land, including some of the most intensiely farmed lands and some of the highest concentrations of farm animals in the United States. It is also home to 15 million people, most of whom are clustered around the Bay and its tidal rivers.

When one puts together these factors, one has a vast land area draining into a very shallow body of water. To put it into perspective, the ratio of land area to volume of water in the Bay is 2700:1. Roughly, for every thousand square miles of watershed there is one cubic mile of water in the Bay. This ratio is nearly ten times that for the Gulf of Finland, the estuary most nearly comparable. Clearly, what is done on the land directly affects this very sensitive, very productive natural system called Chesapeake.

The increasing human population in the surrounding basin has, over the centuries, made extraordinary changes in the ecosystem which once sustained the Bay as a productive habitat for fish, shellfish, and waterfowl. We removed or fragmented vast acreages of forest, paving much of it, thereby accelerating precipitation runoff and speeding the delivery of pollutants from municipalities,

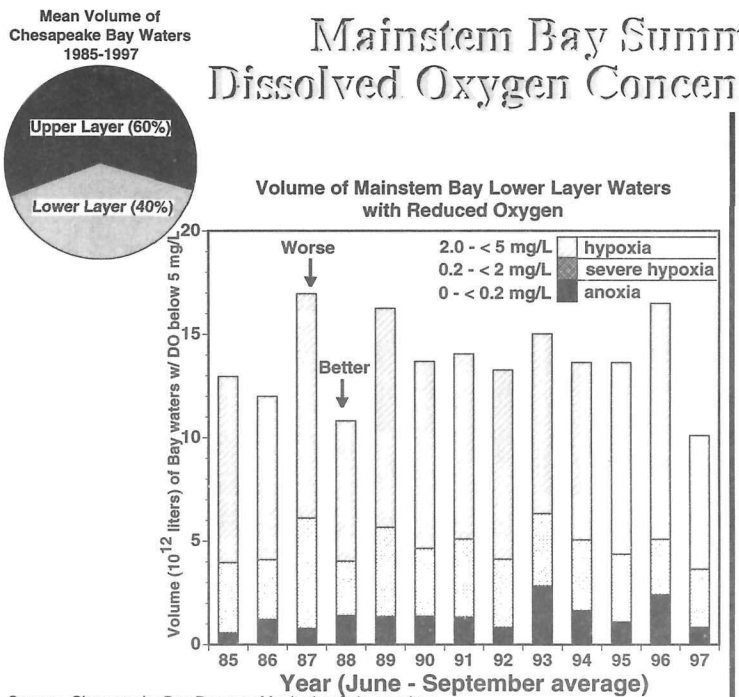
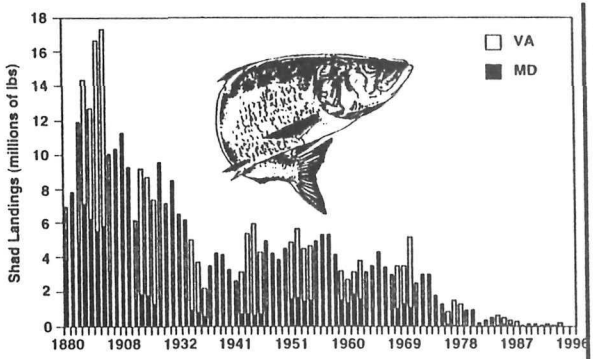


Figure 4. Low dissolved oxygen in the summer reflects eutrophication from nutrients entering the Bay from point and non-point pollution sources.

Landscape Figure 5

Figure 5. Submerged aquatic vegetation in Chesapeake Bay has experienced heartening increases since a low point in 1984. Because of the complexities of flood years, climate, and the success of individual species, this track record will continue to experience ups and downs as restoration progresses. The goal of 114,000 acres is merely interim, and restoration to original abundance is a decidedly long-term project.

American Shad Landings

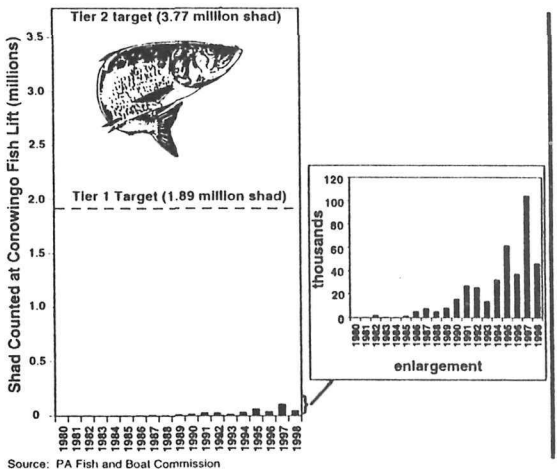


An interjurisdictional effort is in place to restore the fishery:

- MD moratorium since 1980.
- 1984 FERC Mandate Settlement Agreement
- 1985 ASMFC Management Plan
- 1989 CBP Management Plan
- 1992 VA restocking program
- 1993 Susquehanna Fish Passage Agreement
- VA moratorium since 1994.

Source: National Marine Fisheries Service - through NOAA Chesapeake Bay Office

American Shad: Population Trends



GOAL: Restore shad populations in the upper Chesapeake Bay.

STATUS:

Interjurisdictional effort is in place to restore the fishery.

- MD moratorium in Bay since 1980
- 1984 FERC Mandate Settlement Agreement
- Fish lifts operational at Susquehanna River dams: Conowingo (2nd) since 1991; Safe Harbor and Holtwood since 1997.
- 1993 Susquehanna Fish Passage Agreement

Source: PA Fish and Boat Commission

Figure 6. (A) Commercial harvests of American shad from Chesapeake Bay show the effects of both habitat destruction (by dams) and overharvest of a dwindling resource. (B) Population increases as a result of significant management efforts—restocking juveniles and removing stream blockages—need to be kept in perspective with the vast, lost resources of past centuries.

agriculture, and industry. The 150 billion vehicle-miles we now travel annually basin-wide contribute to atmospheric pollution, much of which is washed by rain down into the Bay.

All these stresses have combined over many decades to reduce the resilience of living resource populations in the estuary at the same time they have been subjected to increasing harvest pressure by commercial and recreational fishers. The perception of all these declines, from oxygen to grasses to fish and shellfish, brought a hue and cry from the public for action to recover past vitality.

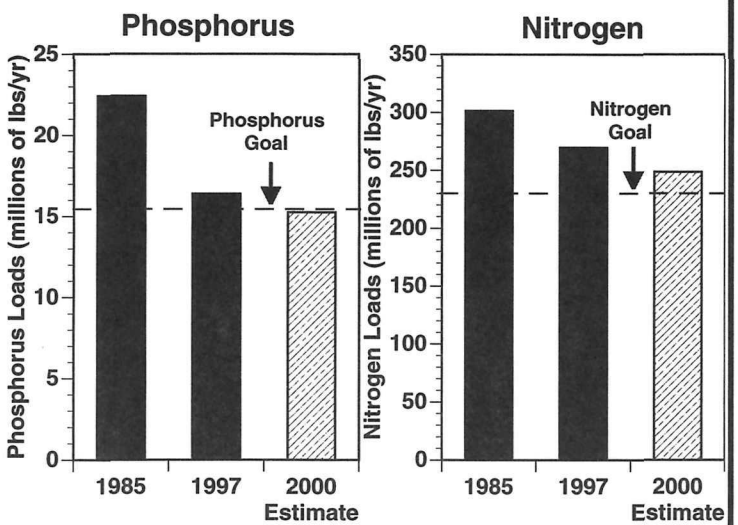
The origins of the Chesapeake Bay Program, the multi-governmental cooperative effort to restore the Bay, go back to a five-year (1979-1983) study funded by the U.S. Congress in to determine the causes of the Bay's decline. The study pointed to nutrient overload as the primary cause and called for efforts to reduce phosphorus and nitrogen loadings. This led to the first agreement on the Bay's restoration in 1983, and to a more detailed set of goals and commitments in 1987. The primary goal established in that agreement was to reduce loadings of both nutrients by 40% by 2000, in order to restore the living resources of the Bay.

The signatories to the agreement are the governors of Maryland, Virginia and Pennsylvania; the mayor of the District of Columbia; the chair of the Chesapeake Bay Commission, a three-state legislative body; and the administrator of the U.S. Environmental Protection Agency for the federal government. It is notable that only one of the six principals is a federal official. The Bay Program has a very strong sense of cooperation, with a dominant state role. Goals are set in the agreement and through a series of directives, which serve as executive orders and are adopted at the annual meeting of this six-member Chesapeake Executive Council.

The cooperative nature of the program is aided by the fact that nutrient pollution is not strongly regulated under the major federal environmental statutes. The Clean Water Act has until very recently dealt mostly with pathogens and toxins, and the Clean Air Act has only recently begun to consider the effect of airborne nitrogen on water bodies. Thus, in order to make progress on nutrients, it has been necessary for the Bay states to agree on such measures as banning phosphate detergents, funding nitrogen removal at sewage treatment plants, and working with agricultural interests on management practices. While the Bay Program provides no exemption from the regulatory requirements of national environmental statutes, in many cases states and localities have enacted more stringent laws and effectively *stayed ahead* of the regulatory process.

In order to manage a system as

Total Nutrient Loads Delivered to the Bay from All Bay Tributaries



Source: Chesapeake Bay Program Phase IV Watershed Model.
Data include total nitrogen and phosphorus loads delivered to the Bay, from point and nonpoint sources, from Chesapeake Bay Agreement jurisdictions : MD, PA, VA and DC.

GOAL: Reduce controllable loads of nutrients 40% by the year 2000 and maintain those reduced levels into the future.

STATUS: Phosphorus loads delivered to the Bay from all of its tributaries declined 6 million lbs/yr between 1985 and 1997. We expect to reach the goal by 2000.

Nitrogen loads declined 32 million lbs/yr. More will need to be done in order to meet the goal by 2000.

Maintaining reduced nutrient levels after 2000 will be a challenge due to expected population growth in the region.

Figure 7. The Chesapeake Executive Council has targeted a 40% reduction in total loads (under human control) of phosphorus and nitrogen by the year 2000. The commitment is to cap loads at that level into the future.

complex as the Chesapeake and its watershed, it is necessary to deal with the full range of resources and impacts. For example, the focus on restoring the living resources requires managing fish and shellfish, as well as protecting and restoring underwater grasses and other habitat. In addition to tracking and upgrading sewage treatment plants, much effort and a large portion of program funds have gone into reducing agricultural pollution. The Bay Program has led the effort to evaluate and deal with airborne sources of nutrients, and to promote forest buffers along rivers and streams.

This comprehensive watershed-wide approach is achieved through a system of committees, subcommittees, and work groups involving the full range of stakeholders, including numerous state and regional agencies, nearly two dozen federal agencies, citizen groups, scientists and academics, local governments, and many others. Just listing participants in these groups takes nearly a hundred pages. While the sheer size of this undertaking can seem overwhelming to the newly initiated, over time folks find their way around and usually come to agree that a comprehensive, ecosystem-based approach to the recovery of a watershed this huge, achieved through a consensus process, is not a simple matter. Nonetheless, it *can* be fun!

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Peter J. Marx

Rhinos and Tigers and Bays (Oh My!), and Other Congressional Tales

There are two things, so goes an old adage, that Americans should never witness the making of: sausages and laws. Those who have witnessed the first can count a number of new vegetarians in their midst, while those in the second group engage in some head-scratching and then can eventually admire a system that ultimately works. I will save the carnivore-vs.-herbivore discussion for another day, but for now will focus on the U.S. Congress and Chesapeake Bay.

Congress has always had an interest in the Chesapeake Bay. The Bay was, and still is, a major avenue for commerce, with Norfolk and Baltimore being two of the four largest ports on the East Coast, and Congress has always played a significant role in the maritime affairs of the nation. The Bay region, because of its historical transportation ties and proximity to the nation's capital, is also home to many federal facilities, particularly Department of Defense installations, and Congress has played key roles in many of those siting decisions. But most importantly, the 535 members of Congress spend most, if not all, of the year living in the Chesapeake Bay watershed. The tidal Potomac River, an arm of the Chesapeake, flows by the nation's capital. And the Bay itself is only 20 miles outside of the Capital Beltway. Many members of Congress fish, hunt, boat, and otherwise recreate on or near the Bay, and some have vacation homes in the area. In many ways, Chesapeake Bay is America's estuary.

