THE GEORGE WRIGHT

FORUM

Volume 15 ❖ **1998** ❖ **Number 4**

TEDDY BIDS THEM ALL GOOD-BYE THIS MORNING.

THE JOURNAL OF THE GEORGE WRIGHT SOCIETY

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

The George Wright Society

Executive Office

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THE GEORGE WRIGHT FORUM

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On the Cover: The *Anaconda* (Montana) *Standard* ran this cartoon at the conlusion of Roosevelt's 1903 visit to Yellowstone. Though bears dominate the picture, in the distance out of the window, a mountain lion expresses relief that the president is leaving. This was apparently a reference to the controversial lion hunt that was canceled before the president reached the park. See Jeremy Johnston's article in this issue.

Society News, Notes & Mail

Erratum: Mountain Protected Areas

In Lawrence S. Hamilton's article "The Mountain Protected Areas Network" (THE GEORGE WRIGHT FORUM, Vol. 15, No. 3), some text was inadvertently left out. The final paragraph on p. 49, carrying over onto page 50, should read: "Mountain protected areas are usually the most isolated in a protected areas system. Researchers and managers working in them find few, if any, professional networks which deal with the unique problems common to mountains. The practical benefit of this network is well expressed in responses to a September 1997 evaluation survey in *UPDATE.*" Our apologies to the author and our readers for the error.

Preparations in Full Swing for '99 Conference

A record number of abstracts (over 250) have been received for the 1999 GWS Conference, the 10th Conference on Research and Resource Management in Parks and on Public Lands, to be held March 22-26 in Asheville, North Carolina. The conference program committee met in early November to make up the program. Because of the exceptional demand for participation, ten additional concurrent sessions have been added, for a total of 60 for the week. All GWS members and abstract submitters should have recently received a registration brochure. If you didn't, you can register on-line at the conference Web site:

http://www.portup.com/~gws/gws99.html

The Web site also has complete details on the conference, including the entire program and abstracts for all the presentations.

Larson, Smith Win Seats on GWS Board

The 1998 GWS election featured what was probably the strongest field of candidates ever to vie for positions on the Board of Directors. Six exceptionally well-qualified persons were on the ballot. Gary Larson and Rick Smith emerged as the winners; the other candidates were George B. Hartzog III, Ken Mabery, Dwight T. Pitcaithley, and Charles Van Riper III. The results were tabulated at the GWS's annual Board meeting on November 6. Gary Larson, who previously served on the GWS Board in the late 1980s, is an aquatic ecologist with the U.S. Geological Survey's Biological Resources Division, based in Corvallis, Oregon. After a career with the National Park Service, Rick Smith now works as consultant on protected areas; he is based

in Placitas, New Mexico. Larson and Smith take office on January 1, 1999, for three-year terms.

Linn steps down as GWS executive director; Harmon takes over

Bob Linn, the long-time executive director of the Society, stepped down from that position this past July. He announced his decision in a letter to GWS President Jonathan B. Jarvis. The Board of Directors subsequently named Dave Harmon, Bob's deputy since 1990, as the new GWS executive director. In 1980, upon retiring from his career in the National Park Service, Bob co-founded the GWS along with Ted Sudia. Both Bob and Ted (who has himself since retired from NPS) were chief scientists with the agency. After the Society's founding, Bob and Ted did a great deal of volunteer work to keep the new organization going during a decade of very little outside funding. Bob handled much of the production and editorial work for THE GEORGE WRIGHT FORUM out of his own house (and pocket). In addition, the GWS was able to put on three major conferences during the 1980s through such all-volunteer efforts. In 1990, the Society received a generous operating grant from Sherry Wright Brichetto, one of George Wright's daughters, and her husband Dick. This enabled the GWS to open its executive office here in Hancock. Bob was officially named executive director at that point by the Board of Directors, and hired Dave as his salaried assistant. Bob, however, declined a salary of his own, and ever since has worked full-time without pay on behalf of the Society—a practice he will continue, even though he has relinquished the title of executive director.

Canon National Parks Science Scholars Program 1999 Announcement & Application Available

The Canon National Parks Science Scholars Program was established in 1997 to develop the next generation of scientists working in the fields of conservation, environmental science, and park management. It is the first and only fellowship program of its kind to encourage doctoral students to conduct innovative research on scientific problems critical to the future of the national parks.

The Canon National Parks Science Scholars Program is underwritten by Canon U.S.A., Inc. Other collaborating organizations include the National Park Service (NPS), the National Park Foundation (NPF), and the American Association for the Advancement of Science (AAAS). Each year, the program awards graduate student scholarships in four broad disciplines: the biological sciences, physical sciences, social sciences and cultural sciences. The amount

of each scholarship is $25,000 per year, for a maximum of three years and $75,000. The program operates as follows:

- Students submit dissertation proposals addressing specific research questions identified each year by NPS park managers.
- The proposals are evaluated by scientific panels convened by the AAAS.
- The AAAS panels select the winning graduate students who become Canon National Parks Science Scholars.
- The NPF transfers scholarship funds to each student's university.
- The students complete their graduate research, write a dissertation, prepare a popular article on the significance of the research, and give a public lecture about their work.

In 1999, the Canon National Parks Science Scholars Program will award scholarships to eight doctoral students. Four Honorable Mentions will also be awarded and include a one-time grant of $2000. The 1999 competition will focus on four specific research questions described in the 1999 Announcement & Application. For a 1999 announcement and application, contact Dr. Gary Machlis, Program Coordinator, Canon National Parks Science Scholars Program, Natural Resource Stewardship and Science, National Park Service, 1849 C Street NW (3127), Washington, DC 20240, or e-mail gmachlis@uidaho.edu. To download an electronic copy of the 1999 announcement and application, visit the NPS Social Science web site at :

http://www.nps.goc./socialscience/waso/acts.htm

Applications are due 15 June 1999.

GWS Seeks Editor for FORUM Anthology

The Society is contemplating publishing an anthology of articles from THE GEORGE WRIGHT FORUM, either under its own imprint or through a commercial publishing house or university press. While the project is contingent upon our securing outside funding to underwrite it, we would like to line up an editor in advance of sending out funding proposals. Our project proposal to funders includes a stipend of $5,000 for the editor. The editor would select the articles to appear, write brief introductions to each, arrange them into a coherent sequence, preface the book with an introductory essay giving a historical perspective on the development of the FORUM, and conclude the book with an afterword that ties together the main themes presented in the selected articles.

We are seeking a person with considerable experience in the protected area field, either as a field practitioner, administrator, or academic. It is essential

that he or she be able to present the FORUM's interdisciplinary perspective; that is, be able to analyze both cultural and natural issues and introduce them to a professional and general audience. A thorough knowledge of the conservation issues covered in the FORUM since its inception in 1981 is also essential. This project—for which we have strong hopes of obtaining funding—would be an excellent opportunity for someone to make a substantial contribution to the conservation literature. If you are interested, please contact Dave Harmon at the GWS office, P.O. Box 65, Hancock, MI 49930-0065 USA, with your CV or résumé.

2000, The Year of Maryland State Parks—and Beyond?

On October 22, 1998, the governor of Maryland, Parris N. Glendening, proclaimed 2000 as the "Year of Maryland State Parks" during an environmental rally overlooking Great Falls, Maryland. The event also featured U. S. Senator Paul Sarbanes; Charles McGrady, the newly elected president of the Sierra Club; and Carol Browner, administrator of the Environmental Protection Agency. In further support of his proclamation, Governor Glendening announced that he would appoint a carefully selected commission to advise him on cost-effective enhancements of Maryland's state parks.

In addition, Glendening has written to the governors of the other 49 states urging them to take similar steps in support of their state parks. Moreover, the Glendening has written to President Clinton to suggest that he proclaim the year 2000 "The Year of the National Parks."

The governor announced that he was implementing a proposal submitted by Maurice Schwartz, a long-time resident of the state who has been involved with parks for 45 years. (Ed. note: Schwartz is a life member of the George Wright Society, and recently guest-edited Vol. 15, No. 1 of the FORUM, a special issue devoted to "The Business Connection.")

Copies of the proclamation and Schwartz's letter to the governor appear below.

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The State of Maryland

Proclamation
From the Governor of the State of Maryland

YEAR 2000
Year of Maryland State Parks

WHEREAS, The Year 2000 provides us with the occasion to celebrate Maryland's State Parks and their endless recreational opportunities for Maryland's families; and

WHEREAS, Maryland is blessed with a variety of natural and historical parks that provide positive recreational experiences for more than 10 million visitors each year; and

WHEREAS, By visiting the Department of Natural Resources State Parks, citizens of all ages can develop a greater appreciation of the natural and historical heritage of Maryland; and they provide opportunities for families to enrich and strengthen their relationships through multi-generational activities; and

WHEREAS, It is appropriate that attention be focused on the physical, mental, and emotional benefits derived from involvement in activities in Maryland State Parks;

NOW THEREFORE, I, PARRIS N. GLENDENING, Governor Of Maryland, do hereby proclaim THE YEAR 2000 AS THE YEAR OF MARYLAND STATE PARKS and do commend this observance to all of our citizens.

Given Under My Hand and the Great Seal of the State of Maryland this 22d Day of October, One Thousand Nine Hundred and Ninety-Eight.

Parris N. Glendening, Governor
John T. Willis, Secretary of State

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A GLENDENING PROGRAM FOR THE PARKS

23 September 1998

Dear Governor Glendening,

The purpose of this letter is to recommend that you communicate the strength of your feelings and the intensity of your commitment to Maryland's State Parks by establishing a carefully selected commission of appropriate citizens whom you shall charge to recommend to you the most cost-effective enhancements of the programs of the State Parks. Such a strategy would be the capstone of the many environmental protection and improvement programs you have initiated. Perfectly consistent with your excellent programs for Smart Growth & Neighborhood Conservation, Live Near Your Work, and Rural Legacy, a Glendening program focused on the State Parks would bring a strengthened dynamic quality to your leadership of natural environment issues that would galvanize a highly significant increase in citizen support.

Your vigorous support of the State Parks would be perfectly consistent with your emphasis on education. Maryland's State Parks, along with museums and historic homes, provide the very best of education supplements to schools at every level of Maryland's educational capabilities.

In standing up for the parks, you will reach the incredibly diverse people of every race, religion, income range, age group, and demographics from urban, suburban, and rural communities within the state. They all enjoy the parks. Even people who never visit a State Park still support the protection of the resources and the provision of park programs in appreciation of the many positive roles of the parks in our state.

Perhaps above all other values, State Parks reach millions of young people through visitation and special programs. Rangers serve as ideal role models. State Parks provide opportunities for young people to experience outdoor values that they will very likely not otherwise learn to appreciate. It is a genuine educational opportunity of very great significance.

You should signal the dimensions of your commitment to the parks by proclaiming the year 2000 THE YEAR OF MARYLAND STATE PARKS. You will set an exemplary example for the other states. Indeed, you should challenge the President to do the same for the National Parks.

The millions of visitors, friends, and neighbors of State Parks have very special positive feelings for those very special places. As our Governor, you should be at the forefront for the parks. A GLENDENING PROGRAM FOR THE PARKS will be remembered in history.

Sincerely yours,

Maurice H. Schwartz

Jonathan B. Jarvis

Box 65: Commentary from the GWS Office and Our Members

Reflections on Six Years with the GWS Board

In 1993, I joined the GWS board and now, passing the presidential scepter to the most worthy Dr. Dick Sellars, have the enviable bully pulpit of a past president to reflect on the last six years. The Society, to the credit of the executive office in Hancock, an active board, and an engaged membership, has matured into a professional organization that makes a difference in the uncrowded field of science-based management of protected areas. We have not changed the world, but we can take some credit for changing the way it is viewed. THE GEORGE WRIGHT FORUM has grown in stature as the place for the presentation of applied science, cogent reasoning of the implications, and thoughtful discourse by those who disagree. Passion can be found in the FORUM between charts and graphs, and that is, in part, what makes the publication different from other journals. We need both passion and science if we are to succeed in the noble goals of protecting natural and cultural resources.

Two years ago, I was contacted by a representative of the Natural Resources Defense Council, interested (finally) in learning more about the role of science in parks. My primary recommendation was to attend the GWS conference in New Mexico, listen in the hallways, and spend the week with the most active minds in the field. Nowhere else could one contact the full range of archeologists, biologists, rangers, historians, and managers engaged in such an exchange and grand debate. The importance of the Society's biennial conference cannot be overstated and it gets better every time.

The last six years have been a tumult of change: the establishment of the Biological Resources Division (BRD) within the U.S. Geological Survey (USGS), the reinvention of government, the reorganization of the National Park Service (NPS), and the application of GPRA (Government Performance and Results Act). They have all changed and complicated the way we do the business of understanding and protecting resources. I apologize to the membership that this reflection will have a clear NPS spin. The GWS membership has diversified (a board goal) and now is just over 50% NPS, but all can learn from NPS successes and foibles.

Secretary of Interior Bruce Babbitt established, by sheer will, the

National Biological Survey, which evolved to the BRD, gathering the scientists from the various bureaus of Interior so their combined efforts could, quote, "avoid the train wrecks." At first embattled by a Congress spurred by the property rights activists, the home for the BRD has finally been established on the quiet shore of the USGS. To abuse the train wreck metaphor, the NPS was pretty much the caboose of the science program anyway but has now been uncoupled from the train and is coasting. BRD is a noble concept, the cadre of scientists there are trying hard, and there are some potential increases in the next few fiscal years that will regain and even surpass the losses in funding suffered in their first few years. However, some park superintendents, feeling the void left by the transfer of the park-based scientist, have begun to hire "science advisors." These gray-haired veterans bring back to the NPS what it lost: a senior advocate for science, unburied in the organization, who can look the superintendent in the eye and say, without concern for reprisal, "that is the stupidest thing I have ever heard." We need these people.

Vice President Gore's reinvention of government led to the reorganization of the NPS, shifting power from the regional office to the superintendent. No longer can a support-office staffer invoke the authority of the regional director and dictate to the superintendent what he or she may do. The superintendency is the last bastion of the feudal lord, and this new power shift works great if the superintendent is well trained, educated, understands the role of science in decision-making, and makes excellent use of the resources specialists on staff and in the support offices or at BRD. It does not work so well if the superintendent is Homer Simpson. D'oh! Never has been so much of the American trust been invested in so few who can still meet the job classification without a college degree. Having worked for nine different superintendents and been one for seven years, the autonomy is downright scary.

In 1996, GPRA became an acronym that still makes many of us shudder. Another congressional attempt to make government operate like a business, we now must measure our success in managing wildlife, wilderness, archeological sites, visitor experience, data, viewsheds, and natural processes the same way Detroit measures assembly-line speed, miles per gallon, and widgets per hour. It is frustrating as we pound the round peg of what a geologist or historian does into the square hole of outputs and outcomes.

There are good signs though. Dr. Sellars' seminal work *Preserving Nature in the National Parks* said authoritatively and in popular print what those of us in the trenches have known for years: we are really good at managing scenery, but don't look behind the façade. Spurred by this

critical assessment, the leadership of the NPS has begun a "Natural Resource Management Initiative" with its inherent steering committee and multiple task groups. The greatest hope for substantial changes to the way the NPS manages resources lies with its acceptance by the leadership, its continued nurturing by the director and the deputy director, and its budgetary endorsement by the Department. It has potential for a long-lasting effect and deserves close attention by all.

The NPS now has a science mandate, thanks to Title II of the National Parks Omnibus Management Act of 1998, sponsored by Senator Craig Thomas of Wyoming and signed into law by President Clinton in November. Tucked neatly within a bill that extends the fee authorization and modifies the park concessions program is language penned by NPS Associate Director Destry Jarvis (a GWS member and my big brother!):

> Section 202: 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.

As a reference, the complete text of the Title II mandate is in this FORUM issue, and a detailed, section-by-section analysis will appear in the next issue. But the key point is that for the first time, Congress has told us that science is part and parcel of the NPS mission of protecting parks and that superintendents will be held accountable for the conditions of park resources and using science in decision-making. This legislation is resource-neutral: in other words, it supports both natural and cultural research and is carefully worded so that it in no way lessens the preservation-use mandate of the1916 Organic Act. Neither does it lessen public participation in the planning and decision-making process. It simply says that from now on, it will be incumbent on the park superintendent to obtain, through base funding, agreements, and outside research, quantitative information upon which to shape park management decisions. For those would say we could have done that anyway, I say, read Dick Sellars' book or any of the other dozen reports written on the subject in the last 30 years. They all say the same thing: we could have, but didn't.

In 1994, I became superintendent of Wrangell–St. Elias National Park and Preserve, the largest unit of the NPS at 13.2 million acres. For a sense of scale, this is larger than West Virginia or Switzerland. My park budget is roughly 14 cents per acre and we have one employee for each 500,000 acres. We also have subsistence hunting and trapping, over 400 mining claims, 100 miles of state road, 1,400 miles of RS-2477s (right-of-way claims), and over 1 million acres of inholdings. This is a

park that gives meaning to the concept of managing at a landscape scale with very little information. Facing this daunting task, I rely on four basics: first, like the Hippocratic oath, "do no harm"; second, from the wisdom of Aldo Leopold, "save all the parts"; third, to use effectively what science we have to shape decisions; and last but not least, to invest in building the knowledge of park resources so managers in the future will have greater insights than I.

I hope to see you all at the GWS conference in Asheville in March.

Jon Jarvis served on the GWS Board of Directors from 1993 through 1998, the last two years as president. He lives in Copper Center, Alaska.

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.

National Parks Omnibus Management Act of 1998:

Title II—National Park System Resource Inventory and Management

Ed. note: *With almost no fanfare whatsoever, landmark legislation giving a research mandate to the National Park System was included as part of the National Parks Omnibus Management Act of 1998. The bill passed Congress in the final days of the session in October, and was signed into law by President Clinton on November 13 (P.L. 105-391). As the name implies, the Omnibus Act rolled together several pieces of legislation related to national parks, including titles on career development and training, studies for proposed new parks, concessions reform (the major focus of the bill), fees, and other miscellaneous provisions. Title II, "National Park System Resource Inventory and Management," is the section mandating research in the System and the use of that research to support resource management decisions. The new law will affect not only the National Park Service, but other federal agencies (e.g., the U.S. Geological Survey Biological Resources Division), universities, and other entities that conduct research in the National Park System. We will have a detailed section-by-section analysis of the law, including its implications for research and resource management, in the next issue of* THE GEORGE WRIGHT FORUM. *The following is the complete text of Title II.*

Sec. 201. PURPOSES.

The purposes of this title are—

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

(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;

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

(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

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

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.

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

(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.

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.

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.

(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.

(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.

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

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.

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.

Source: *Congressional Record—Senate,* 14 October 1998, pp. S12494-12495.

Historical Perspectives on Science and Management in Yellowstone National Park

Susan Rhoades Neel and Paul Schullery, Guest Editors

Introduction

The essays appearing in this issue were originally presented at "People and Place: The Human Experience in Greater Yellowstone," the Fourth Biennial Scientific Conference on the Greater Yellowstone Ecosystem, October 12-15, 1997, at Mammoth Hot Springs, Yellowstone National Park.

Today, science is championed as a critical tool in managing the remarkable and all-too-often threatened resources of the American National Park System. Friends and critics alike continue to bombard the federal government with more and better science. Large segments of the public, politicians, and special-interest groups of all stripes persist in believing that science can sort out complex resource management problems. Yet, almost invariably, introducing science into a management controversy merely transforms it into a scientific controversy—scientists disagree, choose sides, and sometimes add their own rhetorical excesses to ongoing policy debates. Scientists (and the science they produce) are not immune from the ideological assumptions, social biases, and political vagaries of the surrounding culture. Historians of science have long been interested in exploring this interplay of science and society and a growing number of scholars have begun to examine the particular world of science and natural resource management. The essays in this special section of THE GEORGE WRIGHT FORUM present historical perspectives on the conduct of science in Yellowstone National Park—a place noted for a long tradition of innovative and often contentious resource management.

The philosopher of science David Hull recently wrote that "when scientists first opt one way or the other on important issues, the causal circumstances that are relevant to these decisions are extremely particularized. Only an intensive and extensive investigation of these circumstances can explain why science took the course it did.... If one wants to understand the course of science, it must be studied just as minutely as evolutionary biologists study changes in gene frequencies in local populations" (Hull 1988, 21). The following essays shine just such an intensive light on four episodes in Yellowstone's history, from the dawn

of serious interest in science as a management tool in the early twentieth century to the dawn of the modern environmental era in the 1960s. Each essay focuses on a different time period and on disparate subjects, ranging from Theodore Roosevelt's planned (but never realized) cougar hunt in Yellowstone to the earnest (but futile) effort of post-World War II managers to obliterate blister rust in a shower of Agent Orange. Yet all these studies share a common purpose—to demonstrate how integral science and scientists have been to the way in which Americans have imagined, valued, and cared for Yellowstone over its 125-year history.

Jeremy Johnston's reconsideration of Theodore Roosevelt's thinking about predators is an appropriate opener for this series, because Roosevelt (product of a truly particularized experience) provides us with such a vivid example of the state of resource-management science in his day. Make no mistake about Roosevelt's stature as a scholar. Described by the prominent professional biologist Edmund Heller as "the foremost field naturalist of our time," Roosevelt also served a term as president of the American Historical Association (Roosevelt once publicly debated taxonomy with no less a scientific and wildlife authority than C. Hart Merriam, and though Merriam was judged the winner by the observers, Roosevelt's positions were the ones that endured into later generations). The scientific disciplines that would later be so central in national park dialogues were still loosely defined enough to accommodate the occasional citizen-scholar like Roosevelt, and the national parks were still administratively adrift enough to experience the remarkable episodes of presidential micromanagement described by Johnston.

James Pritchard calls our attention to Charles C. Adams, an extraordinarily influential early ecologist who emerged on the scientific scene late in Roosevelt's life, and who was one of the most important voices in park natural-area policy in the first years of the National Park Service. While park defenders of Roosevelt's generation were generally content with simple admonitions to "leave it as it is," Adams and his colleagues began to address the still-problematic question of just what "it" was, and how we were to leave it as it was when it kept changing, and when it kept demanding our attention. The confidence of a Rooseveltian naturalist gave way to the somewhat more puzzled inquiries of an Adamsian ecologist.

The essay by Katherine Kendall and Jennifer Asebrook, on the history of blister rust control attempts in Yellowstone, illuminates a host of "particularized" elements of national park resource management that, though not focused on an individual scientist or manager, nonetheless are essential to appreciating the complex interplay of science and management in a park. Simply the image of park workers hiking along with open, sloshing containers of Agent Orange strapped to their backs gives us pause to consider where Charles Adams' quest for natural conditions

could lead the unwary optimist. More complex images, of various parks going their own ways for their own reasons, of the sometimes long lag between scientific breakthrough and management application, and of the society of BRC staff as part of Yellowstone's human subculture, suggest the convoluted course of the national parks as they sought to honor their mandates in the face of an irrepressible wild invader.

All these deliberations, struggles, and ambitions lead inevitably to a single, pivotal figure in national park science and management (and still perhaps the central figure in the intellectual history of the national parks): A. Starker Leopold. A respected, productive scientist and writer, Leopold and a few colleagues straddled the fence between the insufficiencies of science as a mentor and the perhaps even greater perils of philosophy as a resource-management tool. In the 1960s, as an advisor of the secretary of the interior, Leopold championed science and left a legacy of foresight and eloquence not since matched in management documents or advocacy tracts. Kiki Rydell traces not only the roots of his science but also his metamorphosis from scientist to policy advocate, and, like the three previous authors, sheds further light on how science has sought to come to terms with a modified version of the original Rooseveltian command: leave it as it is, once you figure out what it is.

In less than two generations, Starker's milestone 1963 report to the secretary of the interior has become historic. In the accelerating pace of resource-management evolution, the Leopold Report seems like something that happened long ago, and the pronouncements of earlier thinkers, including Roosevelt and Adams, are too easily discarded as quaint, almost ancient. Conservation biology, landscape ecology, environmental history, and other disciplines that were not even active in the 1960s now expose levels of philosophical, ethical, and scientific complexity that were scarcely imagined when the subjects of these four case studies were at work. But these earlier generations of park thinkers were grappling with issues and problems identical to those we face today. If their technology was feeble by comparison with ours, their intellects were in no way inferior, and their devotion to the parks still inspires us today. We neglect their thoughts, and the lessons of their triumphs and failures, at our peril. And now that Congress has provided the National Park Service with a firm mandate to conduct research (Title II of the National Parks Omnibus Management Act of 1998), the lessons of these historic figures become even more important to modern managers.

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Hull, David L. 1988. Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science. Chicago: University of Chicago Press.