It was not until the 1970s, however, that Congress began to specifically address the health of the Bay. In 1972 Congress passed the landmark Clean Water Act over the veto of President Nixon. This began a relationship that has slowly made the Bay a healthier body of water. But in late June 1972 tropical storm Agnes came hurtling up the Bay and left a wake of destruction. The impact was not felt by humans alone. The intense floods caused severe erosion and tremendous pulses of pollutants and sediment to be deposited in the Bay at a time of year when it was rich with biological activity. The underwater grass beds were decimated, and Agnes sped up a cycle of decline that had only been noticed by those close to the Bay—watermen, scientists, boaters, and fishermen.

The noticeable decline of the Bay

at a time when environmental awareness was dramatically increasing created an intersection that did not go unnoticed. U.S. Senator Charles "Mac" Mathias (R-MD) decided to see for himself what the increasing talk about the Bay's problems was all about. He set out on a friend's boat in the summer of 1973 to see firsthand what was going on. His subsequent trips around the Bay led him to introduce legislation directing the U.S. Environmental Protection Agency (EPA) to embark on a major research project to determine the Bay's problems and make recommendations on how to solve them. Six years and $27 million later, the EPA finished the comprehensive study and eventually released an innovative blueprint for the intergovernmental, interjurisdictional Chesapeake Bay Program that was formed in 1983.

Also in 1983, the Bay area's congressional delegation was working to garner support to fund this new effort. In October, Representative Roy Dyson (D-MD) led eight other House members on a tour of the Bay. Dyson was very specific in his goal: he wanted to get $10 million a year to fund the newly formed Chesapeake Bay Program. It was a different time

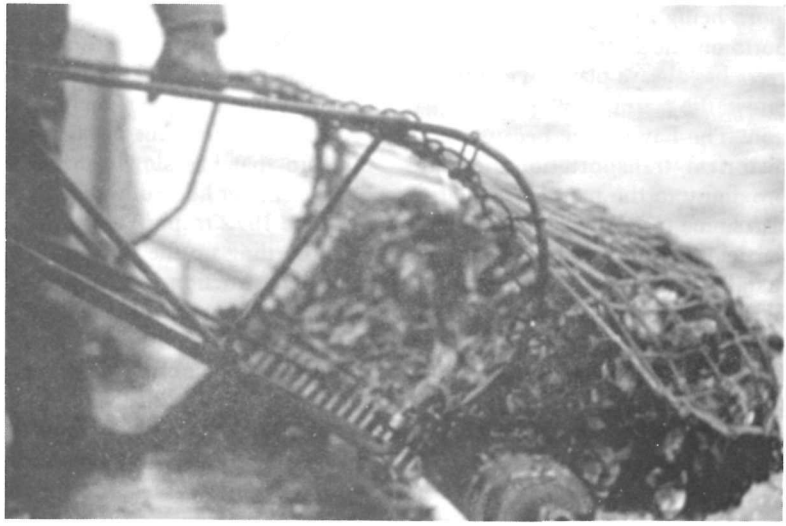


Figure 8. An oyster dredge comes aboard, having harvested one of the Bay's ancient reefs, or "rocks." Live, legal-sized oysters are separated from undersized ones and empty shell, or "cultch," which is thrown back overboard. Photo courtesy Kent Mountford.

and a different Congress, and a diverse group of older veteran members embraced the Bay in a bipartisan manner. Representative Tom Bevill (D-AL), an appropriations subcommittee chair and member of Congress's "College of Cardinals" (senior members who controlled quite a few purse-strings), was quoted on the trip as saying, "[Dyson] tells me what he needs and I help him get it." Representative John Paul Hammerschmidt (R-AR) said: "I think this [the Bay] is seen as a national resource and not just a parochial item, and I think that's the story we'll be able to sell."

The next year fell under the title of "strange bedfellows" when it came to the Bay. In 1984 the Reagan administration was under siege for being anti-environment. Anne Burford had recently resigned as EPA administrator after several years of scandal. There was very negative press coverage about the views of Secretary of the Interior James Watt, as well as about other budget and policy decisions. After reinstalling William D. Ruckelshaus as EPA administrator, and urged on by Senators Mathias and John Warner (R-VA), President Reagan decided to embrace the Chesapeake Bay and its restoration as the centerpiece of his environmental platform for the 1984 presidential campaign. The president mentioned his support for the Bay cleanup in his State of the Union message in January and then toured the Bay during the summer and announced his new platform. Not to be outdone, House Speaker Thomas "Tip" O'Neill, Jr. (D-MA), quickly followed suit, and had a very public tour of the Bay. The health of America's bay was now the topic of a presidential campaign.

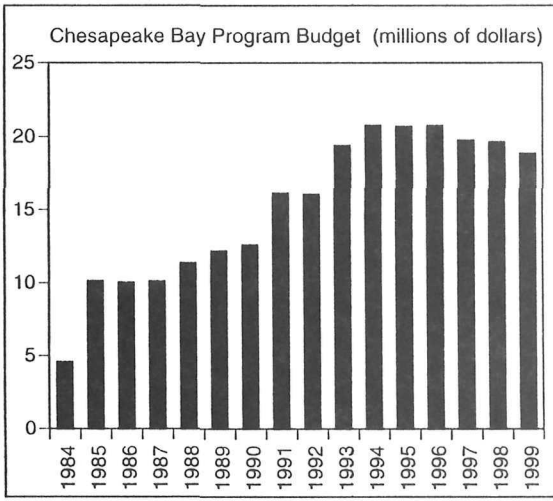
Ronald Reagan won a second term in 1984, and neither the House nor Senate changed hands. Was it support for the Bay that did it? Probably not, but it certainly couldn't have hurt. And Congress appropriated $10 million for the Chesapeake Bay Program in Fiscal Year 1985. Was it the bipartisan camaraderie of the 1983 Congressional boat trip? Representative Dyson sure thought so.

In 1986, Congress reauthorized the Clean Water Act for five more years. With strong legislative support in the Senate from Mathias, Warner and Paul Sarbanes (D-MD), and in the House from such representatives as Steny Hoyer (D-MD), Herb Bateman (R-VA), and Barbara Mikulski (D-MD) (who was soon to succeed Mathias in the Senate), the Clean Water Act included a new section entitled "Chesapeake Bay." This provision, known as Section 117, basically codified the Chesapeake Bay Program and committed Congress to continue funding the restoration effort. President Reagan, who ran on a Chesapeake Bay platform in 1984, vetoed the bill (although not because of Section 117).

The first act of the new 100th Congress, and the first formal vote by the now-Senator Barbara Mikulski, was to override Reagan's veto. So the Clean Water Act was reauthorized and Section 117, mandating the continuation of the Chesapeake Bay Program, was now law. Since then, Senator Mikulski has worked to ensure that Section 117 remains fully funded, first as chair of the Senate appropriations subcommittee with jurisdiction over the EPA budget, and now as its ranking minority member. She, along with the entire Bay watershed Congressional delegation, has been vocal and successful in supporting funds to carry out Section 117.

The latest congressional tale comes from waning days of last year's 105th Congress—and this is where the rhinos and tigers come in. Senator Sarbanes had been trying for several years to pass a package of Chesapeake Bay legislation targeting environmental restoration. Larger substantive and procedural issues in Congress related to the reathorization of the Clean Water Act pre-

Figure 9. EPA Administrator Carol Browner, along with Maryland Senators Paul Sarbanes and Barbara Mikulski, visit the Bay Program Office.



year	Fiscal Year Budget (millions of dollars)
1984	4.6130
1985	10.1772
1986	10.0721
1987	10.1470
1988	11.3963
1989	12.2162
1990	12.6223
1991	16.1784
1992	16.1032
1993	19.4170
1994	20.7890
1995	20.7136
1996	20.7675
1997	19.7709
1998	19.6830
1999	18.8801

Figure 10. Chesapeake Bay Program budget, 1984-1999.

vented Sarbanes from successfully moving his legislative package. Early in 1998, however, Sarbanes was able to attach two of his bills, the Chesapeake Bay Restoration Act and the Chesapeake Bay Gateways and Watertrails Act, to S. 1222, the Estuary Habitat Restoration Partnership Act of 1998. The Senate passed S. 1222 late in the 1998 session, but it languished and died at the last minute in the House of Representatives. Congress rarely has the time or support to act on small regional stand-alone pieces of legislation, so their sponsors frequently attach them to bills that appear to have a chance for passage. During the last week of the legislative session in October 1998, Sarbanes employed that tactic to attach his Gateways and Watertrails bill to H.R. 2807, which appeared to be moving swiftly through the House and Senate. The Gateways bill directs the National Park Service to establish a network of Chesapeake Bay cultural, historic, and natural sites. Sarbanes' maneuver was successful, and H.R. 2807 was passed by both houses of Congress and signed into law by the president.

The legislation the Gateways bill was attached to—H.R. 2807—was the "Rhinoceros and Tiger Conservation Act." And what does the Rhinoceros and Tiger Conservation Act have to do with the Bay? Not much. But no matter how successful the new law is at conserving rhinos and tigers, it is doubtful that any will be spotted at Chesapeake Bay Gateways sites—unless, of course, the National Zoo in Washington is designated as a Gateways site. Nevertheless, rhinoc-

eroses and tigers and the Bay will be forever linked in the legislative history of the U.S. Congress.

There are many other congressional tales: members caught on the Eastern Shore violating migratory bird hunting laws that they themselves helped to enact, mysterious "midnight amendments" for Bay projects that did very little to help the Bay, and many others that didn't make headlines. Perhaps the 106th Congress will give us another Bay tale or two.

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Gary G. Allen
Susan N. Hall

Local Reins on a Sprawling Land

In 1608 Captain John Smith described this land as 'such pleasant plaine, hils and fertile valleyes, and watered so conveniently with their sweete brooks and cristall springs, as if art itselfe had devised them.' But the land and bay are beset by acid rain and the runoff of farm pesticides, fertilizers, and hazardous waste. Here, marine life is hard pressed to overcome the vagaries of men who build cities, pave roads, and build bridges—and until recently paid little heed to a unique resource dying. Still, by most accounts, it is a land and shore of pleasant living for people great and small.

—Robert Grieser and Peter P. Baker, writing in the *Baltimore Sun*

In its mission to protect and restore the Chesapeake Bay in recent years, the Chesapeake Bay Program has focused its attention upstream, following the hundreds of tributaries and rivers that all lead back to the Bay. Nestled throughout the watershed are over 1,650 local communities, each represented by a local government body responsible for local planning and development issues. Decisions made by these local governments on land-use planning, water and sewer planning, construction, and other growth-related management processes have a direct and consequential impact on the health of the Bay.

Protecting a National Treasure

The Chesapeake Bay watershed, historically a gateway to America's Mid-Atlantic States, is a region of diverse cultures, serene, natural beauty, and strong economic growth, making it one of the fastest-growing regions in the nation. The watershed itself stretches through six states, reaching north of the Susquehanna River into central New York State, as far west as West Virginia, and as far south as the mouth of the James River in Virginia. Hundreds of streams and rivers connect towns, municipalities, and boroughs to the Chesapeake Bay. Many of these communities are a short drive from at least one of the region's four large cities: Baltimore, Harrisburg, Richmond, and Washington.

The topography of the land and the economic opportunities born of a metropolis have attracted a diverse

and growing population. Many communities within the watershed have experienced the advantages of economic growth: attracting large industries that offer substantial employment, creating a growing business and residential tax base to support the local community, affording the extension of public sewer and water lines, and attracting a culturally diverse population. Now these communities—and specifically the local governments that have jurisdiction over these issues—must address the effects of rapid and often ill-conceived development patterns, including congested roads, costly public services, decline of open space, and deterioration of the local environment.

Role of Local Governments

Local governments are perhaps the most critical partners in efforts to protect small watershed resources. Defining zoning laws, designating land use, levying property taxes, and enforcing dumping laws falls under the authority of county councils, supervisors, or commissioners, as well as municipal leaders. These powerful local entities are also responsible for providing their communities with public services (e.g., trash pick-up, snow removal) and adequate schools. Local governments have long been concerned with infrastructure, from both public works and economic development points of view. Elected and appointed officials have the ultimate responsibility for ensuring that a community's services meet the needs of its residents and for providing a competitive environment for business and industry.

In many cases, local governments build and maintain infrastructure. This is particularly true in the Chesapeake Bay region, with many major city centers in close proximity. Streets, transit systems, and waterworks are usually government responsibilities. Local governments build airports, shipping facilities, and convention centers. All of these affect not only the community's land, but also surrounding lands, creeks, rivers, and waterways.

In 1950, the Bay's watershed was home to 8.4 million residents. By 1990, this figure had grown to 14.7 million; by 2020, it is a estimated that there will be 17.4 million people living in the watershed. By the mid-1970s, the Chesapeake Bay watershed and its communities were feeling the effects of this population explosion. Local governments were working around the clock planning to accommodate the growth. Now communities are experiencing exponential growth, with housing complexes, roads, shopping centers, and business and commercial complexes sprawling across the watershed, into what had once been open space, forests, and agricultural land.

A local government's land-use code should reflect the unique values, physical setting, and economic conditions of the community. While

regional policies help frame the context for local planning, cities and counties are in the best position to balance the needs and concerns of the citizens of those communities. Local governments have a strong commitment to use the tools they have to provide a sustained quality of life. For these communities to restore and maintain their part in the watershed, they must seek to create a balance of economic growth, quality of life, and environmental benefits. Only then can the communities and the region's natural treasures co-exist and flourish.

The Chesapeake Bay Program Initiative

Since its inception, the Chesapeake Bay Program has addressed the effects of pollution on the Bay. In recent years, the Bay Program has turned its attention to sources of pollution, looking upstream into the watershed. By addressing these sources, the Bay Program has focused on local governments as the key to the management of land use in the watershed. Actions taken in the last decade address a broad array of issues having significant impact on local governments. These actions, as stated in a Bay Program directive, include the preparation of:

- "Population Growth and Development Policies and Guidelines" (1989), which identified educational materials, technical assistance, and financial support available to local governments to encourage them to apply the guidelines.
- Tributary-specific nutrient reduction strategies. Called for in the 1992 amendments to the Chesapeake Bay Agreement, these strategies expressed a need for local government participation to meet the targets. The inclusion of a nutrient cap underscored the need for local government involvement as the primary managers of land use in the watershed.
- The "Riparian Forest Buffer Directive" (1994), which recognized the authority of local governments to apply or modify existing land-use management measures to protect streamside forests from the adverse impacts of development or other activities.
- The "Chesapeake Bay Basinwide Toxics Reduction and Prevention Strategy" (1994), which aims to get all state and local governments to voluntarily reduce the use and generation of potentially toxic chemicals at their facilities by the year 2000.

In 1995, the Chesapeake Bay Program formalized its support for local government participation through a directive on the Local Government Partnership Initiative. Signed by the six members of the Chesapeake Executive Council, the directive called for a "Local Gov-

ernment Participation Action Plan." Now in place, the plan identified financial and technical opportunities available to local governments. It recommended changes to the Bay Program so as to better engage local governments, and also sought new partners for the Program. Several publications were written to provide local governments with the technical resources they need to be effective Bay partners. These publications addressed land management concerns: countering sprawl, protecting wetlands, and preventing pollution.

Identifying Local Government Needs

Through the directive and the Local Government Participation Action Plan, the Bay Program established a formal plan to engage local governments in the protection and restoration of the Chesapeake Bay. The challenge is to address the realities that face local governments as they foster their communities' growth and development. As part of the action plan, direct contact was made with over 300 local government officials and staffers. The task force found that local governments "are committed to enhancing the quality of life of their communities and are willing to increase their role in the Chesapeake Bay effort by protecting local streams, enhancing land use management techniques, and improving infrastructure." The task force chose three themes where local community goals and Bay Program goals could be effectively coordinated.

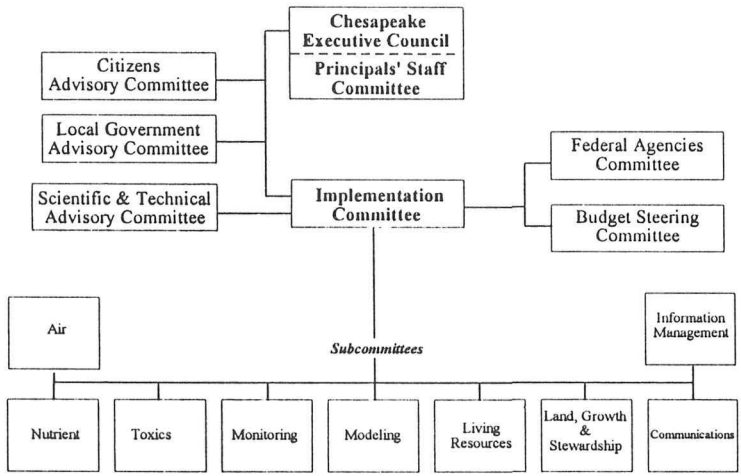

Figure 11. Much of the work of the Chesapeake Bay Program is done through different committees and work groups.

- ***Land management and stewardship.*** Reduce resource consumption and costly sprawl patterns of development by encouraging the revitalization of existing communities and promoting sustainable development patterns. Protect agricultural and forested lands to conserve the countryside and protect water quality and wildlife habitat.
- ***Stream corridor protection and restoration.*** Establish measures to preserve and conserve stream corridors. Coordinate and support efforts to protect, enhance, and restore wetlands and forest buffers important to water quality and fish and wildlife habitat.
- ***Infrastructure improvements.*** Upgrade sewage treatment plant facilities with nutrient removal technologies. Upgrade, maintain, and inspect the stormwater management infrastructure. Encourage the proper use and periodic maintenance of septic systems. Operate recycling, household hazardous-waste collection, small-business pollution prevention, and solid-waste management programs.

As part of the action plan, the "Bay Partner Communities" program was established. Now in its second year, this program recognizes those local governments which have demonstrated a commitment to restore and protect watershed resources. Communities participating have several categories representing general themes of the program. Benchmarks for each category encourage local governments to consider how their actions contribute to the health of the Bay. Local governments are recognized by the Bay Program based on the number of benchmarks they achieve. Categories include: Development that Works; Preventing Pollution; Conserving and Preserving Living Resources; Valuing Trees and Forests; Conserving the Countryside / Revitalizing Communities; and Community Participation.

A Small Watersheds Grants Program was established as well. This program supports community watershed protection and restoration activities. By encouraging local government involvement in Bay restoration strategies, and promoting the exchange of lessons learned, local governments become a true partner in the effort to save the Bay.

Maryland: Preserving the Land

Local governments face different pressures depending on their communities' proximity to cities, major waterways, and roads. The Chesapeake Bay watershed is home to seven of the nation's top ten counties that preserve farmland. All seven are in Maryland. Montgomery County, located just northwest Washington, D.C., is a national example of deliberate, careful land management. Generations of residents have treas-

ured the county's farmlands. Although many of the county's towns are within 35 miles of the heart of D.C., for decades county executives and council members, planning boards, and Maryland's governors have worked to preserve the land from development. In fact, Montgomery County has the most acres under legal protection of any urban county in the nation—over 93,000 acres in 1997, nearly one-third of the county.

Much of the preserved land is protected through carefully managed growth patterns. Officials have created a balance, conserving rural areas to be used as a cultural resource and designating higher-density housing where public facilities and public services can support it. When the county began to feel the pressure of population growth, local officials moved to steer development to designated growth areas. Public services, public water and sewer lines, wide paved roads, and recreational facilities were not extended beyond designated limits, thus encouraging growth to remain where such facilities are provided.

The elected officials put in place a number of programs that allowed buying easements or placing restrictions on thousands of acres. Montgomery County also installed a program to sell land or development rights, preserving over 40,000 acres. The county court system also worked to support the concept of stewardship by supporting broad local authority to set up programs that protect the community as a whole.

Many in the regional development community believe that Montgomery County, and other counties with similar attitudes, cannot continue to prevent development beyond designated borders. As the population increases, there will be a greater demand for roads and facilities to support the people. Local municipalities faced with economic challenges see a higher tax revenue from communities within the designated growth areas. Farmers are already having a difficult time making enough money to live off the land, preferring instead to sell it to the highest bidder. Developers can offer a quick cash layout—an attractive benefit for a community facing economic hardship. They also may entice a community by providing a plan that designates a percentage of the land for recreational purposes, and include large, open space areas attractive to residents. Developers may offer to build the town a community building, or pay for extended infrastructure, incorporating the cost of extending water and sewer lines.

It should be recognized that the goals Montgomery County have tried to meet do more than protect more the county's treasured lands. Careful management of growth areas allows for natural buffers, barriers, and filters to absorb the effects of human presence. This in turn prevents pollution from running into the Bay

through the watershed.

Pennsylvania: Protecting a Way of Life

The commonwealth of Pennsylvania has a different local government structure, made up of counties, boroughs, cities, and townships. While the counties may have a larger funding base and can provide local communities with development plans and models, transportation routes, and suggested stormwater systems, they do not have direct authority over implementation. The individual cities, townships, and boroughs have control over land use and zoning.

For decades, Lancaster County—located in the southeast corner of Pennsylvania between two of its major cities, Harrisburg and Philadelphia—has been characterized by strong Amish communities, broad agricultural lands, and charming villages, boroughs, and towns. The Lancaster County Board of Commissioners and the County Planning Commission became concerned by the tremendous growth in population as people moved from the nearby urban centers. Increased development was converting the county's extensive agricultural land. Quaint towns and villages were becoming overcrowded, industrialized, unsafe, and unattractive. In response, they developed a program to encourage local governments within the county to consider options for "Livable Communities." Bringing together elected officials, business leaders, community members, and county staff, they created a comprehensive plan which provided the county and its communities with a vision for the future.

Through organized events such as the Livable Communities Forum and Workshop, the community as a whole could learn about innovative solutions to local development and growth. By looking closely at the elements of livable communities—multi-purpose interconnected streets, town centers, mixed-use developments, agricultural buffers, and lot size—alternatives for a more sustainable community were created.

Local government officials now have development options to take into consideration as they face future growth projects. Changes to land-development regulations and zoning laws can make a tremendous difference in the character of the community. For example, a community zoned for mixed-use buildings, with walkways and alleyways and on-street parking, puts the needs of residents ahead of those of cars. Agricultural buffers, wildlife cover, and forests provide for more natural and effective stormwater management and groundwater recharge.

Fragmented government is cited as a major obstacle to protection and sustainable use of natural resources. In Pennsylvania, the authority for action and implementation lies at the municipality level, not at the county level as in Virginia and Maryland. So in Pennsylvania municipalities within

counties must work together. An example of how this can be done comes from Centre County. In 1997 a commission of 14 municipalities in the county was created to establish a long-range vision for the Spring Creek watershed, a natural resource shared by all them all. The goal is to advance projects that protect the natural resources and enhance the quality of life within the watershed. The municipalities are represented on the commission by one elected official from the member townships and boroughs. What is unique about this commission is that it is a coordinated, watershed-wide, multi-jurisdictional effort. As one of its priorities, the Spring Creek Commission has initiated a stormwater management plan to minimize the impact of additional stormwater resulting from development in the 14 municipalities. Funding for this plan was made available through the Pennsylvania Department of Environmental Resources. The commission is now looking at designing a plan to deal with water quality issues.

Virginia: Restoring the Watershed

Another example of how local governments can take action to preserve their environment comes from Prince William County in northern Virginia. Like the two examples above, Prince William County is located close to a major city, lying just south of Washington, D.C., and has also experienced tremendous population growth. In 1950, it had a population of 50,000; now its residents exceed 270,000. The area is particularly attractive to large businesses and industries, people looking for inexpensive houses, and developers of discount shopping centers seeking easy access to the urban area, space to build, and established transportation routes.

Residential and commercial development were seriously affecting the county's wetlands and stream habitats. Reacting to the decline of healthy watersheds and degradation of environmentally sensitive lands, Prince William County officials developed an environmentally sensitive watershed-wide stormwater management plan. Bringing together the experience of federal, state, and local partners, the officials worked to reduce and prevent pollution and improve water quality standards, specifically in three adjacent watersheds that drain into the Potomac River and eventually into Chesapeake Bay.

By restoring riparian buffers and stream channels, the county is able to begin rehabilitating vital habitat and water quality. To do this, the county has had to address four major tasks: drainage, water quality, erosion, and flooding. By considering the effects of development on sensitive lands, the county can install measures to prevent future development from negatively affecting watersheds.

Like all environmental initiatives, there is no such thing as a one-time fix. Stormwater management must be

carried out on a continual basis. To ensure funding for the plan, county residents are taxed based on the amount of impervious surface area their property has. By using an alternative funding approach, Prince William County has created a successful, sustainable activity.