Susan Rhoades Neel, Department of History, Montana State University, Bozeman, Montana 59715
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Jeremy Johnston

Preserving the Beasts of Waste and Desolation:

Theodore Roosevelt and Predator Control in Yellowstone National Park

Theodore Roosevelt's role regarding predator control in Yellowstone is often times misinterpreted or confused. When examining the history of predator control in Yellowstone, Roosevelt is sometimes portrayed as the hero or villain, depending on the writer's environmental interest. Much of this confusion is due to Roosevelt's continually changing attitude and his actions towards Yellowstone predators. In his ranching days in the Dakota Badlands, Roosevelt often referred to predators, such as wolves, as the beasts of waste and desolation.[1] His early writings clearly paint predators as destroyers of cattle and big game, yet from this flamboyant portrayal there eventually developed a careful study of predators and their natural behavior. This close study of wildlife in his early years, combined with a vast amount of time spent in the West, led Roosevelt to change his perception of predators. In Yellowstone, Roosevelt attempted to end predator control in order to maintain a natural balance of big game populations. This switch in perspectives was influenced by many things, including Roosevelt's goal of establishing a wildlife reserve in Yellowstone, his personal desires, and an increased knowledge of natural history.

Roosevelt's real interest in Yellowstone began in 1885 when he met the famed naturalist George Bird Grinnell. Roosevelt sought out Grinnell to demand an explanation for his review of one of Roosevelt's books. Grinnell explained his reasoning behind the problems he found with Roosevelt's book, Roosevelt realized the validity of Grinnell's arguments, and shortly after the two became good friends. Their friendship and shared interest resulted in the founding of the Boone and Crockett Club, an organization that worked to defend Yellowstone and its wildlife.

During his active role in campaigning for Yellowstone's defense in the name of the Boone and Crockett Club, Roosevelt began to envision the park as a breeding ground for wildlife. Roosevelt hoped that by protecting the park's wildlife, populations would dramatically increase and spread out to the surrounding regions. This would ensure the continuation of hunting, his favorite pastime, in the Yellowstone ecosystem. This would check Roosevelt's fears that the West was becoming a series of private game reserves, in which only the rich could hunt. As his political career progressed to the presidency of the United States, Roosevelt found himself in a position to achieve this goal.

The purchase of a pack of dogs to kill cougars became Roosevelt's first

step towards creating a wildlife refuge in Yellowstone. The purchase of the dogs resulted not just from Roosevelt's wishes to establish a predator control program in Yellowstone, but from his desire to arrange a personal cougar hunt in the park. A cougar hunt in Yellowstone would meet two objectives. First of all it would continue the ongoing process of eliminating predators in the park, allowing big game populations to recover from the results of intensive hide hunting within the park. A hunt in Yellowstone would also allow Roosevelt an opportunity to get reacquainted with his friend and hunting guide, John B. Goff.

Roosevelt first met Goff in January 1901 shortly after his election to the vice presidency. Goff guided the vice president-elect on his first real mountain lion hunt. Cougars greatly interested Roosevelt, yet as of 1893 he had only seen two live mountain lions in the wild. All of his natural history studies of the animal came mostly from the tales of outdoorsmen he met in the Badlands.[2] Roosevelt learned a vast amount about cougars during his hunt with Goff. The hunters killed fourteen cougars during the trip, twelve of which were killed by Roosevelt. Today this may be seen as useless slaughter, but in a time before high-tech film and advanced scientific methods were used to study wild animals, hunting was the only option available to those wishing to closely examine wildlife. "My narrative in the volume 'Outdoor Pastimes of an American Hunter'" wrote Roosevelt, "gave the first reasonably full and trustworthy life history of the cougar as regards its most essential details."[3] Clinton Hart Merriam, director of the Division of Biological Survey, agreed with Roosevelt. After receiving the cougars' skulls from the hunt, he wrote Roosevelt "your series of skulls from Colorado is incomparably the largest, most complete, and most valuable series ever brought together from any single locality, and will be of inestimable value in determining the amount of individual variation."[4] This information on cougars was later used by Roosevelt to make decisions on the use of predator control within the park.

Roosevelt began planning another hunt with Goff for the spring of 1903—a hunt which almost occurred in Yellowstone National Park. Philip B. Stewart, a political leader from Colorado Springs, initially took on the task of organizing the hunt, but one thing after another confounded his plans. First of all, Goff was wounded by an over-eager tourist during a cougar hunt. "I hope he beat the 'tourist' who inflicted the wound severely," Roosevelt wrote to Stewart.[5] Goff did recover rapidly and promised plenty of game to keep Roosevelt satisfied, but on January 22, 1903, Roosevelt wrote Stewart canceling the hunt. "Many things are conspiring to make it unlikely that I can go," he complained.[6] Instead Roosevelt was to make a grand tour of the Western states with one stop at

Yellowstone.

Still Roosevelt did not give up hopes of going on a hunt with Goff. Shortly after canceling his hunt, Roosevelt wrote Stewart of the possibility of sending Goff to Yellowstone. By bringing Goff to Yellowstone, Roosevelt would meet his objectives: control of predators in the park and an enjoyable hunt. "The park authorities say they would like Johnny Goff to be up there with his dogs on trial for the business of killing out some of the mountain lions," he wrote, "then if things went right, I might get a week with him myself."[7] Roosevelt's plan soon began to unravel. Secretary of War Elihu Root noted that Roosevelt's public image might be tarnished if he killed any animals in the park.

Roosevelt attempted to solve the issue by writing Major John Pitcher, the military superintendent of Yellowstone, asking if he had submitted any applications requesting hounds for killing predators. Roosevelt wanted to be sure if Goff could not reach Yellowstone for any reason, he would still be able to hunt mountain lions by using the park's pack of dogs. Pitcher's response is not known, but it appears that an application for three hounds was submitted. On March 2, Roosevelt ordered the secretary of the interior to send Pitcher an additional five dogs. Still worried about his public image, Roosevelt noted that "it would be better not to have Goff if you have good dogs that can hunt."[8] Roosevelt ordered Pitcher to put the dogs through a trial run, to be sure they would work. "We must be dead sure we get our mountain lion," noted Roosevelt.[9]

On the same day Roosevelt wrote this letter, Pitcher wrote a report for the president on the hunting possibilities. Pitcher must have made Roosevelt's day by describing the number of mountain lions in the area. He also noted that the park's buffalo keeper, Buffalo Jones, captured a live lion while feeding some bighorn sheep in the area. Pitcher reported the dogs from Texas would arrive in the park soon and kennels were awaiting them. "Now these lions have simply got to be thinned out, and if you will lend us a hand in the matter, you will be of great help to us," Pitcher wrote, "and no one can offer any reasonable objection to your doing so."[10] When the hounds arrived in Yellowstone, Roosevelt canceled Goff's services to avoid any talk of bringing a hunting guide to the park.[11]

Roosevelt continued eagerly planning for his trip to Yellowstone with Pitcher's assistance. Although being president regulated his planning for hunts, especially in regard to his public image, it did have its advantages. By being commander in chief one could commission the army to arrange hunts on public lands where no hunting by the public was allowed. However, Roosevelt's plans

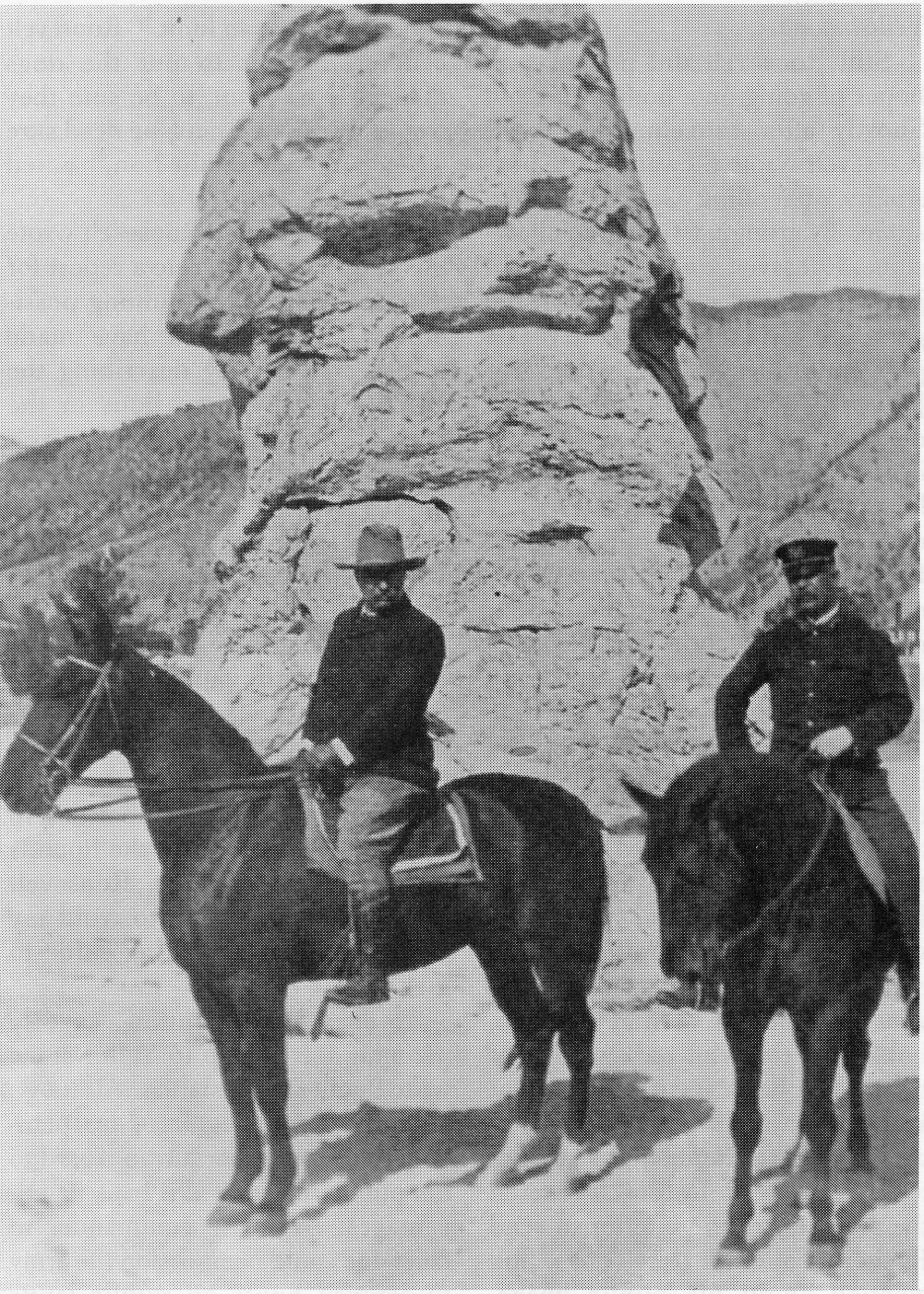

Figure 1. Theodore Roosevelt and Major John Pitcher, acting superintendent of Yellowstone National Park, at Mammoth Hot Springs during the president's 1903 visit to the park. Liberty Cap, an extinct hot spring cone, is directly behind them, with Fort Yellowstone in the middle distance. National Park Service photo.

began to take another turn on March 21, when Pitcher informed the president that only four of the eight dogs were received, and those were untrained. Buffalo Jones was attempting to train them by using his captured mountain lion. Pitcher also noted that he telegraphed Mr. Poole, who was supplying the dogs, and informed him that he needed the other four, two of which must be trained or the contract was void. Poole telegraphed back saying four more dogs were being shipped to the park. Pitcher requested Goff's address in order to contact him should the four new dogs be unsuitable.[12]

Upon receiving the news, Roosevelt wrote back to Pitcher to cancel the hunt. "Having had experience in the past with individuals who sold hounds," Roosevelt wrote, "I am not in the least surprised at your news."[13] Roosevelt also commented "an untrained hound is worse than useless. Such a pack will run deer or elk in the place of lion, and will be a perfect curse to the Park."[14] Roosevelt also noted that bringing Goff up to the park would be unacceptable. "The more I have thought it over ... [Goff's] coming up would cause a great deal of talk," reflected Roosevelt.[15] He concluded the letter by noting that seeing the game of the park would be exciting enough, and if on the off chance the hounds were trained in time, he would attempt to hunt mountain lion. Roosevelt then made plans to visit the park with John Burroughs on a sight-seeing tour only.[16]

Roosevelt's visit allowed him a substantial amount of time to study Yellowstone's wildlife. During the trip, Roosevelt's perspective of predators began to change, especially after viewing the conditions of Yellowstone's elk herds. The president viewed many elk along his way to the first camp site on Cottonwood Creek. Roosevelt noted that elk "were certainly more numerous than when I was last through the Park twelve years before."[17] The President, with the aid of Pitcher and Elwood Hoffer, their guide, counted three thousand head of elk in one sitting. Roosevelt also noticed many elk carcasses lying on the ground. He paid close attention to what had caused their deaths. Two were killed by scab, some were killed by cougars, but the majority were killed by starvation, resulting, Roosevelt believed, from overgrazing by wild animals in the region.

Roosevelt now began to defend the cougars' presence. "As the elk were evidently rather too numerous for the feed," he later wrote, "I do not think the cougars were doing any damage."[18] He began to worry the elk herds would meet the same fate as his cattle herds had in the disastrous winter of 1886-87. Roosevelt feared the elk would overgraze the range, leaving little if any winter feed. He felt this would lead to starvation for the elk herds and other wildlife. Big-game populations, especially the elk herds, needed to be thinned down,

and Roosevelt realized predators would be needed to fulfill this function. This was an unusual view of predators for the time, especially from a former western rancher.

The main predators that concerned Roosevelt were cougars, for he felt coyotes and wolves were not as dangerous to the big-game herds. Roosevelt now realized predators could keep down the elk numbers, but he still feared predation would destroy other big-game populations such as deer and bighorn sheep. Roosevelt began advocating a limited predator control program for Yellowstone. The hounds imported for Roosevelt's planned hunt were placed under the control of Buffalo Jones; however, Jones soon ran into a conflict with park military officials and resigned his position as gamekeeper and predator-control agent. The job of regulating predators was now open and Roosevelt stepped in to fill it. Roosevelt knew the man for the job: his old hunting guide John B. Goff. Roosevelt had kept in touch with Goff after canceling his services for the proposed Yellowstone hunt, and in the spring of 1905 Roosevelt finally hunted with him near Glenwood Springs, Colorado. During this hunt, the President wrote to Major Pitcher; A. A. Anderson, forest inspector; and Ethan A. Hitchcock, secretary of the interior; requesting that Goff be "given all the privileges that can be given for killing lion within or without the park."[19] Goff left for Yellowstone in June 1905, expecting the job of thinning out the Yellowstone lion population would take four years.[20]

The president's instructions to Goff clearly indicate Roosevelt's new approach to predator control. "Of course you can not afford to let the cougar exist in the neighborhood of where the deer and sheep are," Roosevelt wrote Goff, "but any cougar that are found off where there are practically nothing but elk, I should think it a good plan to leave them alone."[21] Roosevelt failed to realize that Yellowstone's predator population was already too low after years of steady hunting by various individuals. "Roosevelt was misinformed about the lion situation," Byron Goff, John's son, later recalled.[22] John Goff soon discovered that the mountain lion population was not as great as expected and after less than a year of service he resigned.

Shortly after Goff left the park, Roosevelt began to see how dangerously low the predator population had become. Roosevelt then took actions to repeal his predator control policies. In a 1908 letter to Superintendent S. B. M. Young, Major Pitcher's replacement, Roosevelt ended the predator control program:

> I do not think any more cougars should be killed in the park. Game is abundant. We want to profit by what has happened in the English preserves, where it proved to be bad for the grouse itself to kill off all the peregrine falcons and all the other birds of prey. It may be advisable, in case the ranks of the deer and antelope right around the Springs should be too heavily

killed out, to kill some cougars there, but in the rest of the park I certainly would not kill any of them. On the contrary, they ought to be let alone.[23]

After this directive, cougars were not harmed (though hundreds of coyotes were killed) in Yellowstone until the winter of 1913-14 when another predator control agent was hired to kill the predators. Predator control would continue through the conclusion of the army's role in the park in 1918, and into the National Park Service's administration, until the 1920s, when the mountain lion and wolf populations were almost entirely eliminated from the park.[24]

Roosevelt's attention again focused on Yellowstone in 1912. Roosevelt became concerned over the increasing populations of elk within the park. He had previously expressed his worries regarding the overgrazing of elk within the park, now he feared the problem would result in a disaster.[25] The only solution, Roosevelt decided, was that "it would be infinitely better for the elk, infinitely less cruel, if some method could be devised by which hunting them should be permitted right up to the point of killing each year on an average what would amount to the whole animal increase.... Of course the regulation should be so strict and intelligent as to enable all killing to be stopped the moment it was found to be in any way excessive or detrimental."[26]

A number of problems prevented Roosevelt's new elk policy from being established. It was hard to convince the public, including park administrators, that the Yellowstone elk herds should be culled in some manner. The park administrators did attempt to solve the problem by decreasing domestic grazing in the National Forest Reserves and by shipping elk outside of the Park, but this was not effective, in Roosevelt's opinion.[27]

As Roosevelt predicted, the winter of 1916-17 took a heavy toll on the elk populations. Heavy snowfall kept the elk herds from traveling to their winter range. Many elk died from starvation and many people became overly alarmed that the species was again headed for extinction. Most of this fear was based on exaggerated counts from previous years, but the new park administration responded to this fear by implementing a policy of continually feeding hay to the elk. Roosevelt felt this would only compound the problem by once again raising the elk population to uncontrollable standards, now that predators were no longer effectively culling the herds.[28]

Death prevented Roosevelt from pursuing a solution to the issue of elk overpopulation in the park. In 1919, Roosevelt passed away at his home Sagamore Hill, New York. With his death, Yellowstone lost one of its most important defenders. Roosevelt's handling of predators in Yellowstone will always be debated as being good or bad. Yet one thing is clear: Roosevelt attempted to estab-

lish policies that he believed were in Yellowstone's best interest. Unfortunately, he failed to grasp many environmental changes that were occurring in Yellowstone during his lifetime. He failed to recognize how drastically the environment had been changed by those before him, especially how much damage had been done to the predator populations. He also failed to recognize that the large increase in elk populations and the effects of winter kills were a natural part of the Yellowstone ecosystem. Despite these failures, Roosevelt's attempts were fairly advanced for his day and age. He made an effort to look beyond the image of predators as beasts of waste and desolation to critically examine their valuable role in the Yellowstone ecosystem.

Endnotes

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Charles C. Adams and Early Ecological Rationales for Yellowstone National Park, 1916-1941

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As America's first national park, Yellowstone has long been the focal point for contentious public debate over federal resource management policies. Few such policies have been as hotly contested in recent years as what has come to be called "natural regulation"—a policy of letting ecological processes, such as fire, take their natural course within Yellowstone's boundaries. Critics of natural regulation, most notably Alston Chase in his 1987 jeremiad *Playing God in Yellowstone,* attribute this policy to "a new philosophy of nature" invented by "California cosmologists" in the 1960s. The sixties were, indeed, an era of shifting popular and scientific ideas about the environment and consequent changes in federal approaches to managing national parks. It is, however, a serious misreading of Yellowstone's history to suggest that ecological rationales emerged fully formed in the 1960s and then spread within National Park Service ranks like an insidious foreign plant species. Such ideas, in fact, had been the subject of study and discussion among park managers and scientists for many decades. Charles C. Adams, an early twentieth-century animal ecologist, conceived a scientific rationale for Yellowstone in the 1920s, arguing that the park preserved "natural conditions" and thus enabled scientists (and the public) to observe nature's processes free from human intervention. An examination of Adams' work demonstrates that the idea of Yellowstone as a place to preserve natural conditions has been a powerful and enduring theme in the park's history.

During the first two decades of the twentieth century, scientists influenced park development by participating in the movement for national park standards, and by advocating the preservation of natural areas. Charles Christopher Adams was an instrumental member of the movement to protect "primitive conditions" in national parks. Arriving from Harvard at the University of Chicago in 1899, Adams studied under Charles B. Davenport, Henry C. Cowles, and Charles Otis Whitman. He worked as a curator at the University of Michigan's Natural

History Museum while completing his Ph.D., awarded in 1908. From 1908 to 1914, he served as a professor in animal ecology at the University of Illinois. In December 1914, he participated in the initial organizational meeting of the Ecological Society of America (ESA), along with Victor Shelford, Henry C. Cowles, and others. The ESA named Adams its president in 1923.[1]

In 1913, Adams's *Guide to the Study of Animal Ecology* discussed the importance of ecological investigations, pointing out that experts in taxonomy traditionally designed the surveys employed by museum expeditions and for analysis of fishery resources. Economically useful lists resulted, but these were of limited use for discovering relationships among animals. A descriptive element was essential in ecology, yet the scientist must do more than collect specimens, also gathering "observations on the habits, activities, interrelations, and responses of animals."[2] Ecological surveys needed to be developed in a deliberate manner. Adams was self-consciously splitting away from natural history traditions as he helped create the field of animal ecology.

For Adams, field work was essential to ecology. He repeated the question posed by William Keith Brooks in 1899: "'Is not the biological laboratory which leaves out the ocean and the mountains and meadows a monstrous absurdity?'"[3] Adams thought answers to important questions would be found not in the laboratory but in the field. Ecologists must not simply gather data, but learn to habitually "study in the field."[4] By this he meant thinking, endlessly mulling over facts and observations: field data helped the ecologist to arrive at the ultimate aim, "the *interpretation* of the responses of animals to their complete environment."[5]

The work of Charles C. Adams gave the National Park Service scientific reasons to protect the "primitive" character of its landscapes. While use of the term "primitive" over time seemed to yield to the word "original" and finally to "natural," the terms were interchangeable through the early 1930s as scientists and conservationists discussed the conditions they aimed to preserve in the parks. Adams urged scientists to conduct ecological surveys to record animal "associations, their interrelations and responses to their environment—before they have become too much changed or exterminated."[6] Adams suggested that saving every type of environment might not be possible, but he felt it important to at least record for posterity the ecological relationships. Adams sought a study of "original conditions," which were vanishing with each succeeding generation.[7] He wondered "if the naturalists of the future will commend our foresight in studying with such great diligence

certain aspects of biology which might be very well delayed, while ephemeral and vanishing records are allowed to be obliterated without the least concern."[8]

Adams was not alone in his concern about preserving natural conditions in park landscapes. In 1916, Joseph Grinnell and Tracy Storer, scientists at the University of California's Museum of Vertebrate Zoology at Berkeley, published "Animal Life as an Asset of National Parks" in the journal *Science.* Their thoughts about the national parks reflected some of the latest ecological thinking, but also revealed how natural history traditions and cultural baggage limited conservation practices.

To "realize the greatest profit" from parks' native animal and plant life, wrote Grinnell and Storer, "their original balance should be maintained." Dead trees should not be cut down, because they "are in many respects as useful as living" ones: woodpeckers which ridded the living trees of destructive insects found sustenance as well as nesting sites in standing dead timber. They considered downed timber also essential in maintaining a "balance of animal life," for decaying logs provided homes for mice and thus supported hawks, owls, fox, and marten. Undergrowth or thickets should not be destroyed in parks any more than necessary because they provided "protective havens" as well as berries for birds, squirrels, and chipmunks. Non-native species, they thought, should be excluded from the parks: "In the finely adjusted balance already established between the native animal life and the food supply, there is no room for the interpolation of an additional species." The well-known example of the English sparrow proved this point—that introduced species often competed so well that they displaced native species.[9]

Grinnell and Storer saw the predator situation very differently from the NPS Ranger Division and the Bureau of Biological Survey. The Berkeley scientists advised that predators in the national parks be allowed to "retain their primitive relation to the rest of the fauna," even if they levied a considerable annual toll on the other native animal life. These naturalists were convinced that prey species, such as mice and squirrels, had adjusted themselves to regular predation by carnivores. Like many other naturalists of their time, Grinnell and Storer thought of predatory animals such as marten, fisher, fox, and golden eagle as "exceedingly interesting members of the fauna."[10] In the context of 1916, "interesting" meant that the animal was of considerable scientific curiosity because naturalists knew very little about the species.

Grinnell and Storer argued for an absolute prohibition against hunting or trapping any wild animals in the parks. The principle was simple: "The native complement of animal

life must everywhere be scrupulously guarded," especially along roads where the animal life was most likely to be seen by visitors, and thus had the "highest intrinsic value from an esthetic viewpoint."[11] Grinnell and Storer equated park predator control with the destruction of natural balance, and they offered an attractive esthetic justification for nature preservation.

Yet their willingness to entrust nature with the balance had limits. Nature might be adjusted, they suggested, to present the animal life of a national park at its best to the human visitor. Managers might increase native berry-producing plants, especially in the vicinity of camps and buildings, making up for thickets destroyed in building and road construction, allowing visitors to see a greater variety of bird life. They thought that local feeding stations during tourist season would not alter natural conditions "in any serious degree."[12] Their emphasis on the localized control of predatory birds in order to create roadside venues for bird-watching demonstrates their conviction that naturalists might control nature, carefully arranging the wildlife for display.