Initiating Local Government Action: The Center for Chesapeake Communities

The communities highlighted above are of course just a small fraction of the number of local governments in the Bay region that are facing growth and development pressures. The Local Government Participation Action Plan, in making its recommendation to the Bay Program, stated that local governments required focused financial and technical programs to enhance their capacity to restore the Bay. To do this, the Local Government Advisory Committee, one of three advisory committees of the Bay Program, was directed to investigate the establishment of a non-profit organization which would provide local governments with a clearinghouse of technical information to support watershed initiatives. The non-profit would also try to expand the pool of money currently available to local governments by seeking private and public funding, in addition to Bay Program money. After assessing local government needs, the Center for Chesapeake Communities (CCC) was established in August of 1997.

The CCC works on two tracks. First, it provides local governments with funding, specifically making

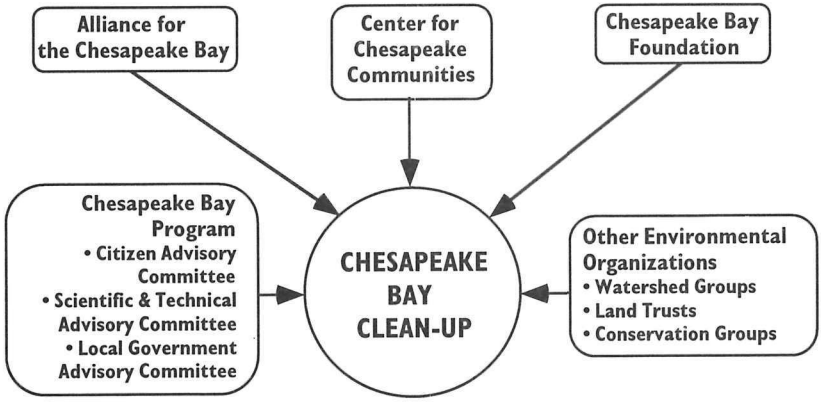

Figure 12. Citizen involvement is a key ingredient in the Chesapeake Bay Program.

available small watershed grants for projects to protect and restore the environment. Initial funding was made available by monies appropriated by the U.S. Congress. It is expected that funding for another round of grants will be made available in 1999. The CCC is working to match these federal dollars with alternative funding.

The second track is to provide technical assistance that encourages and enables local governments to implement sustainable development. Sustainable communities incorporate local economic realities and needs with the desire to offer residents a high quality of life while remaining sensitive to the environment. Incorporating all three requires local governments to consider their communities' use of land and development; preserve important historic, cultural, and natural resources; adopt pollution prevention measures; achieve a balance between growth and resource use which will permit high standards of living; enhance the quality of renewable resources; and strive for maximum recycling of depletable resources.

To encourage communities to move toward sustainability, the CCC will provide:

- A clearinghouse of successful models, tools, and funding strategies pertaining to stormwater management, site planning, pollution prevention, etc.;
- Financial assistance for innovative projects that protect local natural resources and enhance the quality of life in the Bay watershed;
- Topic-specific training sessions where local government officials learn the latest environmentally sensitive land-use and protection techniques and how to implement them;
- A network of local government peers and organizations who can share expertise on successful resource protection; and
- A broader link to technical expertise through the creation of partnerships with natural resource, finance, and planning experts.

The concept of sustainable communities has an international following. Major think tanks such as the World Resources Institute and the Sustainable Development Research Institute, and such international nonprofits as the International Council for Local Environmental Initiatives and Global Environmental Options, are developing strategies to initiate sustainable living. President Clinton established the President's Council on Sustainable Development to seek new approaches to achieve the nation's economic, environment and equity goals. The U.S. Department of Energy has also created an education program to provide information to communities on the significant benefits of working toward a sustainable community. The U.S. Environmental Protection Agency encour-

ages sustainable development by directing funding to related projects and by establishing special programs to promote the development of green communities. Joining this revolution, the CCC, with the support of the Bay Program, aims to build a network of government and non-government entities to promote sustainable development in the watershed by specifically urging local governments to implement sustainable practices.

The restoration and sustained protection of the Chesapeake Bay will require the synergistic efforts of all 1,653 local governments in the watershed. The Bay Program has created a growing awareness and the formal structure of support to provide local governments the tools they need to protect their local environment and, ultimately, the Bay. Continued outreach, communication, and coordination of efforts will make a significant difference in the health of our nation's largest estuary.

Local governments are critical partners in the effort to protect local natural resources and the Chesapeake Bay. These locally elected and accountable bodies of government manage the authorities that affect water quality and habitat. Additionally, local governments are in the unique position to nurture community and private business efforts to protect stream systems and prevent pollution. Clearly, the role local governments play is pivotal to protecting the environment, improving local economies, and preserving the quality of life in communities around the Bay.

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Jack Greer

Bringing Back the Bay: The Role of Science in Making Policy

"Our society is awash in politicized science; very often the public recognizes it and distrusts research, scientists, and associated organizations because of it" (Kenner 1998). Brian Kenner, who warns against the politicizing of science, joins other thinkers and researchers who argue that moneyed interests often "shape the framing and resolution of issues, including the conduct of scientific research" (Jasanoff 1997). In the words of David Orr, "The politicization of science has become a growth industry ... undermining good science and sound public policy in the cause of exploitation" (1994, 122).

"Science is not helping," according to C. S. Holling, "largely because there are not only conflicting voices but conflicting modes of inquiry and criteria for establishing the credibility of a line of argument" (Gunderson 1995). Some take a particularly cynical view, arguing, for example, that oceanographers in the United States should be seen as an "elite labor force" operating essentially for the state, while enjoying the "illusion of autonomy" (Mukerji 1989).

And yet others argue that without sound science our efforts to manage a system as complex as the Chesapeake Bay will prove fruitless. "As a nation with a reawakening concern about the quality of the environment, we must strive to ensure that the most current and best techniques are applied under the best possible conceptual framework or we will make little long-term progress in environmental management" (D'Elia 1989).

In the large-scale federal–state partnership known as the Chesapeake Bay Program, scientists and scientific research have unquestionably played a key role in shaping management, though the relationship between science and policy has often been as complex as the estuary itself. On the one hand, researchers have at times played the role of pushing the policy envelope, complaining, for example, that "officials ... seem compelled to de-emphasize scientific evidence that might imply the need to adopt some unattractive (to them) course of action, such as nitrogen removal..." (D'Elia 1987).

On the other hand, scientific evidence or scientific uncertainty is sometimes used to slow environmental policies: thinkers like David Orr complain, for example, that scientists too often suffer from a "hy-

perobjectivity" that interferes with their function as caring human beings (Orr 1994). We recall, too, that Aldo Leopold at times rejected the cold rationality of science: "We are not scientists," he said. "We disqualify ourselves at the outset by professing loyalty to and affection for a thing: wildlife." (Leopold [1941] 1991). Leopold goes on to say that "[t]he definitions of science written by, let us say, the National Academy, deal almost exclusively with the creation and exercise of power" (p. 276).

Working in the inevitable context of influence and power, have scientists studying the Chesapeake Bay been able to maintain their relative objectivity, while at the same time contributing to the restoration of this treasured resource? How has science influenced policy-making in the Chesapeake? What factors have brought scientific rigor and caring for the environment together in the interest of a common goal?

Early Warnings

If, as I will argue, scientific findings have come to steer many of our most important efforts to save the ecological health of the Chesapeake Bay, this was clearly not always the case. Consider, for example, the Bay's oyster industry, which once produced more meat in the region than beef cattle and provided the economic backbone for bayside communities in Maryland and Virginia. In the case of the oyster, scientific warnings came loudly at the end of the nineteenth century, most notably from William K. Brooks, a Johns Hopkins University professor and devoted student of the oyster. "Proud as our citizens once were of our birthright in our oyster-beds," said Brooks a century ago, "we will be unable to give to our children any remnant of our patrimony unless the whole oyster industry is reformed without delay" (Brooks [1891] 1996). Brooks's judgment was harsh: "We have wasted our inheritance by improvidence and mismanagement and blind confidence..." (p. 3).

As researcher Kennedy Paynter points out, the oyster population in the Chesapeake Bay is now estimated to be "at its lowest level in recorded history" (Paynter, in Brooks [1891] 1996). Despite Brooks's pleas, Maryland and Virginia proved unable to turn the tide on the bivalve's demise. Decade after decade of overharvesting, habitat destruction, and disease soon decimated what were once among the richest natural oyster bars in the world.

One could argue that here the science was not difficult: the looming collapse of the Bay's oyster stocks was perhaps visible to many. What was missing was a "sustaining and supporting social order" needed to "reassure skeptical publics and serve as a compelling basis for policy decisions" (Jasanoff 1995).

Lacking the social consensus necessary to make difficult decisions, science failed to alter the

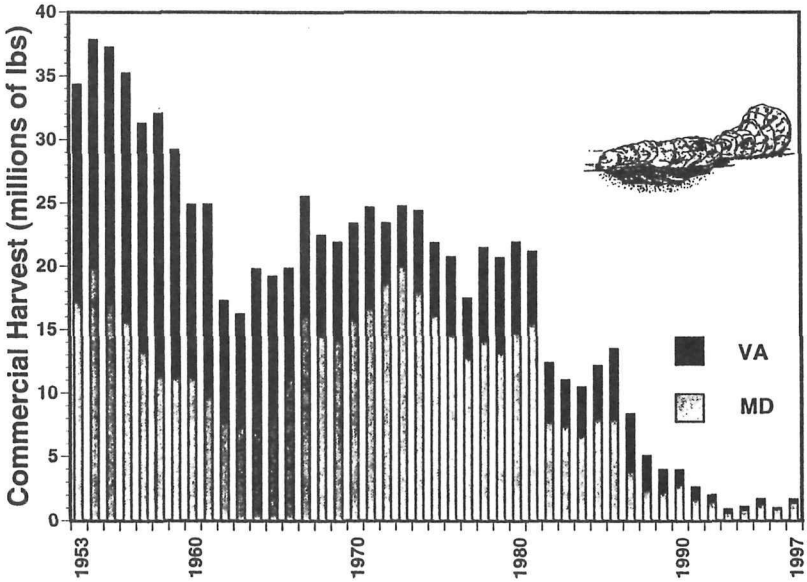


Figure 13. Commercial oyster harvests, 1953-1997.

course of the Chesapeake oyster's long and catastrophic decline. According to current research (Newell 1988; 1997), the catastrophe has had ecological as well as economic consequences. Since oyster reefs serve as prodigious "filters" of algae—algae now superabundant in the Bay—their disappearance has meant a double jeopardy. Just as the Bay started to receive increased nutrient loads from a watershed cleared for agriculture and development, humans inadvertently began to remove what may have been the very best mechanism for helping to control excess algae fueled by nutrients: the long white rows of oyster reefs that once lined the shallow sides of the Chesapeake.

While science—joined with aggressive restoration programs—now probably offers the best hope of restoring the oyster fishery, especially through research on two devastating oyster diseases (Leffler 1998), it is clear that science, even with a prophet as passionate as William Brooks, was not enough to turn the tide for the Bay's oyster bars.

The Emergence of Ecology-Based Policy

In Sheila Jasanoff's words, "The question before us is not how to produce the 'best' possible science for

policy, a problem definition that falsely presupposes the autonomy of scientific inquiry. Rather we must ask how to achieve the moral certainty needed for real-time decisions." She calls for a science that achieves "moral as well as epistemological authority" (1997, 232).

In the Chesapeake Bay, science has found a powerful social context in which to "speak truth to power," a context defined by a strong moral imperative put forward by politicians such as Maryland State Senator Bernie Fowler and Virginia State Senator Joe Gartland, and influential writers such as William Warner and Tom Horton, who have articulated for many a strong affection and concern for the Chesapeake.

According to Robert Costanza, the recent management of the Chesapeake Bay has moved through three distinct periods:

- 1965 - 1976: An era of shared experience and raised consciousness.
- 1977 - 1983: An era of intense scientific analysis with political backing.
- 1983 - present: An era of implementation and monitoring.

In Costanza's view, this management has evolved to deal fairly successfully with "point-source" issues, such as industrial outfalls and waste treatment plants. It is now, he suggests, "primed" to deal with difficult nonpoint issues, including agriculture and stormwater run-off (1995, 200).

Several important factors have made possible this move from "raised consciousness" to "scientific analysis" to "implementation." The first was the expression of public concern. The Bay's protected and abundant waters drew human interest early on, but during the 1960s, residents in the Bay region began to realize that the Bay's remarkable biological productivity—an abundance they had too often taken for granted—was beginning to decline. In that same decade, concerned citizens formed the Chesapeake Bay Foundation, an advocacy and educational group that now boasts more than 80,000 members.

In 1976, William Warner published *Beautiful Swimmers,* an evocative and compelling depiction of the Bay blue crab and those who make their living catching it. *Beautiful Swimmers* galvanized interest and concern for the Bay, and when it won the Pulitzer Prize, it attracted attention from far beyond Bay country. At the same time, and especially during the 1980s, Tom Horton was reporting on the Bay through insightful and incisive articles for the *Baltimore Sun* and then in several popular books on the Bay, further raising public awareness, understanding, and concern.

Concurrent with this, and no doubt arising from it, a large multistate and federal initiative soon began, one that would depend squarely on the scientific work carried out by

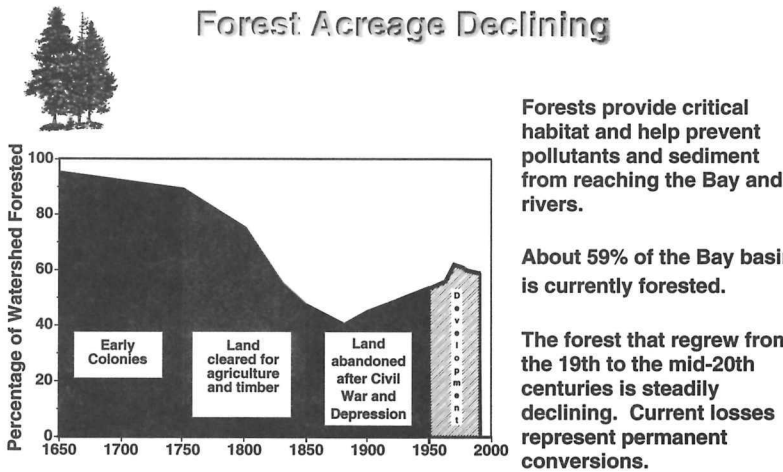


Figure 14. Forested acreage in the Chesapeake Bay watershed, 1650-2000

a group of dedicated researchers, researchers who had themselves often been long-term residents and observers of the Bay.

The federal initiative—and much of the scientific work—found its support and focus through the U.S. Congress, and perhaps most specifically through Senator Charles "Mac" Mathias of Maryland. Mathias was hearing from his constituents that this mother of estuaries, a central feature of his home state, was ailing. In 1973, he took, with his family, what has become a historic trip around the Bay to see for himself and to hear directly from watermen and other citizens. By the end of the trip, he determined that things were indeed bad, and that something had to be done on a large scale.

Mathias recalls that he also turned to scientists like Eugene Cronin, then head of the University of Maryland's Chesapeake Biological Laboratory, for advice and guidance. Researchers thus found themselves in a position to influence public policy, as politicians rallied to support a comprehensive scientific study of the Chesapeake. This cooperation was unusual. On the one hand, the Bay did not suffer from acute chemical contamination—with a few notable exceptions, such as contamination in Norfolk and Baltimore harbors or the

spill of the pesticide Kepone into the James River that would occur in the 1980s. In general, and unlike, say, Love Canal, threats to human health were not apparent.

On the other hand, politicians found themselves facing a powerful public wave of anger and concern. "I was amazed," said Maryland Governor Harry Hughes, "to see how passionate people were about the Bay no matter where I went in the state" (personal communication, 1998). What Hughes and other political leaders could not foresee were the conclusions that scientific research would suggest—conclusions that would point the way toward a whole new policy regime.

Stemming the Tide

"We all thought it was going to be Bethlehem Steel," Senator Mathias recalled at one point, reflecting the popular sentiment held by many around the Bay that big industry, with its smoke stacks and foul pipes, had caused the demise of the Chesapeake. Meanwhile, researchers at the University of Maryland Center of Environmental Science (UMCES, both the Chesapeake Biological Laboratory and the Horn Point Laboratory), the Virginia Institute of Marine Science, the Smithsonian Environmental Research Laboratory, the Academy of Natural Sciences Estuarine Research Center, and elsewhere were on the trail of other possible culprits, including agriculture—many of them working with EPA funds, thanks to Mathias and the federal government.

One of the key mysteries facing scientists was the catastrophic disappearance of underwater grasses, an important part of the Bay's bottom-dwelling (or benthic) ecosystem. Clearly, Tropical Storm Agnes had in 1972 scoured many of the grasses with its heavy punch of sediment and fresh water, but why didn't the grasses come back as a year and then another and then another passed? And why had so many species of grass disappeared all through the Bay, even in southern tributaries like the York River, far from the flooding Susquehanna?

"We thought it was herbicides," remembers Walter Boynton, a researcher at UMCES. Boynton and his colleagues could see from aerial maps that underwater grasses were disappearing not just near the big cities and industrial harbors like Baltimore and Norfolk, but all around the Bay, even in remote areas of the Eastern Shore. While there was little industry in many of these outlying areas, there was another active enterprise: agriculture. And since World War II the use of weed killers—herbicides—had grown exponentially, especially with such practices as no-till farming, developed to reduce plowing and therefore prevent unnecessary loss of soil, but also heavily reliant on herbicides.

After several years of research in the late 1970s and early 1980s, however, data did not point to herbicides

as the cause of the great sea grass die-off. These chemicals could potentially damage the grasses, especially in confined, near-shore areas and coves, but levels did not appear high enough in the open waters to cause the kind of wholesale disappearance of grass beds that had occurred up and down the Bay (Orth et al. 1986).

What the researchers found next would have a profound effect on policy and on the course of the Chesapeake Bay Program.

Boynton tells it best. "I had a graduate student," he says, "who kept coming up to ask, 'What is this slime on the grass blades?' I told him not to bother me, that we were trying to figure out what was killing the grasses" (personal communication, 1989). Of course, it turned out that the "slime" was a key clue to the sea grass die-off. Like a final, fatal blow, nutrients not only fueled the growth of algae that clouded the Bay's waters, but they also encouraged the growth of tiny plants—epiphytes—that flourished on the blades of the underwater grasses, covering them with a glove of "slime" and further blocking out the light.

The diagnosis: the Chesapeake Bay was dying from a lack of light. The causative agent: nutrients, not only phosphorus, but, as argued by scientists like Christopher D'Elia and James Sanders, nitrogen—a nutrient much more difficult to contain. (D'Elia 1987).

The New Dispensation

When scientific findings were announced at a Baywide conference in 1983, policy makers had the ammunition they needed to initiate a large-scale, multi-jurisdictional restoration program, and with the signing of the first Chesapeake Bay Agreement the Chesapeake Bay Program was born.

But the Chesapeake Bay is not a national park or protected area, and controlling Bay uses (and abuses) presents a daunting task. Even areas established as "estuarine research reserves" have encountered considerable resistance when authorities have attempted to limit use of public waters—as resource managers found, for example, when they tried to limit water-skiing on Maryland's Rhode River. To affect large-scale policies in the Bay region—that is, to influence large-scale legislative and regulatory change—resource managers and conservationists needed powerful arguments capable of swaying public (and therefore legislative) opinion. Those arguments relied heavily on the research results that emanated from a five-to-six-year, $27 million study, funded by the Environmental Protection Agency.

Was science co-opted by political pressures? The answer must be a resounding, "No." Early work on nitrogen, for example, caused problems for regulators, resource managers, and political leaders because it suggested that the states would need to undertake expensive nitrogen re-

moval in the watershed's waste treatment plants. Despite some wrangling, the science stood, and biological nutrient removal is now a cornerstone of the Baywide control of point sources of nitrogen.

In fact, the Bay Program has at times gone out of its way to acknowledge the uncertainty principle, careful not to overlook potential threats, even when scientific evidence remains mixed. Some researchers, for example, recommended removing Atrazine, at times the most widely used herbicide in the watershed, from the Bay's Toxics of Concern List, based on studies that failed to find damaging concentrations. When a scientific review suggested that uncertainty remained, the Bay Program decided, at least for now, to keep Atrazine on the list.

With the emergence of a new environmental threat, *Pfiesteria piscicida,* the research and management communities face yet another area of uncertainty. In the late 1980s aquatic botanist JoAnn Burkholder at North Carolina State University discovered and named, along with her colleagues and taxonomist Karen Steidinger, a new toxic dinoflagellate, which they called *Pfiesteria* after the well-known aquatic botanist Lois Pfiester. The name *piscicida* means "fish killer," and was chosen because extensive evidence, both in the laboratory and in the open water, suggests that this tiny marine organism, not much larger than a bacterium, can kill fish with powerful toxins.

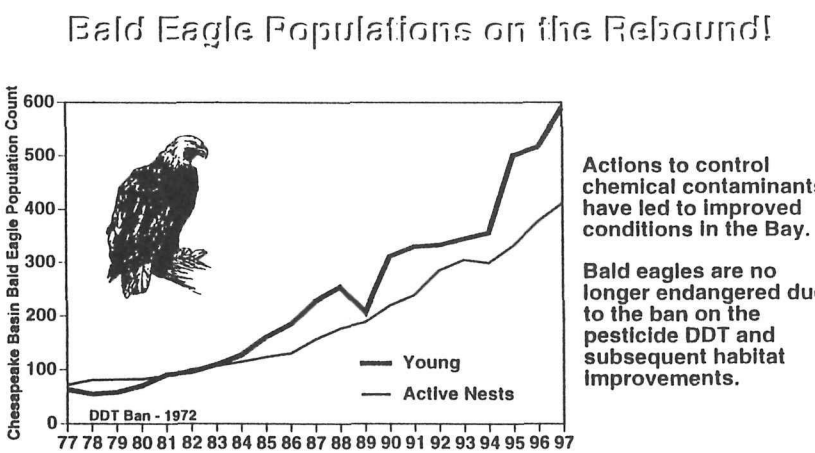


Figure 15. Chesapeake Basin bald eagle population, 1977-1997

Pfiesteria, which also appears to sicken people (Morris 1998), has made not only regional but national and international news. Early on, many observers linked outbreaks of *Pfiesteria* with pollution, especially run-off from hog or chicken farms, but scientists are still scrambling to make connections between causes and effects, between run-off from the land and other physical, chemical, and environmental factors and outbreaks of this noxious algae.

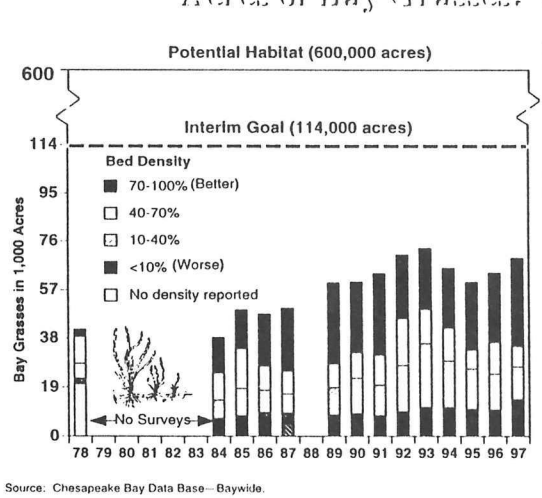
Alan Lewitus, who, with his colleagues, first found *Pfiesteria* in the Chesapeake Bay (in 1992), says that he discovered it near the Horn Point Laboratory where he then worked, "in the first place I looked" (personal communication, 1998). To find a marine organism that measures no more than 10 microns the first time you look for it suggests that it must be at least relatively abundant.

Most likely, suggest researchers like Donald Boesch, Christopher D'Elia, and others who have studied coastal ecosystems like the Bay, *Pfiesteria* has been around for quite a long time. In the words of one waterman, it has probably been here since "the dawn of time." The question, of course, is why has it suddenly become so virulent?

To answer that question means not only launching a new line of inquiry into the behavior of a novel "ambush predator," but continuing a line of scientific work that has been underway for decades. Just as earlier work helped document how something as benign as nutrients could cause the demise of vast areas of underwater grass, so current work will reveal to us exactly how a highly productive estuary like the Chesapeake Bay responds to shifts in climate, land use, and other factors to produce its remarkable food web, a food web that includes microscopic organisms we have not yet even named.

The roles of phosphorus and nitrogen (especially organic forms such as urea), already of interest, are being re-examined largely because of *Pfiesteria.* Whether environmental changes resulting from nutrients are the immediate cause for *Pfiesteria* outbreaks remain to be confirmed, though considerable circumstantial evidence exists to suggest a link (Boesch 1997). With powerful interest from the environmental community on the one hand and large-scale nutrient producers such as agribusiness on the other, the challenge to the Bay's research community remains serious.