Adams helped spark a larger movement in the Ecological Society of America. In 1917, ESA President Ellsworth Huntington appointed Victor Shelford to head a new Committee on Preservation of Natural Conditions for Ecological Study, which functioned through 1946. By 1921, the committee identified nearly six hundred natural areas, many of them in the national parks, that deserved preservation. Emphasizing scientific rationales over recreational and aesthetic reasons for preservation, the committee advocated "An Undisturbed Area in Every Natural Park and Public Forest." By 1921, about ten percent of the ESA's membership enthusiastically joined the Committee, which during the 1920s fought irrigation schemes in the national parks, including one intended for the Bechler Basin in southwestern Yellowstone. Scientists were concerned that logging and hunting were one step behind, forever changing the original conditions found there. Other organizations such as the National Research Council signed on to the campaign to preserve natural conditions. A widely-noted public statement of scientists on the subject came in 1921, when the American Association for the Advancement of Science passed a resolution opposing the introduction of exotic plant and animal species into the parks. Significantly, the resolution opposed "all other unessential interference with natural conditions."[13]

Barrington Moore, editor of the journal *Ecology,* joined Adams and Shelford in publicizing the need for preserving natural conditions in the national parks. In the Boone and Crockett Club's 1925 publication

Hunting and Conservation, Moore explained the scientists' case for preserving parks in a natural state. People must see conservation in the broadest sense, wrote Moore, where the object was putting every acre of land to its "highest use."[14] National parks were important for recreation, but they also offered an opportunity to study plant and animal life "in their natural surroundings."[15] Moore argued that scientists were becoming less satisfied with collecting and identifying, wanting instead to pursue new studies in heredity and environment. Laboratories were necessary but not sufficient; studying in nature's workshop would enable investigation of evolution and adaptation first-hand.

Despite his recognition of a constantly evolving world, Moore also saw a balance of nature. Investigating this balance made national parks important to science, thought Moore, as the parks increasingly represented the last undisturbed places. He argued that the "processes of nature are so delicately adjusted" that when people interfered with nature the results were entirely unpredictable.[16] In America, Moore thought, species of animals had gone extinct precisely because people had upset the balance of nature by introducing nonnative fish and game animals to forests and parks, and by removing dead trees.

Not only scientists, but national park advocates as well spoke out on behalf of primitive nature in the parks. The National Parks Association (NPA), established in 1919, utilized the idea of preserving "primitive" conditions through the early 1930s in its language and view of the parks' purpose. Robert Sterling Yard was associated with the National Park Service from its inception. When Stephen Mather came to Washington to take charge of the new bureau, he brought Yard at his own expense to serve as the agency's publicity director in Washington. An experienced journalist, Yard wrote articles that brought favorable publicity to the parks. With Mather, Yard established the NPA, but soon friction developed between them.

Yard's ideal vision of the parks was embodied in his campaign for "National Park Standards," an effort to restrict the national park designation to landscapes of national interest. Yard's standards defined the parks as large landscapes that essentially maintained their "primeval" state, superior in quality and beauty, lands deserving preservation for people's education, inspiration, and enjoyment. The NPA suggested that parks should be "a sanctuary for the scientific care, study, and preservation of all wild plant and animal life within its limits, to the end that no species shall become extinct." The NPA urged that "wilderness features" in parks "be kept absolutely unmodified." Finally, National Park Standards urged that "sanctuary,

scientific, and primitive values must always take precedence over recreational or other values." Thus during the 1920s, the NPA saw not only the danger of industrial intrusions into the parks, but already worried about the proper balance between use and preservation.[17]

Charles C. Adams remains central to this story because he served as an early connection between ecology and the National Park Service, contributing to science in Yellowstone in a very direct fashion. In 1919, Adams helped establish and became the first director of the Roosevelt Wild Life Forest Experiment Station, located at New York State University's College of Forestry in Syracuse. Professor Alvin Whitney, Adams's colleague at the School of Forestry, operated a Boy's Forest and Trail Camp from 1921 to 1923 in Yellowstone. Although the camp ended up a financial bust, it provided the first connection between Yellowstone and the Roosevelt Experiment Station. Field parties began to journey from Syracuse to Yellowstone National Park, establishing their headquarters at Camp Roosevelt near the junction of the Yellowstone and Lamar Rivers.[18]

The Roosevelt Experiment Station supported several of the earliest scientific studies of wildlife in Yellowstone. In 1922, Edward R. Warren published an article on "The Life of the Yellowstone Beaver," while Richard A. Muttkowski's study on the food habits of Yellowstone trout appeared in the *Roosevelt Wild Life Bulletin* in 1925. Edmund Heller, a staff member of the Museum of Vertebrate Zoology and co-author (with Theodore Roosevelt) of a book about African wildlife, turned his talents to a study of big-game animals in Yellowstone in 1925.

While some contributors to the *Bulletin* visited Yellowstone only briefly, Milton P. Skinner spent much of his professional career associated with the park, working as Yellowstone's first park naturalist from 1920 to 1922. Skinner then secured an appointment as one of two Roosevelt Field Ornithologists. He was promoted to Roosevelt Field Naturalist in February 1924.[19] In 1925, his voluminous study on Yellowstone's birds appeared in the *Roosevelt Wild Life Bulletin*, and in 1927 Skinner wrote a prescient article on predatory and fur-bearing animals of the park for the journal.[20] In 1925, he also published *Bears in the Yellowstone.* A veteran of many days in the field, Skinner had observed the bears enough to make detailed comments on their food habits, information that became important during the 1970s when biologists questioned the dependency of bears on park garbage dumps. Bears, noted Skinner, ate roots and bulbs in the spring, berries at the end of summer, pine cones, timber ants, termites, "fat juicy grubs," indeed "practically everything edible."[21]

In 1926, Adams became preoccupied with his new position as director of the New York State Museum in Albany, busy with work on the American Society of Mammalogists' Committee on Wild Life Sanctuaries, and engaged with the ESA Committee for the Preservation of Natural Conditions. The Roosevelt Wild Life Experiment Station did not sponsor additional projects in Yellowstone, although it pursued studies in New York and published its *Bulletin* until 1941. Even though the station's staff performed investigations in Yellowstone for a relatively short time span, they performed some of the earliest significant ecological science in the park.

There were limits, of course, on how much the idea of preserving natural conditions affected NPS management practice during the 1920s. Yellowstone's creation owed much to the influence of railroads, and their interest in promoting tourism set precedents for the park. NPS Director Stephen Mather also emphasized tourism development to build a popular base of support for the bureau. Defending the national parks from commercial development meant encouraging park use. Yellowstone Superintendent Horace Albright never fully embraced Adams's notion of preservation to protect an unmodified nature. Pragmatically, he protected and manipulated animal populations with the intention of providing tourists with the opportunity to see abundant wildlife.

Yet the connection between Adams and Yellowstone laid a foundation for later thinking about what the parks could protect and preserve. The idea of preserving natural conditions influenced Yellowstone's wildlife management in significant ways. During the 1930s, national parks stopped controlling predators. Shortly after World War II, Yellowstone dismantled its bison ranching facilities to present wild animals in their natural setting. Park administrators closed the bear feeding platforms with the idea of eliminating the most garish zoo-like features of the park. To preserve a "natural" range, Yellowstone rangers began a systematic program of transporting (and eventually slaughtering) "surplus" elk in the 1920s. Since the late 1960s, however, park biologists have questioned prevailing ideas about what a rangeland should look like in a natural condition. Today, Yellowstone no longer sponsors a fish hatchery that artificially augments sport fish populations.

Not only scientists, but tourists and philosophers still look to the national parks as places where nature proceeds according to its own rhythm. The Yellowstone ecosystem, despite the limits our culture and our past place upon it, remains "one of the largest, essentially intact, wild ecosystems remaining in the earth's temperate zone."[22] As Charles C. Adams hoped, it remains one of the

last places where biologists can watch functioning natural systems with most of their original complement of animals and plants, largely unaffected by human manipulation. The reintroduction of the wolf represents a major step in recreating the natural conditions Adams wanted to preserve. We sometimes think of nature preservation in the parks as the direct descendent of aesthetic preservation. In fact, a complex interaction among cultural movements, ideal notions about how nature works, changing conservation strategies, scientific information, institutional structures and a dash of politics have informed and shaped park policies. Scientists, including Adams, proposed during the early twentieth century that Yellowstone serve as an ecological control. This has endured as one of its most significant purposes, underlying both management and public understandings of nature in Yellowstone.

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The War Against Blister Rust in Yellowstone National Park, 1945-1978

Following the discovery in the early 1900s that white pine blister rust threatened North American forests, the federal government launched a massive campaign to eradicate the disease. This control program ran for more than fifty years, first under the auspices of the Office of Blister Rust Control (created in 1916 as part of the U.S. Department of Agriculture Bureau of Plant Industry) and, later, under the U.S. Forest Service (Benedict 1981). The war on blister rust cost more than $150 million and was the most extensive forest disease control effort in the history of American forestry (Maloy 1997). As scientists now understand, this effort was ineffective in preventing the spread of blister rust. In the greater Yellowstone area, the fight against blister rust did not begin until the 1940s and, paradoxically, gained momentum just as blister rust control programs in other regions dwindled in the face of evidence that eradication measures were not working. The story of greater Yellowstone's belated entry into the war against blister rust and the persistent commitment to a program that had been discredited in other areas offers a valuable case study in how resource management decisions are influenced by a complex matrix of scientific, social, and economic forces.

Figure 1. A typical blister rust control camp in Yellowstone National Park

Blister Rust Life Cycle

Blister rust is caused by the fungus *Cronartium ribicola* Fischer. This organism requires two alternate hosts: white pines and plants of the genus Ribes that includes wild currants and gooseberries. The rust is a harmless annual on ribes plants but is a lethal perennial on many white pine species.

White pine blister rust cannot be passed directly from pine to pine. The fungus has a complex life cycle involving two spore phases in the bark of white pines and another three phases in ribes leaves. After residing in trees over the winter, the fungus produces sacks in spring that push through the bark, creating tree blisters or cankers. Each sack is filled with thousands of orange-colored spores. In May and June, these sacks mature and rupture, releasing spores that can be wind-dispersed many miles to ribes plants. The spores create pustules on ribes leaves and, under favorable conditions, a second type of spore is produced that infects other ribes plants. In late summer or fall, telia (hair-like spore columns) develop on the pustules, creating a brownish or rust-colored mat on the underside of ribes leaves. Telia produce sporidia, the spores that infect white pine. Sporidia are wind-dispersed and usually travel only a few hundred feet. However, under highly favorable conditions it may spread a mile or more (Miller et al. 1959). Viable transport and germination of sporidia usually occurs when the weather is cool (temperatures less than 70 degrees Fahrenheit) and moist (relative humidity greater than 97%). When the spores reach pine needles, the sporidia germ tubes enter the stomata and, within a year, grow into the bark at the base of the needle bundle. As the fungus grows, the bark swells and releases ribes-infecting spores that perpetuate the cycle. Once a canker grows completely around the trunk, it is girdled and the tree dies. Sometimes only branches are infected but this, too, can kill the pine if cankers defoliate most needle-bearing twigs.

About half of the 80 species of ribes native to the United States grow within white pine range. The susceptibility of ribes to blister rust varies by species (Miller et. al. 1959), although all are capable of supporting rust.. Of the ribes found in the Yellowstone area, the order of susceptibility to blister rust is *Ribes petiolare* > *R. montigenum* = *R. inerme* > *R. cereum* = *R. setosum* > *R. lacustre* = *R. viscosissimum* (Maloy 1997). Two white pines occur in this region: whitebark and limber pine. While both are highly vulnerable to blister rust, whitebark pine is rated as the most susceptible white pine in the world (Hoff et al. 1980).

Distribution

Blister rust was first discovered in the Unites States in 1906 in Geneva, New York (Miller et. al. 1959) on a plantation of young white pine *(Pinus strobus)* seedlings imported

from a European nursery. Later dating of cankers on other white pines demonstrated that blister rust was likely introduced to the east coast in 1898. Ironically, blister rust spread to Europe from the Baltic region of Russia, where white pines had been introduced from America (Miller et. al. 1959). By 1900, blister rust had spread over most of Europe.

Blister rust was introduced to the West Coast of North America at Vancouver, British Columbia, in 1910, again on infected nursery stock from Europe. It went unnoticed until 1921 when it was found in several white pine stands in British Columbia and northwestern Washington (Miller et. al. 1959). The disease then spread in several stages along the West Coast. Blister rust moved slowly through northwestern Washington until the 1920s when the rate of spread increased dramatically. By 1933, the disease was established along the Oregon coast, well into northwestern California, through northern Idaho, and into western Montana. This surge corresponded to 'rust waves' regulated by favorable weather conditions in 1919, 1921, 1923, 1927, 1933, 1937, and 1941 (Maloy 1997). From 1943 to the late 1960s, blister rust infection spread in a slower and less uniform fashion into Wyoming and arrived in Yellowstone and Grand Teton national parks. After its discovery in Laramie, Wyoming, in 1967, blister rust was not found south of Wyoming until 1990 when it was found on southwestern white pine *(Pinus strobiformis)* in southeastern New Mexico (Conklin 1994).