So far, the role of science, thanks to the work of a dedicated, highly sophisticated cadre of researchers, has proven pivotal in the current effort to restore the Chesapeake Bay. In fact, awards are now given to scientists for their contributions to research in the interest of public policy, such as the Mathias Medal, named for Senator Mathias and awarded by the Sea Grant Programs of Maryland and Virginia, and by the Chesapeake Research Consortium.



GOAL: The interim goal is to restore Bay grasses to all areas where they were mapped from 1971 -1990.

STATUS: The percentage of higher density beds (70-100%) was about 50% in 1997, compared to 37% in 1984. The highest percentage of higher density beds was observed in 1989 when it was 53%.

Figure 16. Density of Chesapeake Bay grass beds, 1978-1997

Nevertheless, despite the direct impact of science on Bay-related policies, many still underestimate (and misunderstand) the value of research. Some politicians, for example, after the conclusion of the initial Chesapeake Bay Study, said, verbatim, "We've had enough research. Now we need action."

Clearly, if we are to restore the Chesapeake Bay to anything approaching its historic health and productivity, we need to take action; but without research, we will never be certain of what actions to take. The recent blooms of *Pfiesteria* and other potentially harmful algae in several Chesapeake Bay tributaries reinforce this point. What we need, to take E. O. Wilson's word, is "consilience," the joining together of knowledge from many different disciplines (Wilson 1998)—in this case to solve complicated environmental problems. In the Chesapeake we have clearly had a group of dedicated individuals with diverse backgrounds in chemistry, biology, geology, physics, and other fields, all of whom have come together to pool their knowledge in an attempt to determine how we might restore what was once the nation's richest estuary.

It is devoutly to be hoped that our leaders will no longer claim that "we've had enough research," but

will understand that ongoing scientific inquiry presents our only hope of understanding what is happening to the Chesapeake Bay and other of America's rich ecosystems. At the same time, it will be important to avoid the "hyperobjectivity" David Orr refers to.

In the Chesapeake Bay, it is fair to say that a passionate concern has in fact joined with intense scientific inquiry to help address many pressing policy issues. We must applaud a circle of scientists who care, recognizing at the same time how science actually works: that despite our committees, our strategic plans and integrated programs, it is often the free-ranging individual intellect that leads us to new discoveries. As C. S. Holling argues, the management of ecosystems runs into problems when people forget "that all policies are experimental." Holling calls for investments in "eclectic science, not just in controlled science" (1995, 9). We must always be willing to listen to the graduate student who approaches us, squinting in the sun, asking, "What is this slime?"

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Lowell Bahner

Chesapeake Information Management System and the World Wide Web

The Chesapeake Bay Program is making information about the Bay and its tributary rivers readily accessible and useful using the Internet and the World Wide Web (http//www.chesapeakebay.net). Citizens, schools, local governments, federal agencies, and non-governmental organizations are all large user groups interested in current information about the health of the Bay and its tributaries. Since the Bay Program encompasses work conducted by many agencies and organizations over a six-state area, data tend to be located all across the Bay basin. The Chesapeake Information Management System (CIMS) is an initiative to organize this large amount of information, using distributed Internet technology.

CIMS: Re-engineering Data Management for Chesapeake Bay

The growth of the information age has pushed the Bay Program's data center to re-examine how it does its business. In June 1996, the Program's Information Management Subcommittee conducted a workshop to gather and discuss user information needs. Approximately 100 people, representing most Chesapeake Bay Program agencies, participated to make their needs and expectations known.

The major findings of the workshop were:

- Many users or potential users find it difficult or impossible to get the data they need, and what are available are often outdated, too broad geographically, or insufficiently documented, increasing the amount of time needed to perform even routine procedures;
- Environmental Indicators, an important priority for the Chesapeake Bay Program, are difficult and inefficient to produce with the current system;
- To undertake complex analyses, different types of data need to be integrated;
- There are important changing directions in Chesapeake Bay Program investigations that will require new types of data and new ways of managing them; and
- There is difficulty summarizing and analyzing data spatially (e.g., loadings related to sources in a specific geographic location).

The major recommendations of the workshop were:

- Promote a Chesapeake Executive Council directive on data management;
- Develop standards for data providers, including a requirement that all Bay Program data be accompanied by standardized metadata;
- Make as much Bay Program information available over the Internet as is feasible; and
- Develop the CIMS, making it appropriate for the needs of a diverse user group, so that it is easy to use, allows users to query both spatial and textual information, and is partly decentralized.

The immediate response to the workshop's findings and recommendations was to improve access to information held by the Bay Program. For years, raw data had been managed, but with access to the Internet, documents, press releases, fact sheets, graphs, charts, environmental indicators, and data interpretations could all be made available for public access at a fairly low cost. Each Bay Program subcommittee was given the responsibility of publishing and maintaining its information using agreed-upon formats. A management team was created to oversee Web site development and maintenance. Soon partner agencies were creating their own Web sites. This ad hoc approach gained much popularity as a means of making information available to the public, students, scientists, and government agencies. However, the rapid creation of many different Web sites in the Chesapeake region, while a major improvement in obtaining information instantly, would also be a detriment when an integrated assessment was required by partner organizations.

Figure 17. CIMS information pyramid

CIMS Implementation

In October 1996, the Chesapeake Executive Council (comprising the governors of Pennsylvania, Maryland, and Virginia; the mayor of the District of Columbia; the chairperson of the Chesapeake Bay Commission; and the administrator of the U.S. Environmental Protection Agency, representing all federal agencies) signed the "Strategy for Increasing Basin-wide Public Access to Chesapeake Bay Information" (http://www.chesapeakebay.net/bayprogram/pubs/96cims.htm). This document directs the Bay Program to maintain a coordinated data management system, which not only provides timely information on the progress of the restoration program, but promotes greater understanding among citizens about the Bay, its problems, and the policies and programs designed to help it—thereby fostering individual responsibility and stewardship of the Bay's resources. The strategy directs the implementation of the basin-wide CIMS as a coordinated, user-friendly, Internet-based system, designed as a distributed network among participating organizations throughout the watershed and nationwide. Participating agencies must ensure that data and information products that are created or procured through grants or contracts can be loaded easily and maintained on the network.

The Bay Program's Information Management Subcommittee has developed policies and guidelines for directing CIMS-related activities ("Chesapeake Bay Program Guidance for Data Management," http://www.chesapeakebay.net/cimspol4.pdf). This document provides guidance for all participating organizations on locational accuracy, map coordinates, metadata, station names, common data dictionaries, database design, calendar dates, method codes, and data reporting and deliverables. These policies set the baseline rules so that a coordinated, yet distributed, information system can be created and maintained.

The success of a distributed information system depends on each partner organization doing its share. Memoranda of understanding are being signed by partner organizations to state what that organization's role will be in helping to implement CIMS. The process of getting these memoranda signed serves the purpose of focusing the upper management of federal, state, and local governmental agencies, universities, and non-governmental organizations on their responsibility properly manage information, publish it in a timely manner, and give the public access to it. Historically, the Bay Program's data center was one of the largest repositories; however, there was a large cost to maintaining a central repository because data in computers at the center would soon get "out-of-sync" with those held at state agencies due

to edits and updates not being made to all copies. These problems were very expensive to fix, and fixes were soon out-of-date anyway. By changing the process so that the generating organizations become the owners and keepers of the data, quality will increase while the overall cost decreases. Significant savings are already being reported due to publication of Bay Program data and information products over the Internet.

Timely access to information was another issue that is solved by having the data generator publish over the Internet. The generator, being the owner of the information, is more likely to improve the quality of the information through pride-of-ownership, and the information can be made available over the Internet in a timely manner since there are fewer layers of handling. This is important when quick management decisions need to be made in response to an environmental hazard.

Making a distributed information system work relies on the partners following the same road map. The importance of the policies and guidelines comes into play—i.e., the rubber meets the road—when data from one location need to be merged with those from another. Since this is an everyday occurrence for analyzing the interactions of air, land, and water quality with living resources within the region, it is crucial that all partners use the same language—that is, the data dictionaries for all the various databases must be consistent. The Internet has provided the means for sharing information, but the largest challenge is for each organization to publish its information in the same language so others can access and use it.

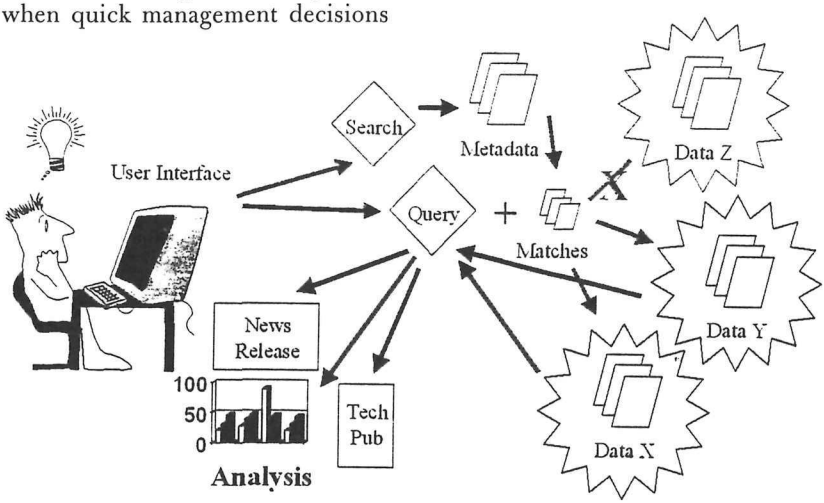

Figure 18. CIMS at the desktop

The vision for how all of this will work is becoming clear: a user can select specific information of interest through a "smart" user interface. The user interface engine will take this search request and send it to the metadata search engine, which acts like a library card catalog. The metadata search engine will search the metadata holdings (the extended documentation for every document or data set) and identify where (i.e., on whose computer) the actual information is housed. The query portion of the search request is then forwarded to those remote computers that are identified as having the requested information. If they do, the information is sent to the requesting computer. Once all of the information is received, it is packaged into a user-friendly format and delivered to the user's computer. This "CIMS at the desktop" goal is to provide data, graphs, charts, maps, and documents to the user in a manner that is most useful, much like the daily newspaper or the six o'clock news, but with the extended capability of "drilling down" into more detailed information when required.

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If you would like more information on the Chesapeake Bay Program on-line, visit its Web site at http://www.chesapeakebay.net. You will find detailed information about the program's partners, activities, publications, maps, and monitoring data.

Robert D. Campbell

The National Park Service: Filling Our Roles in the Chesapeake Bay Program

The Chesapeake Bay is a national treasure and a resource of international significance. The Bay encompasses 2,500 square miles of water; its watershed includes over 40 tributary rivers, and 64,000 square miles of land in six states. The watershed is an incredibly complex ecosystem of water and land, creatures and people, cultures and economies. Effective stewardship of this complex ecosystem requires complex partnerships. It also requires a complex understanding of how this ecosystem works and how it has become degraded.

The Bay today is still beautiful and teeming with life. But the Chesapeake Bay, largest of all estuaries in the United States, has been losing its wonderful biodiversity and abundance for decades. Since the first comprehensive scientific study of the Bay in the mid-1970s, the Chesapeake Bay Program partners have learned a great deal about what we need to do to keep this ecosystem healthy.

Since its inception, the Bay Program's highest priority has been the restoration of the Bay's living resources—its finfish, shellfish, bay grasses, and other aquatic life and wildlife. A decade ago the Bay Program had primarily a water agenda focused on the mainstem of the Bay. Then initiatives expanded to include the tributaries of the entire watershed. Now the challenge includes redressing the impacts from a vast airshed. If water and air have dominated the environmental restoration agenda to date, then land use increasingly will be linked to water quality across the Bay's sprawling watershed. The Bay Program has evolved in response to the ever-increasing understanding of the complexity of the ecosystem.

The National Park Service (NPS) mission is to preserve and interpret the nation's most precious natural and cultural resources and to provide for the public's enjoyment of these resources. As people have gained a deeper understanding of the intricate relationship between species and their landscapes, the concept of parks as integral parts of greater ecosystems has emerged. Heightened public awareness and changing expectations has necessitated new approaches to managing parks, and new roles for the NPS in conservation leadership. As the world presses in around us, our attention as park

managers will increasingly be drawn from the more familiar realm within our park boundaries to the lands and resources beyond. More and more, the NPS is called upon to help others conserve and protect resources beyond park boundaries where most of the work to effectively manage resources as part of a whole ecosystem must be done. Such is the case in our partnership with the Bay Program.

The Bay Program is a multi-governmental, interstate partnership that includes the states of Pennsylvania, Maryland, and Virginia; Washington, D.C.; the Chesapeake Bay Commission, a tri-state legislative body; and the U.S. Environmental Protection Agency (EPA) as the lead agency for the federal government. The top executive from each Bay Program participant—the governors of each state, the District of Columbia mayor, the Chesapeake Bay Commission chairperson, and the EPA administrator—make up the Chesapeake Executive Council, which has been guiding the Bay's restoration since 1983. Representatives from each of the jurisdictions, along with officials from other federal agencies and local governments, as well as citizen representatives, meet regularly to carry out the policies set by the Chesapeake Executive Council.

Through a 1993 memorandum of understanding with the EPA, the NPS became a formal partner in the Bay Program. In joining, the NPS

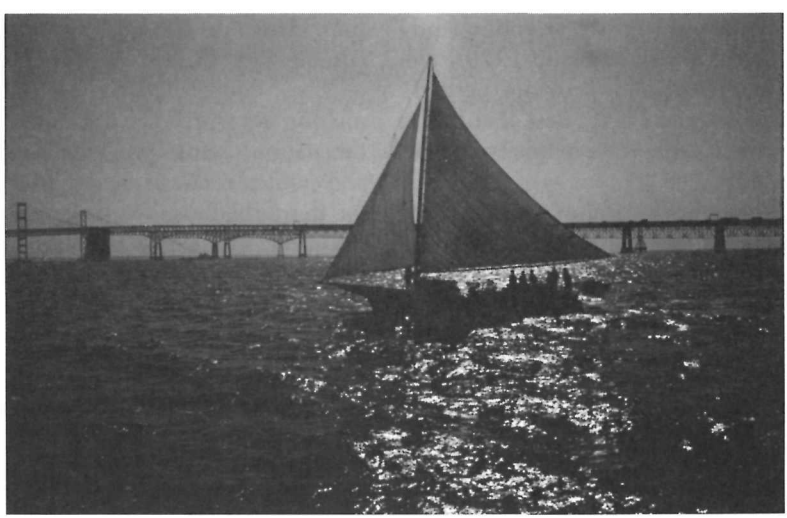

Figure 19. Skipjack, Chesapeake Bay Appreciation Day, 1987. Photo courtesy Steve Delaney.

agreed to contribute to the restoration, interpretation, and conservation of the Chesapeake Bay's many valuable resources—both within the national parks of its watershed and in coordination with others striving for the Bay's continued recovery.

Through the 1994 Agreement of Federal Agencies on Ecosystem Management in the Chesapeake Bay, the federal partners have built a solid record of measurable accomplishments. To continue in our leadership role, the Federal Agencies Committee (FAC) drafted an update to the 1994 agreement—a vehicle for taking a fresh look at the current and future work that Federal agencies are doing in the Bay watershed.

The 1998 Federal Agencies Chesapeake Ecosystem Unified Plan (FACEUP) provides a timely response to the new watershed management initiatives identified within the president's Clean Water Action Plan and keeps the Bay Program on the cutting edge of ecosystem management nationally. The 1998 FACEUP challenges the NPS and other federal agencies to achieve specific measurable goals in areas such as watershed management, sustainable development, protection of human health, habitat restoration, stewardship of living resources, and nutrient and toxics prevention and reduction.

The secretary of the interior and the director of the National Park Service again joined in cosigning this 1998 FACEUP agreement, which will provide a blueprint for measuring our accomplishments in several important areas in the coming years. Many of the initiatives identified are well underway within NPS parks and program centers in response to established policy and mandates; others will challenge us to increase our commitment to partnerships, resource management, and ecosystem management within the Chesapeake Bay watershed.

Organizing to Support the Chesapeake Bay Program

The most fundamental work of the Bay Program can be referred to as "shaping the conservation agenda." The Bay Program at its most effective is a marriage of good science informing good policy (a perspective explored fully in Jack Greer's companion article) that requires an elaborate process of consensus-building. For all of the partners, the challenge is to bring the programmatic strengths of their agencies or organizations into the Bay Program in the way that yields the greatest combined efficacy for the partnerships as a whole. The best metaphor might be that of finding how to "hitch our horses to the common wagon," so that we are "pulling our part of the common load." Our organizations inform, and are informed by, the dialogue among all the partners in science and policy as we work together to shape the conservation agenda within the Chesapeake Bay watershed.

At a minimum, this requires that all the partners have a liaison relationship within the Bay Program. "Liaison" is here defined as a means of communicating between bodies, groups or units—a close relationship, in other words. For the NPS as a partner, this necessitated the evolution of some parallel structure within our agency that allows us to bring our individual expertise to the Bay Program partnership, and take from the partnership its collective wisdom.

NPS contributions to the Bay Program are the product of the shared responsibility and coordinated efforts of the National Capital and Northeast regional offices and the collective efforts of all the parks and program centers within the Chesapeake Bay watershed. The two regional offices established and co-funded the position of NPS Chesapeake Bay Program coordinator. The coordinator serves as principal liaison, representing the NPS on key committees of the Bay Program. This facilitates communication and develops working relationships between NPS and other Bay Program partners. It also allows the NPS to assist in shaping the conservation agenda within the watershed. The coordinator is assisted in this area by a number of NPS personnel whose professional expertise makes them appropriate representatives given the subject matter of the Bay Program committee.

To facilitate communication within the NPS related to the Bay Program, each park and support office has a designated Chesapeake Bay point-of-contact (POC). The coordinator works in tandem with them and NPS's Chesapeake Bay Task Force to organize and sustain Bay-related efforts. The task force is a self-selected interdisciplinary group of park managers and program specialists, from throughout the two regions and the Washington office, who are committed to the restoration effort. The coordinator and task force members work through the POCs to communicate initiatives and identify staff to assist with them. The POCs take the lead in reporting park-based activities in support of the Chesapeake Bay, and work with the coordinator and task force to broker technical assistance to parks.

The task force has had its stalwart members, but theoretically its membership is ever-evolving, and includes any of the POCs or other NPS staff. It's less important to think of the task force as a standing committee than as a standing mechanism, serving two important purposes: 1) communication and coordination, and 2) actions and initiatives. The task force functions as the umbrella for the formation of work groups in response to Bay Program initiatives.

Finding Our Roles in the Bay Program

Prior to joining the Bay Program in 1993, the NPS conducted a study to evaluate some potential roles for our agency in the restoration effort.

We were seeking leadership roles for which our strengths are best suited. Just as the Bay Program has evolved since then, so too have our leadership roles, but they can be generally categorized as follows:

- **Stewardship of park resources.** Employing management practices within the units of the National Park System that support the restoration goals of the Chesapeake Bay, thereby leading by example.
- **Communication and education.** Helping the broader public (both residents and visitors to the Bay region) understand the function and importance of the Chesapeake Bay ecosystem, the environmental issues confronting it, and the efforts underway to help restore the its ecological health.
- **Local resource stewardship assistance.** Providing technical assistance to local governments and community organizations in developing plans for local stewardship of resources.

These functional areas are inherently related in ways that will become apparent as each is described in more detail.

Stewardship of Park Resources

The primary challenge for the National Park Service is to be "standard bearers" in our resource management, and to model programs and management practices on NPS lands that complement the goals and objectives of the Bay Program. Our management of resources will be subject to conflicting demands and increasing levels of public scrutiny. As such, we will need to be paragons for multi-disciplinary and multi-objective resource management.

The task force is assisting park staff to adopt or adapt management practices within the parks that support the overall restoration effort. To better broker technical assistance, the task force, through the park POCs, surveyed park staff to gather information on issues related to the Bay Program. Twenty-six of twenty-seven parks in the watershed responded to the survey, giving the task force a good snapshot of their technical assistance needs. The following issues were identified as either high- or medium-profile (meaning parks deal with them on at least an annual basis) by more than half of the parks:

- Exotic and invasive species management
- Cultural and historic scene management
- Integrated pest management implementation
- Adjacent watershed development
- Erosion and sedimentation (from inside or outside of the park)
- Right-of-way management
- Ornamental plant and landscape management

- Turf, lawn, and field management
- Stream bank and shoreline management
- Stormwater management problems
- Estuary and wetland habitat impacts, preservation and restoration

These survey results will help the task force establish priorities for assistance activities, and are already helping to direct technical materials and training opportunities to park staff.

At more than 60 NPS sites within the watershed—encompassing over 286,000 acres—resource managers are already working to adopt management practices supportive of Chesapeake Bay restoration goals. Well over 15 million people visit these sites per year, affording the NPS an important opportunity to help the public better understand how we work to protect their resources. Where we are using best management practices that support the Bay restoration effort, we can help the public understand what we are doing and, by association, what they need to do in their communities and homes to be better resource stewards.

Communication and Education

The Chesapeake Bay watershed is both a biological and cultural system. We find geology, biology, and ecology overlaid with history, lifeways, and economies in a collage that gives this area its identity. To a historian, the Chesapeake Bay conjures up visions of tall ships and different cultures encountering each other in the distant past, and a land holding a bounty of natural resources that most European colonists found hard to believe. To ecologists, it is a complex system of soils and fresh and salt water mixing to create a broad diversity of life, from mountaintop forests to seagrass meadows near the mouth of the Bay. To many, it is simply where they live. By telling the stories of the Bay, we can help people find their place in a complex world and within an ecosystem where land, water, plants, animals, and people's cultures, both past and present, are linked.

In the NPS, we have come to appreciate the maxim that people value what they understand, and they protect what they value. That is a big reason why we have interpretation in national parks: to give people a place-based education, and help them understand and value resources. The corollary within the Bay Program is the emphasis on improving public access to the Bay, both physical and educational. The story of the Chesapeake Bay is multifaceted and must be encountered in places both historic and natural, and through both cultural and recreational experiences.

Noting the existence of outstanding resources, as well as the

need to study and interpret the connection between the unique cultural heritage of the Chesapeake Bay watershed and the natural resources on which the settlements depend, the U.S. Congress in 1998 passed the Chesapeake Bay Gateways and Watertrails Act. The purposes of the act are to identify opportunities for increased public access to and education about the Chesapeake Bay, and to provide financial and technical assistance to communities for conserving important natural, cultural, historical, and recreational resources within the watershed. NPS has been given the responsibility for identifying a network of gateways and watertrails and administering the assistance program.

With the visitation that we enjoy at our sites, the NPS has an important opportunity to educate visitors about resource stewardship and to interpret the relationship between individual sites and their biocultural context. We can tell these untold stories in some of our parks and help others do a better job of telling the stories of their communities as well. For the NPS and the other Bay Program partners engaged in communication and education initiatives, the challenge is to shape the conservation agenda through giving the public access to the resources of the Bay and educating them about its stories, advocating for a healthy ecosystem, conserving resources, and engaging communities in sustainable resource stewardship.

Local Resource Stewardship Assistance

In addition to stewardship of national park sites, the NPS also provides assistance to other Bay Program partners in conserving and interpreting important cultural, historical, and natural resources. This is provided through NPS programs for rivers, trails, and conservation assistance; resource planning and grants management; public education; interpretation; and cooperative heritage planning.

Wendell Berry, in his essay "The Futility of Global Thinking," cautions against "the 'will-o'-the-wisp,' the large scale solution to the large scale problem, which serves mostly to distract people from the small, private problems that they may, in fact, have the power to solve" (Berry 1991). To adapt his thinking, then, the question that must be addressed is not only how to care for the Chesapeake Bay, but how to care for each of the Bay's human and natural communities, each of its small pieces and parcels of land, each one of which is in some precious way different from all the others.

To accomplish this we must engage people in the stewardship of resources within their own communities. Obviously, venturing into community-based planning assistance is an important new effort for the Bay Program. This will

necessitate effectively engaging 1,650 local governments in the Bay's restoration, and poses the daunting challenge of staying ahead of the population curve. Nearly 15 million people already live in the Bay's watershed, and 3 million more are expected to join them by the year 2020. "The problem is not just the environmental impact of more people, but also the impact of more people consuming and wasting more per capita. For example, we have improved landfill technology but increased our garbage per capita by 50% in the last 30 years. We have built cleaner cars but drive so much more that auto emissions rose five times faster than population. We pride ourselves on better planning and zoning but use nearly four times more residential open space per capita than we did in 1950. Now the task is to define convincing alternatives that offer a high quality of life" (Horton 1992).