Control in Yellowstone and Grand Teton National Parks

The first blister rust survey in and around Yellowstone National Park was conducted in 1934. Although no evidence of blister rust was found in the park at this time, the survey determined that approximately 550,000 acres, or about 25% of the park, supported stands with whitebark and limber pine trees.

Scouting for the disease increased in Yellowstone once blister rust infection was found on ribes in 1937 in the Bear Creek drainage of the Gallatin National Forest, 19 miles from the park boundary. Reconnaissance focused in areas with heavy concentrations of *R. petiolare*, a species highly susceptible to infection. In 1944, blister rust was found for the first time in Yellowstone on two *R. petiolare* bushes in Clematis Gulch in the Mammoth Hot Springs area. From this point, blister rust continued to spread through the park. By the end of the blister rust control era, 31 areas totaling 115,470 acres were designated for protection (Figure 2).

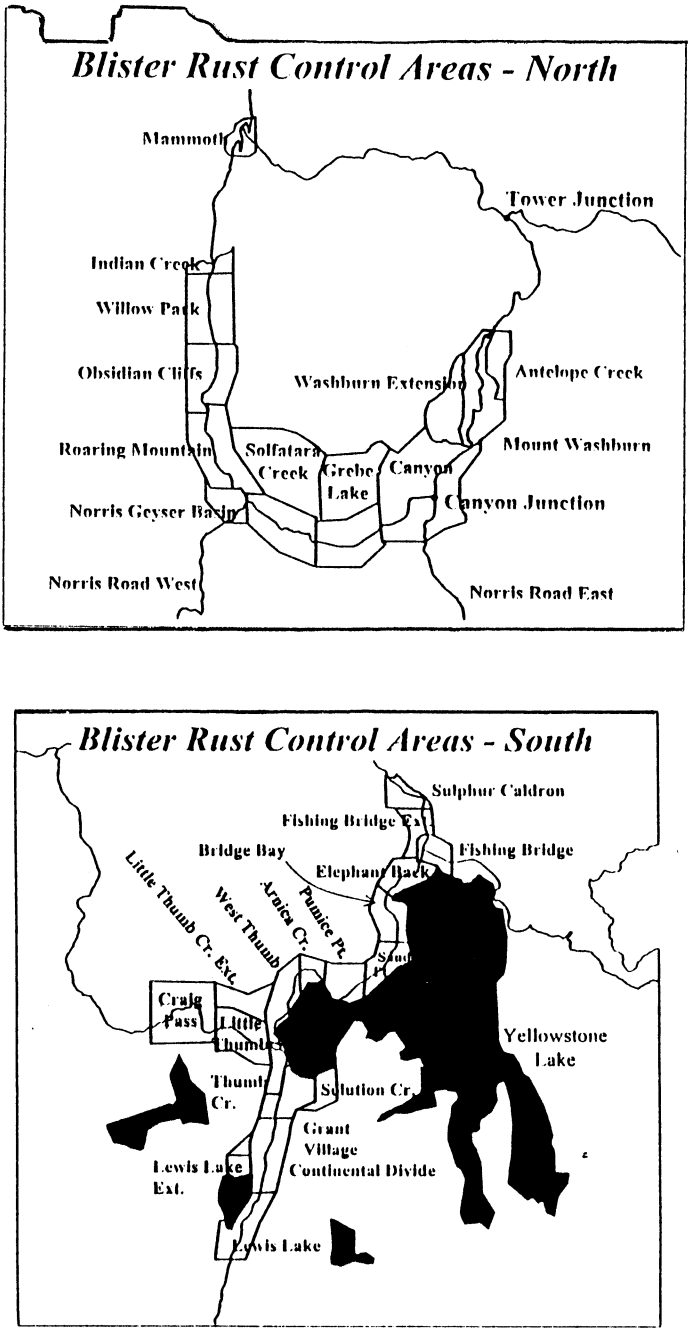

Figure 2. Blister rust control units in Yellowstone National Park

The period 1945-1956. Blister rust control officially began in Yellowstone in 1945, coinciding with the replenishment of the labor pool with the discharge of troops at the end of World War II. One camp with 20 men was established to begin eliminating ribes in three control units: Mammoth, Mount Washburn, and Craig Pass. Like many of the control units that were to be established along the Grand Loop road system, these original units were chosen because of their scenic value along roads and in high visitor-use areas. These units totaled 9,600 acres and, with the addition of the Mount Washburn extension unit (3,500 acres) in 1951, were the focus for treatment until 1956 (Figure 3).

Treatment during these years went through many changes, due mostly to the development of new technology and herbicides. The first year of control included hand pulling ribes plants and chemical spraying of ammonium sulfamate in solution on root stocks. Manual removal continued to be a significant method of eradicating ribes plants through the entire program, but herbicides quickly became an integral component of ribes control in Yellowstone. Although its blister rust control program started later, Yellowstone began to use chemicals three years before other national parks in the region.

Figure 3. Blister rust control crew (possibly at Canyon), Yellowstone National Park, 1952

From 1946 to 1948, 5,592 gallons of ammonium sulfamate and 2,4-D (Dichlorophenoxyacetic acid), a common defoliator, were sprayed on root stocks or leaves of ribes plants. Beginning in 1949, however, and continuing until 1967, Yellowstone used 2,4,5-T (Trichlorophenoxyacetic acid) for chemical ribes control. Yellowstone, like many other parks and national forests, used more powerful chemical applicators as they were developed. In 1952, the park began using portable power sprayers, increasing the efficiency of chemical application of 2,4,5-T on ribes. By 1958, they began to use Hi-Fog units with 1,000 pounds of pressure per square inch at the nozzle, capable of producing a mist-like spray. This was desirable because it made it possible to use only small amounts of concentrated spray on the ribes bushes.

When combined with 2,4-D, the hormone chemical 2,4,5-T creates 'Agent Orange', the defoliant widely used during the Vietnam War. This chemical was eventually used by other agencies and parks throughout the region despite the fact that the dangerous dioxin TCDD had been found in 2,4,5-T in 1957. Workers clearly did not know the potential hazards of this chemical. One Yellowstone worker later wrote: "We pumped tons of 2,4,5-T.... Had great water fights with it—don't know if Agent Orange had any effects on co-workers—not on me or progeny." Clark Penn, a blister rust control crew member, reports that the portable backpack sprayers used in Glacier National Park in 1952 had open-topped tanks. As a result, the herbicide solution often sloshed out of the tank and down the men's backs as they scrambled through brush and over mountainsides (personal communication, September 1998).

During the Depression years of 1933-1940, before blister rust control began in the Yellowstone region, an infusion of labor through the Civilian Conservation Corps (CCC) and money from emergency programs greatly accelerated control programs across the country. The control workers during this period, however, were often found to be inexperienced and without interest in the work. Retention of a competent labor force was a constant problem prior to the late 1940s (Maloy 1997). The post-World War II crews used in Yellowstone, however, were "run ruthlessly in a military fashion.... Veterans fresh from military service and the war necessitated a similar military treatment to insure the discipline and efficiency tantamount to doing the job and doing it right. Not only did this partially utilize the surplus workers available but it established a degree of excellence unparalleled in earlier times" (USDA 1947). This paramilitary approach appears to have instilled an esprit de corps, and established a reputation of blister rust control crews as being hard-working and tough that per-

sisted to the end of the program. Blister rust control was also supported on many levels because these personnel were also available and sought-after for fighting fires (Benedict 1981).

As ribes infection continued to spread, the cost of control increased. The more seasoned crews in Yellowstone, no doubt, helped reduce costs and improve results. From 1945 to 1956, crews had treated or pulled 3,825,186 ribes plants, used 122,493 gallons of 2,4,5-T, initially treated 13,060 acres, and reworked 9,290 acres (Table 1). A total of 414 employees had put in 17,826 workdays and $381,000 ($2,273,670 in 1994 dollars) had been spent on the program.

The period 1956-1966. Beginning in 1950, however, rust rapidly intensified and spread through Yellowstone. Blister rust was found for the first time on a limber pine in 1950 (1948 infection origin) in the Slide Lake Creek drainage approximately three miles north of Mammoth Hot Springs and on a whitebark pine (1945 origin) in the Mount Washburn area in 1951. Clearly, white pine infection had been present longer than previously recorded. Ribes infection was also found in Lamar River Valley, on Stevens Creek, and on Elk Creek, and was twice as heavy as 1946 estimates at Slide Lake Creek by the early 1950s. By 1954, heavy pine infection centers had been found adjacent to the north and west boundaries of the park and infected limber pine were found within one mile of the Mammoth control unit. So in 1956, Yellowstone included 20,190 additional acres in the program with control units at Antelope Creek, Canyon, and Fishing Bridge, and an addition to Craig Pass (Figures 1 and 5).

Nineteen fifty-six was also the year that blister rust control began at Grand Teton National Park when the disease was found for the first time on a limber pine at Deadman's Bar. Grand Teton treated approximately 1,000 acres at this one control unit during four individual years. They eliminated 182,700 ribes plants through hand-pulling and spraying in 1957-1958 (Figure 4) and used 10,990 gallons of 2,4,5-T (Table 2). In 1961 and 1966 another 19,900 ribes plants were removed by hand-pulling; no chemicals were used in those years.

Blister rust continued to infect unprotected whitebark and limber pines. A 1961 survey outside the Mammoth control area found 7% of the trees infected, with 67% of those having killing cankers. With infected trees also found near Glen Creek, Golden Gate, Obsidian Cliff, and the Tower Fall campground, Yellowstone continued to add other blister rust control areas to the program. In 1962, 35,730 additional acres were slated for protection at Norris (East), Norris (West), Lake, Bridge Bay,

Table 1. Blister rust control activities in Yellowstone National Park

Year	Total # of ribes removed	Total acres worked	Total man days	Gallons of herbicide	Trees Examined for Pruning	Real Cost ($)	Adjusted Cost (1994 $s)
1945	95,769	1,567	992	765		7,360	60,638
1946	94,200	599	768	1,056		10,831	82,286
1947	382,917	4,877	3,172	1,101		61,250	406,705
1948	172,700	1,967	1,495	2,670		25,554	157,532
1949	406,000	1,900	1,939	6,313		33,828	210,549
1950	221,000	1,160	1,260	5,950		23,865	147,121
1951	48,000	870	870	990		14,680	83,795
1952	365,000	1,210	1,220	10,010		30,446	170,039
1953	469,000	2,310	1,710	21,930		42,103	233,374
1954	627,000	2,370	1,910	21,170		38,138	210,492
1955	635,000	1,440	1,490	34,700		53,470	296,061
1956	308,600	2,110	1,270	21,430		39,427	215,077
1957	372,700	2,798	2,570	37,840		74,511	392,777
1958	473,000	10,660	4,030	59,260		121,961	625,671
1959	879,000	7,930	4,680	77,020		121,657	619,190
1960	628,000	13,110	3,490	36,300		96,433	483,194
1961	223,000	11,720	3,820	15,000		134,742	668,020
1962	140,000	10,090	2,090	7,430		83,930	411,368
1963	279,000	13,030	3,080	18,000		106,949	517,806
1964	357,000	17,860	3,630	17,800		108,967	520,743
1965	452,000	11,410	3,350	23,400		116,735	548,729
1966	176,000	11,030	2,810	5,500		113,862	520,081
1967	98,966	14,513	2,305	1,750		117,900	523,707
1968	15,498	7,121	1,348			126,038	537,221
1969	9,261	11,200	1,270			110,250	446,007
1970	21,213	10,840	1,067			118,740	453,371
1971						118,000	432,332
1972	340				2,798	79,000	280,106
1973	1,027				21,134	82,000	273,651
1974	1,493				55,299	78,200	235,283
1975	2,117				123,293	79,100	218,053
1976	135					47,313	123,257
1977	50					3,000	7,335
TOTAL	**7,954,986**	**175,692**	**57,636**	**427,385**	**202,524**	**$2,420,238**	**$11,111,570**

* 1949 - 1967: 2,4,5-T herbicide used.

1970: Ribes eradication ended in Yellowstone National Park.

1971 - 1977: Pruning program only. Funds may be estimates.