In 1996, the Chesapeake Executive Council adopted the "Priorities for Action for Land, Growth, and Stewardship in the Chesapeake Bay Region," acknowledging that the expected population growth "will continue to test our abilities to meet restoration goals while accommodating growth and development." "New residents and citizens who are already in the region will want to attain economic prosperity, will expect to live in communities where the quality of life is high, and will insist on an environment that is clean and available for their enjoyment. Integrating economic health, resource protection, management and enhancement, and community participation will be a challenge for us all" (Chesapeake Executive Council 1996). The council requested that the "Priorities" be addressed through broad public outreach, and in 1996 also adopted the Local Government Participation Action Plan. The goal of the "Priorities" is "to encourage sustainable development patterns, which integrate resource protection, community participation and economic health." The first objective is to "foster a sense of community and place to protect heritage," acknowledging that "the Chesapeake Bay Region's heritage is a composite of its landscape, people, institutions, and history. The special character, communities, and sense of place are important qualities to residents and a motivation for local protection and restoration efforts" (Chesapeake Executive Council 1996).

Community-based planning promotes local decision-making. The community must be engaged in self-determination of choices; otherwise external forces will make the choices. A shared community vision provides the blueprint for their desired future. It allows a community to control its own destiny, to conserve the region's heritage, to tell its stories, to retain the places that are special to people, and to maintain its economic base for present and future generations. It is

an opportunity for residents, governments, civic organizations, and businesses to work together to establish a plan for stewardship and management of such valued resources as open space, beautiful views, and historic places that give the region its distinctive character.

The challenge at the community level is to find the appropriate scale of stewardship. Is it a neighborhood? A town? A county? A subwatershed, which might encompass several municipalities? For citizens, the questions are: What do we value enough to protect? Where do our common interests intersect? What size region do we have the commitment and the capacity to steward?

The objectives for the NPS and other Bay Program partners in community-based planning are two-fold. First is to be advocates for conservation, including various forms of interpretation, as a way to build understanding of and appreciation for the important resources of the area. Second, and more important in terms of public process, is to be impartial facilitators of consensus-building. We can only be accepted in this role if we are first up-front about our advocacy. And as committed conservation advocates, our facilitation role requires a certain leap of faith and belief in the process of consensus-building. We must trust that true consensus and public buy-in will serve to protect many, if not all, of the resources we value. Certainly, sustained protection is only possible with broad public support.

Now, the goal for the Bay Program should be citizen-based and community-grounded management of the Chesapeake Bay watershed that balances environmental, economic, and cultural values. For the NPS and other Bay Program partners, our objectives should be to lead by example, share what we know, and help build community capacity for local resource stewardship. By expanding our ability to educate and provide technical and planning assistance, we can help local stewardship efforts. And only through effective stewardship in all communities can we hope to be successful in our efforts to restore and conserve the Chesapeake Bay.

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Charles D. Rafkind

One Park and the Chesapeake Bay: The Colonial Experience

When I came to Colonial National Historical Park in late 1988 as its first full-time natural resource management specialist, I knew I was at one of the premier historical parks in the nation: the site of the first permanent English settlement at Jamestown Island, and the last major battle of the Revolutionary War, at Yorktown. I asked myself what my role as a natural resource specialist was at Colonial. I soon learned that the park:

- Had significant natural resources, including extensive wetlands, and rare, threatened, and endangered plants and animals.
- Did not have a good understanding of the natural resources and the associated issues, problems, and needs.
- Needed to integrate natural and cultural resource management planning and research.
- Needed to understand that it was part of a larger environment, a larger ecosystem and a larger watershed going beyond the park boundaries, called the Chesapeake Bay.

Park management had a long history of commitment to regional planning—with federal, state, local and non-governmental organizations—to ensure the successful protection of its cultural resources. Now the park saw the need to make the same commitment to meet its obligations as good land stewards of its natural resources and the Chesapeake Bay. Therefore, the park implemented a natural resource program with a network of partners, including government agencies, non-governmental organizations, academia, neighbors, and the general public. This network is the critical ingredient for the success of the natural resource program at Colonial.

The keys to understanding the park's program, and the Chesapeake Bay Program as a whole, are the concepts of stewardship, ecosystem, watershed management, sustainability, and partnership. The park program is a vision, a commitment to these concepts.

The park and Chesapeake Bay programs are an approach to planning and management with the goal of economic vitality combined with environmental protection, enhance-

Figure 20. Archaeological site of New Town on Jamestown Island, Colonial National Historical Park. Photo courtesy National Park Service.

ment and restoration. The Bay Program is a regional watershed approach that emphasizes good science as well as a heightened awareness of what we do and how it affects the larger natural and cultural environment—and, ultimately, the quality of life. It involves active, interdependent collaborating by all levels of government and the public.

Before discussing Colonial's resource management program within the context of the Bay Program, I would like to digress a little and look at the issues of design, sustainability, ecosystem management, partnerships, and good stewardship.

William McDonough, dean of the School of Architecture at the University of Virginia, delivered the centennial sermon at the Cathedral of St. John the Divine in New York City on February 7, 1993. In his remarks, titled "Design, Ecology, Ethics and the Making of Things," he said that "I am going to speak about the concept of design itself as the first signal of human intention. I would like to reconsider both our design and our intentions."

> If we understand that design leads to the manifestation of human intention and if what we make with our hands is to be sacred and honor the earth that gives us life, then the things we make must not only rise from the ground but return to it, soil to soil, water to water, so everything that is received from the earth can be freely given back without causing harm to any living system. This is ecology. This is good design....

Our culture has adopted a design stratagem that essentially says that if brute force or massive amounts of energy don't work, you're not using enough of it.... [D]esigners are now designing for the machine and not for people.... [W]e need to work with living machines, not machines for living in. The focus should be on people's needs, and we need clean water, safe materials, and durability....

Not only does nature operate on 'current income,' it does not mine or extract energy forms the past, it does not use its capital reserves, and it does not borrow from the future. It is an extraordinarily complex and efficient system for creating and cycling nutrients, so economical that modern methods of manufacturing pale in comparison to the elegance of natural systems of production....

Finally, the characteristic that sustains this complex and efficient system of metabolism and creation is biodiversity. What prevents living systems from running down and veering into chaos is a miraculously intricate and symbiotic relationship between millions of organisms, no two of which are alike....

Our present systems of design have created a world that grows far beyond the capacity of the environment to sustain life into the future. The industrial idiom of design, failing to honor the principles of nature, can only violate them, producing waste and harm.... If we destroy more forest, burn more garbage, drift-net more fish, burn more coal, bleach more paper, destroy more topsoil, poison more insects, build over more habitats, dam more rivers, produce more toxics and radioactive waste, we are creating a vast industrial machine, not for living in, but for dying in....

We have to recognize that every event and manifestation of nature is 'design,' that to live within the laws of nature means to express our human intention as an interdependent species, aware and grateful that we are at the mercy of sacred forces larger than ourselves, and that we obey these laws in order to honor the sacred in each other and in all things. We must come to peace with and accept our place in the natural world.

In the National Park Service (NPS) report titled "Ecosystem Management in the National Park," dated September 1994, it is stated:

Widespread land development, increasing human population, global demand for natural resources, and changing dynamics of communities and economies place enormous stress on natural and cultural resources.... NPS units and programs have an impact on the way of life in communities.... The NPS must adapt its management practices to confront these challenges to resource stewardship. An ecosystem approach to management will require actions to be targeted to root causes of problems whether they exist inside or outside park boundaries, The NPS stewardship mandate cannot be met through introspective actions alone. We should increasingly work in cooperation with partners to help manage resources of larger areas.

Ecosystem management is an awareness [that] living things exist in complex, interconnected systems within a broad landscape.... Ecosystem approaches are driven by collaboratively developed and evolving visions of desired conditions that integrate environmental, economic, social, and, cultural factors affecting a management unit defined primarily by ecological—not political—boundaries. It is a flexible and collaborative approach that encourages innovation and replaces single-issue management. An ecosystem approach recognizes that change is an integral component of ecosystems.

Natural processes and cultural themes transcend park boundaries and do not conform to political borders.... Human influences also transcend park boundaries, including air and water pollution and habitat and cultural landscape fragmentation. Communication improves coordination and reduces conflict among stakeholders. Administrative savings can occur with agency coordination of common activities such as inventory, monitoring, and sharing of scientific data and methods. Cooperation will help to ensure that agencies are not working at cross-purposes. Multiple long-term problems can be addressed simultaneously through ecosystem management, rather than piecemeal approaches to problems.

So, what is Colonial doing to integrate these principles of ecosystem, watershed, sustainability, and partnerships?

First, a little background. Colonial National Historical Park lies within the boundaries of the counties of York, James City, Gloucester, and Surry, and the cities of Virginia Beach and Williamsburg. The park is located in the coastal plain of Tidewater Virginia with all of the parklands having a direct hydrological link to the Chesapeake Bay. Over 30 of the park's 105 miles of boundary extends along either the York or James rivers, two of the largest rivers on the western shore of the Chesapeake Bay. In addition, over 50 miles of perennial and intermittent streams flow through the park and feed directly into these two rivers. Over 25% of the park is classified as wet-

Figure 21. King's Creek, Colonial National Historical Park. Photo courtesy Charles D. Rafkind.

Table 1. Partnerships in natural resource management at Colonial National Historical Park

Partners	Representative Activities
• College of William and Mary: Departments of Biology and Geology, Center for Archaeological Research, Center for Conservation Biology • Virginia Institute of Marine Science: Department of Natural Resource, Center for Coastal Management and Policy and Departments of Physical and Environmental Science • Colonial Soil and Water Conservation District • Colonial Williamsburg Foundation • Friends of the NPS, Green Springs, Inc. • Hampton Roads Planning Commission District, Virginia • James City County, VA • North Carolina State University, College of Forest Resources • U.S. Army Corp of Engineers • U.S. Coast Guard • U.S. Department of Agriculture, Natural Resource Conservation Service and US Forest Service • U.S. Department of the Interior, Geological Survey and Fish and Wildlife Service • U.S. EPA Chesapeake Bay Program and EPA Region III • Virginia Extension Service • Virginia Department of Conservation and Recreation, Division of Soil and Water; and Division of Natural Heritage • Virginia Department of Environmental Quality • Virginia Department of Geology • York County, VA	• Benthos studies • Endangered species inventory and planning • Environmental reconstruction of Jamestown Island • Flora and fauna inventory • Geographic Information System data sharing • Ground and surface water planning and investigations • Hazardous materials investigations • Neotropical migratory bird survey • Shoreline conservation planning • Wetlands investigations, inventory, and management • Agricultural planning and permitting • Erosion and sedimentation control • Open fields planning • Oil and sewer spill response and planning • Regional planning for water quality and quantity • Adjacent land-use planning • GIS data-sharing • Cartographic design • GIS data development: cultural, natural, infrastructure • Vegetation (forest, fields, wetlands) inventory • Wildfire planning and GIS applications • Coastal area planning for oil and chemical spills • Forest pest management • Fisheries inventory • Geohydrological framework investigation • Springs and seeps studies • Surface water quality inventory • Chesapeake Bay Program-related activities • Integrated pest management • Revegetation techniques • Trail management

lands, both tidal and non-tidal, forested and non-forested. Mixed pine and hardwood forests cover over 60% of the park; fields and lawns, about 12%. Colonial has the second highest number of state- and federally-listed rare and threatened flora and fauna species of any NPS site in Virginia (after Shenandoah National Park). There are an additional 25 such species on adjacent private and public lands. So far, 975 species of plants, 40 of mammals, 244 of birds, 33 of reptiles, 32 of amphibians, and 79 of fish have been identified as occurring within the park.

In developing its natural resource management program over the past nine years, Colonial has nurtured many successful cooperative partnerships (Table 1).

The Chesapeake Bay Program is not just another layer of rules, regulations, and laws, but a great opportunity, a vision, a model of good land stewardship and sustainability. It provides innovative ideas, input, and support for integrating good management into the larger context of the Chesapeake Bay ecosystem. It provides exciting opportunities to work with a variety of professional, dedicated agencies and organizations, and with politicians, businesses, and citizens in doing creative projects to understand, protect, and enhance the multi-state Chesapeake Bay watershed.

Partnerships are the backbone of NPS management at Colonial and the cooperation and dedication of all involved have led to these and other successful efforts in integrated ecosystem management. The challenge for managers is how to be stewards of one's park in the context of the larger watershed and ecosystem—how to work beyond park boundaries with neighbors, partners, and visitors, not just to meet goals and objectives, but to realize the *vision* to be good stewards of the land and to ensure a sustainable future.

Ed. note: the extended quotation from William McDonough is used with the author's permission.

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