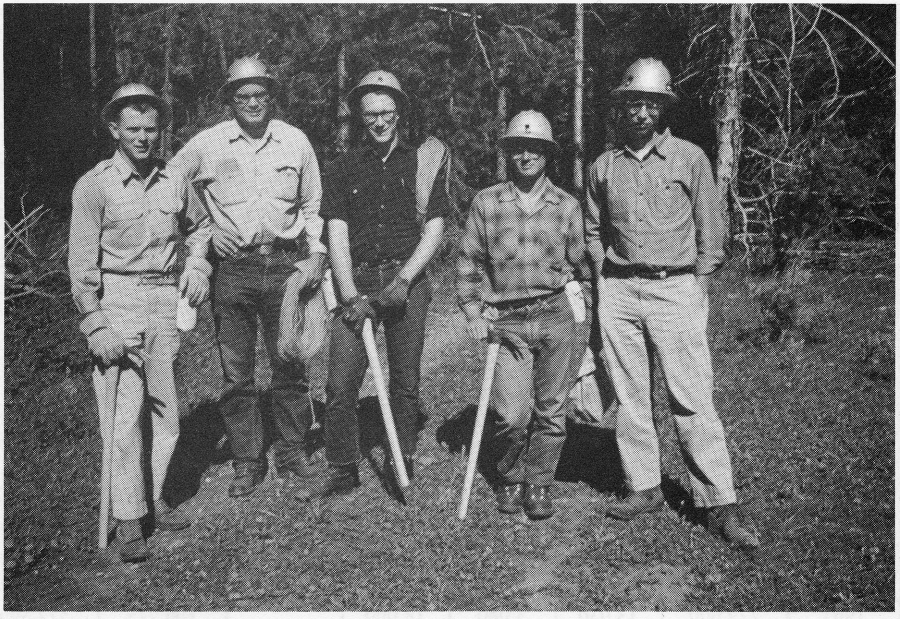

Figure 4. Blister rust control crew in Grand Teton National Park, 1957

Figure 5. One of the 1956 blister rust crews in Yellowstone National Park

Table 2. Blister rust control activities in Grand Teton National Park

Year	Total ribes removed	Total acres worked	Total man days	Gallons of spray
1957	130,700	620	280	4,100
1958	51,000	680	280	6,890
1959	No ribes eradication conducted			
1960	No ribes eradication conducted			
1961	7,000	900	210	
1962	No ribes eradication conducted			
1963	No ribes eradication conducted			
1964	No ribes eradication conducted			
1965	No ribes eradication conducted			
1966	12,900	980	90	
TOTAL	**201,600**	**3,180**	**860**	**10,990**

Grant Village, West Thumb, West Thumb Creek, Lewis Lake, Continental Divide, Arnica Creek, Pumice Point, and Sand Point, and, in 1963, Grebe Lake (Figure 1). Finally, in 1964, the last units, totaling 41,230 acres, were added for protection at Solfatara Creek, Norris Geyser Basin, Roaring Mountain, Obsidian Cliff, Willow Park-Indian Creek, Sulphur Cauldron, Elephant Back, Solution Creek, Lewis Lake Extension, Little Thumb Creek, and Little Thumb Creek Extension. From 1957 to 1966, crews had treated or pulled 3,979,700 ribes plants, used 297,550 gallons of 2,4,5-T, and treated 109,638 acres (Table 1). A total of 778 employees had put in 33,550 work-days and $1,079,746 ($5,307,580 in 1994 dollars) had been spent on the program. Many of these figures were double those from the first decade in Yellowstone.

It is interesting to note that during this time of blister rust control program expansion in Yellowstone and Grand Teton, many other areas were abandoning their efforts to eradicate ribes due to its questionable effectiveness. Soon after World War II, a pathologist employed by the Office of Blister Rust Control from the University of Idaho found that infection could spread beyond designated protective zones and that the amount of ribes live-stem allowed per acre was too high (Maloy 1997). A 1958 study in the Lakes Region found that ribes populations had little relation to rust infection rate (Maloy 1997). Mount Rainier National Park ceased control activities as early as 1953 because, despite 24 years of control, white pine had been nearly eliminated in the park by the disease. By

1958, similar revelations in Glacier National Park resulted in a decline in ribes eradication and more emphasis on treating white pines with antibiotics such as Acti-dione and Phytoactin. Glacier stopped all ribes eradication by 1961 and used only antibiotics until all treatment against blister rust ended in 1968.

One obstacle to the blister rust control program was the continued rise of wages and other expenses. Two problems contributed to this. First, while finding and removing the first ribes cost little, finding and removing the last ribes in a pine stand cost a lot more (Benedict 1981). Second, it became clear that repeated reworking for up to three or four years were necessary to break the cycle of ribes re-germination. While some land managers had already begun to use one-man crews or contractors to eliminate the cost of camps (Benedict 1981), Yellowstone continued to staff large camps.

It is also puzzling that Grand Teton started a blister rust program in the first place given a 1945 review of the park's blister rust status. The report made a recommendation against attempting protection of white pine from blister rust in Grand Teton because conditions appeared to render protection impractical if not impossible due to: (1) high susceptibility of whitebark pine; (2) general distribution of *Ribes petiolare*, a highly susceptible ribes known to infect whitebark pine over considerable distances; (3) rough topography involving hazardous and costly ribes eradication; (4) occurrence of ribes in open upland sites favorable to wide dissemination of sporidia from ribes to pine; and (5) meteorological conditions characteristic of high elevations, including mists and strong winds, favorable for formation of sporidia and their rapid transport over long distances.

Three circumstances caused Yellowstone to buck the trend and continue with control efforts. First, blister rust was still spreading in the park. It would have been difficult to stop control measures when there was available money and the problem was so evident. Second, and more important, managers believed that ecological conditions in the Yellowstone area were different from the northern Rocky Mountains. Since infection levels were lower in this area than in northern Idaho and western Montana, they believed that the relatively cool and dry conditions of Yellowstone's higher elevations were unfavorable for spread and intensification of blister rust. With this low chance of spread in combination with large eradication units, they believed there was a possibility of total blister rust control. Finally, other studies found that blister rust infection did not necessarily constitute a lethal threat and that occasionally trees remained free of rust in severe infection conditions. There was still reason to be hopeful.

The period 1967-1977. Nineteen sixty-seven was probably the

year that the blister rust program in the west turned from hopeful to hopeless. First, it was then that the Northern Region (Region 1) of the U.S. Forest Service drastically curtailed its blister rust program. It acknowledged that, due to climatic conditions, ribes eradication had not given adequate protection to white pines except on a very small acreage. They also stated that the antibiotic Phytoactin was not effective in fighting rust infection and the antibiotic Acti-dione was not effective unless cankers were scarified and received direct application of the material. At that time, the agency made the decision to focus on a rust-resistant tree breeding program. Second, by 1968 NPS blister rust funding was cut from all the region's parks except Yellowstone. Some still conducted rust distribution surveys and certain scenic areas were treated on an individual-tree basis, but all significant control efforts were abandoned. Lastly, a 1968 study in the western white pine region found no significant differences in rust incidence between stands never eradicated and stands from which ribes were eradicated as many as eight times (Maloy 1997). The study concluded that long-range spread must, therefore, be of greater consequence than was previously thought.

Yellowstone did curtail the blister rust control program by 1968, reducing its seasonal force by 80%. Yellowstone also did not initiate control work in units approved in 1964, leaving only 23 control units, totaling 95,160 acres, receiving some treatment (Table 1). However, at this late date, a study was initiated to test if eradication of ribes reduced or eliminated blister rust infection at the Mammoth and Mount Washburn complexes.

In addition, between 1969 and 1977, Yellowstone began a pruning program at Mammoth, Mount Washburn, and Glen Creek sites. Pruning involved cutting off limbs with non-lethal cankers and excising lethal cankers on the bole of the tree. Although all ribes eradication operations were suspended by 1969, Yellowstone continued to get funding through 1977 for blister rust control and was one of the last places to practice control in the region. These last few years of ribes control and the pruning from 1967 to 1977 resulted in the removal of 144,938 ribes plants, the use of 1,750 gallons of 2,4,5-T, and the treatment of 43,674 acres, much less than in the prior decade (Table 1). A total of 459 employees had put in 7,187 work-days and $959,541 ($3,530,323 in 1994 dollars) had been spent on the program. In addition, 5,162 acres had been pruned with over 200,000 trees examined for cankers.

Conclusion

In the end, nearly 8 million ribes plants had been removed from Yellowstone National Park, over 175,000 acres had been worked and reworked for blister rust control,

1,651 employees had put in over 57,000 work-days, and more than 427,000 gallons of herbicide had been sprayed on ribes plants throughout the program. The majority of the ribes pulled were in the Mount Washburn (56%) and Norris–Canyon (27%) control areas. A total of $2,420,238 ($11,111,570 in 1994 dollars) had been spent on the 32-year program. From a cost perspective, this was almost triple what Glacier National Park spent on blister rust control and nearly ten times the amount spent on control in Mount Rainier, Grand Teton, and Rocky Mountain national parks. The same trend follows for the number of ribes removed, employees hired, and herbicide used.

It was only in 1978 that blister rust control came to complete stop when a paper was published on the non-effectiveness of ribes eradication as a control of white pine blister rust in Yellowstone National Park (Carlson 1978). A study in Mount Washburn found that rust incidence remained low even though ribes were extensive in some areas. The study concluded that ecological conditions of the area probably limit rust spread, that eradication of ribes was clearly not warranted in the future, and the existence of white pine in Yellowstone was not threatened by blister rust.

More recently, scientific opinion has changed on the long-term outlook for Yellowstone white pines in relation to blister rust. Heavy infection and mortality from rust continues to move into areas previously thought safe from the epidemic. Rare weather events have created infection "wave years" several times in the last couple of decades in the Sierra Nevada; the same is likely to occur eventually in the greater Yellowstone area. Monitoring plots established in Yellowstone for Carlson's study were revisited in the mid-1990s. All trees sampled in 1970 were uninfected and alive; by 1996, 11% were infected with rust and 2% were dead (Kendall and Schirokauer, in preparation). Perhaps even more telling is the current status of seedlings and saplings in Yellowstone that were healthy when individually marked in 1969. When relocated in 1996, 18% were dead and another 19% were infected with rust (Kendall and Schirokauer, in preparation). There is clearly cause for concern for the future of whitebark and limber pine in Yellowstone.

Although all the Herculean labors of surveying for rust and pulling and spraying ribes were in vain, most blister rust control crew members look back on their days with great fondness and enthusiasm. Blister rust control money put a lot of young men through college and summers in the camps launched more than a couple of National Park Service ranger careers. This episode in history serves to remind us of the grave danger of exotic species to native flora and fauna. It also counsels caution when we are tempted to try sav-

ing one native species at the expense of another, or at the risk of environmental contamination. The chance of success must be weighed against the costs and consequences.

Acknowledgments

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A Public Face for Science: A. Starker Leopold and the Leopold Report

Ed. note: This paper is part of a full-length biography of A. Starker Leopold that the author is working on.

In 1963 a group of scientists and wildlife experts authored a report—subsequently, and more commonly, referred to as the Leopold Report—to help the National Park Service manage its wildlife. While the Leopold Report reflected in broad terms the scientific thinking of wildlife biology in the 1960s and, in a narrower sense, some of the ideas put forth by previous Park Service critics, it bore the unmistakable imprint of its primary author, Aldo Starker Leopold. Son of conservationist and wilderness advocate Aldo Leopold, Starker Leopold was at the time a wildlife biologist at the University of California in Berkeley. The report is a prime example of Starker Leopold's particular expertise: his uncanny ability to translate biological ideas into public policy.

The Leopold Report developed logically, or naturally, from Starker Leopold's earlier thinking about nature. As eldest son of Aldo Leopold and member of the Leopold family—all of whom shared a deep and enduring love for and scientific interest in the outdoors—Starker found a natural and comfortable place in wildlife biology. He brought to the discipline a love for hunting and fishing and a inquisitive mind that was forever searching for ways to understand the natural world.

Starker's early years were spent on the Rio Grande River and in the oak and prairie country around Madison, Wisconsin, hunting and fishing with his parents and siblings. From an early age he kept a hunting journal in which he recorded —clearly and systematically—the conditions and count (or bag) of the day.[1] He and his father were very close and they shared insights about nature and wildlife habits. When Aldo's classic text *Game Management* was published in 1933, he gave Starker a copy for Christmas and inscribed it with these words: "The materials for this book were gathered from the four winds, but the conviction that it should be written comes largely out of our trips together on the Rio Grande."[2]

After completing his undergraduate studies at the University of Wisconsin, the younger Leopold fol-

lowed his father's footsteps to Yale Forestry School in 1936 but decided in 1937 to continue his graduate work at the University of California and work with zoologist Joseph Grinnell.[3] After his first term at Berkeley, he took what was to be a very important field trip with his father: For a month in the winter of 1937, he hunted in the Mexican wilderness of the Rio Gavilan. The trip had a profound impact on Starker's wilderness and wildlife ecology education. "[The trip] gave me my first real look at an honest-to-god wilderness, an ecosystem unaltered by any livestock or people," he commented forty-five years later. He was especially taken with the role fire played in keeping the land "healthy." "It began to dawn on me that fire was a perfectly normal part of that sort of semi-arid country, and might even be an essential part of it." Leopold was also struck by the natural and apparently beneficial role predators played in this healthy landscape. "There was a tremendous crop of deer," he remembered later, "but not too many because there was also a big crop of mountain lions and wolves, both of which were killing the deer."[4]

Leopold did research for his dissertation on "The Nature of Heritable Wildness in Turkeys," while working for the Missouri State Conservation Commission and wrote the dissertation in the fall of 1943

Figure 1. A. Starker Leopold hunting chukkar partridge in the Tremblor Range, San Luis Obispo County, California, 1955. Photograph by Eben McMillan, courtesy of James McMillan.

while living with his parents. He successfully defended his dissertation in the spring of 1944 and it was well received by most biologists. One source of criticism came from a University of Chicago biologist, Joseph Hickey, who favored rigorous quantitative analysis over natural history. Leopold took no heed of Hickey's criticism and he would never belong to the group of wildlife biologists calling for rigorous quantitative analysis to replace factual description based on careful observation.[5]

For two years after graduation, Leopold worked in Mexico collecting the field data on Mexican wildlife he would later include in his award-winning book *Wildlife of Mexico* (1959), a natural history of true Leopoldian proportions.[6] In 1948, soon after his father's death, Leopold returned to the Mexican wilderness of the Rio Gavilan area he had visited a decade earlier. He had planned to collect specimens and "initiate some long-term studies of the native fauna under virgin conditions."[7] But instead he found that civilization had invaded the wilderness: lumber trucks, new roads and grazing stock littered the landscape. "We knew then," he wrote in a piece for a popular journal, "that instead of initiating an era of renewed acquaintance with the wilderness, we had come to witness its passing."[8] Leopold returned from the trip determined to preserve wilderness: "Must there be a cow on *every* hill and a road in *every* valley?" he asked.[9] And he returned with a deepening awareness of the complexities of the predator-prey relationship. Just how much should predators be controlled before the "natural balance between predator and prey" was disturbed, he pondered.[10]

Leopold was hired by Alden Miller, who replaced Joseph Grinnell as director of the University of California's Museum of Vertebrate Zoology, to fill a new position at the museum in "Wild Life Conservation." In particular, Miller wanted Leopold to provide "leadership in research and public relations in this field for the Museum."[11] Leopold rose quickly through the ranks, becoming, in 1958, Miller's assistant director of the Museum of Vertebrate Zoology. Miller recognized and appreciated Leopold's practical bent and approach to wildlife management issues. Leopold became known, in fact, for his expertise in "human affairs" and for his ability to synthesize scientific ideas and then translate them into political and lay terms.[12] These skills and a decade of experience handling hot topics—such as deer management and fire and predator policy—prepared him well for the role he would play as advisor to Secretary of the Interior Stewart Udall in the 1960s.

In the early 1950s Leopold presided over a group of wildlife biologists studying deer management in

California. In his capacity as director of the project, Leopold was primary author of the two ensuing reports and the primary recipient of the criticism that arose when recommendations were made. The deer irruptions, Leopold argued, were the result of poor management. "Chronic undershooting, often coupled with unnecessary predator control, has permitted countless local irruptions of varying degrees of severity—an unexcusable [sic] waste of game and range resources as well," he wrote. Just as the problem with irruptions lay with wildlife and range management, the remedy for irruptions, according to Leopold, also had *a management solution*. In particular, Leopold recommended "deliberately and purposefully manipulating plant successions to maintain high range capacities for deer" and liberalizing the hunting regulations—to include doe hunting—for full harvesting of the annual deer crop.[13] Especially with this last point, Leopold's recommendations raised the roof. To put it mildly, doe shooting was highly unpopular. But Leopold did not shy away from what he thought was good science for the sake of popularity. "Let me make this clear at the outset," he argued forcefully in a piece for the popular press, "there is no controversy over deer management among those who have studied the animals in the field. The controversy is among those who study the problem beside a pot-bellied stove or in a smokey conference room."[14]

Another issue Leopold took on in the 1950s was fire policy and controlled burning. In 1957, Leopold presented a paper at the Fifth Biennial Wilderness Conference entitled "Wilderness and Culture." In this talk, he tackled the issue of fires in wilderness areas, especially national parks. "There is still one striking exception in the trend toward naturalness in park preservation," he observed: "the complete exclusion of fire from all areas, even those that burned naturally every year or two before becoming parks." "I am convinced," he continued, "that ground fires some day will be reinstated in the regimen of natural factors permitted to maintain the parks in something resembling a virgin state. Both esthetic considerations of open airy forest versus dense brush, and assurance of safety from conflagration of accumulated fuel will force this issue sooner or later."[15] In an interview almost thirty years later, Leopold described the Park Service personnel attending the conference: "[O]ut of the corner came the old-time Park Service boys," he related. "Harold Bryant, who was one of the old timers, stood up, and he was shaking he was so mad. And he made me mad when he started out and said, `I am amazed that the son of Aldo Leopold....' And boy that really set me off."[16] As with the deer management issue, Leopold did not budge, predicting—correctly—that

allowing fires to burn would become part of park policy "sooner or later."

Leopold gave a great deal of thought to the idea of wilderness. He was a strong supporter of wilderness areas for their scientific as well as esthetic value. Anticipating his work in the 1960s on national park policy, Leopold advocated in 1955 that wilderness areas be managed to "stimulate original conditions as closely as possible."[17] As part of his management strategy, Leopold applied his ideas on the importance of fires to a healthy ecosystem. "As a matter of policy in preserving natural areas we *are going to have to accept responsibility* for ... controlled experimentation with fire," he wrote in a professional paper.[18]

As with deer management and fire-control issues, Leopold did not do any original research in the area of predator–prey relationships. Rather he synthesized the material from the research of others and more importantly brought it to the attention of the public. He was a public educator *par excellence*. In 1954, he presented a paper to the National Association of Biology Teachers on the ecology and economy of predation, in which he argued that instead of rebuking predation, humans should consider it an advantageous way to limit surplus individuals because, as he put it, predation "cleanly eliminates some individuals without impairing the vigor and health of the survivors." "Alternate controls such as starvation, disease, and intra-specific bickering," he continued, "impose a drain on all members of a population, leaving survivors weakened in body or spirit" by the loss of food or social intolerance.[19]

At this point it is important to remember that Leopold was a wildlife biologist-manager and not purely a biologist. His work had a very practical side: learning about wildlife systems so these same systems could flourish. His particular expertise came not so much from his own science *per se* as from his ability to take scientific ideas into a public arena and stand up for them with eloquence and authority.

During the 1950s, Leopold worked together with British naturalist Frank Fraser Darling on policy recommendations for managing Alaskan wildlife populations. To manage well and fully utilize the big-game herds of Alaska, Darling and Leopold advocated habitat preservation by "deliberately controlling two of the principal influences on range conditions—fire and numbers of grazing animals."[20] The key to the success of the wildlife resource was management—management based on sound policies. The bone the biologists chose to pick with the agencies managing Alaska's wildlife resources was "the inadequacy of present policy."[21] Leopold's concern for policy issues and his readiness to take up a position as advisor to the government on management concerns an-

ticipated his involvement in wildlife resource policy in the 1960s.

Leopold worked on a number of projects on a variety of wildlife and conservation issues throughout the 1960s. Most continued work started at least conceptually at an earlier date. His publications, while never at the scientific center of the burgeoning field of wildlife ecology, now veered even further from the cutting edge of primary research and turned to public policy work based on secondary sources. This is not to say that Leopold became more theoretical; he, in fact, held fast to his practical bent. Nor is it to argue that he left his field boots behind for a comfortable armchair position from which he could reflect peacefully on uncontroversial wildlife principles. While he donned his field boots less frequently for research and more for policy studies, Leopold became deeply embroiled in some of the hottest wildlife issues of the decade. More than involved, Leopold moved to the center of the storm over national park wildlife policy, predator control, and wildlife refuge definition.

When, in 1962, Secretary of the Interior Udall called on Leopold to serve as chair of his Special Advisory Board on wildlife matters, Yellowstone park was in a state of crisis. Park Service employees were implementing a two-pronged policy to restore some sense of "balance between Yellowstone's animal populations and their environments": first, reduction of elk herds on the northern range of the park and second, the education of the public about the need for such massive killings. Neither prong was developing smoothly: vociferous complaints about the reduction continued.[22] Leopold was well aware of his board's assignment. "It is acknowledged," he wrote in the report, "that this Advisory Board was requested by the Secretary of the Interior to consider particularly one of the methods of management, namely, the procedure of removing excess ungulates from some of the parks."[23] Familiar with the questions of management his committee would have to address, he knew the report would be in the limelight of a heated wildlife management debate.

The report provided Leopold with the opportunity to air in public many of the ideas he had been grappling with for years: the ecological necessity of both fires and predators, and the importance of habitat maintenance for healthy wildlife populations. "I really worked long and hard on that [report]," he later remembered. "I got in a lot of the ideas that had been brewing in my mind for a long time."[24]

He also saw the report as a real opportunity to influence wildlife policy nationally and even internationally. As he put it "the world was looking at us." "If," he told one listener, "we were to recommend public hunting of elk, parks in Africa would feel pressed to permit the

public hunting of elephant. We decided that we would develop a philosophy of management that could be applied universally."[25] With such a serious mission at stake, Leopold did not shy away from advocating an unpopular position on issues of park management. As he later told one interviewer: "I figured, `Okay, I'm in my career here; I can say any damn thing I want.'"[26]

The Leopold Report advocated continuation of the park service's policy of elk reduction as part of its idea of "purposeful management of plant and animal communities as an essential step in preserving wildlife resources `unimpaired for the enjoyment of future generations.'"[27] Other management methods could include re-introducing native species and allowing fires and other natural controls such as predators to curb explosive populations. "Of the various methods of manipulating the vegetation," he wrote in the report, "the controlled use of fire is the most `natural' and the easiest to apply."[28] Leopold received criticism from several directions for his position on both fire as a management tool (some environmentalists initially opposed this idea) and continued Park Service reduction of "excess" ungulates (obviously many hunters opposed this idea).[29]

It is especially interesting to watch Leopold mature as a wildlife biologist with respect to the issue of public hunting in the park. Pressure to allow public hunting from the sporting side of the wildlife management field must have been tremendous. Even one of his colleagues on the Special Advisory Board —Thomas Kimball—supported this position. Kimball referred to the excess elk that he and other committee members observed in the park as part of their research as excess "game," for example.[30] But Leopold came out firmly opposed to the idea.[31] The parks' "primary purpose ... is not public hunting," he argued. If one traces Leopold's own growth as a wildlife biologist it comes as no surprise that he felt so strongly about this issue. While he remained an avid hunter, Leopold by the 1960s had developed a philosophy of wildlife management that was quite different from his previous philosophy. In earlier decades, producing a crop for hunting had been the primary purpose of wildlife management for Leopold. According to the more mature Leopold of the 1960s, however, wildlife existed not just to be harvested, but also to be viewed.

As trained wildlife biologists, he told an audience of students, "we must take a broader view of our objective than the narrow and rather specific one in which I emerged as a young wildlife biologist, namely that we're producing a crop for hunting.... [T]hat is only a part of our total responsibility."[32] Of equal weight, according to Leopold, was

"wildlife management for its aesthetic values."[33] Thus while the values of hunters—and those in wildlife management who believed that hunting was the main reason to preserve wildlife populations—remained important to Leopold, they were not the defining parameters within which all wildlife management decisions should be made.

When it came out, the Leopold Report received for the most part high marks from the biological and wildlife management community. Its two main recommendations—continued ungulate reduction and management of the parks according to scientific principles to restore and preserve wildness—rested on comfortable premises for most wildlife biologists. The ungulate reduction proposal, while politically controversial and difficult for many hunters to accept, was scientifically in accordance with the ideas of the time. One scientist, for example, wrote to the associate superintendent of Yellowstone shortly after the report came out: "I found their conclusions to be very encouraging. It is interesting that the conclusions reached by all persons who examine your problems objectively are essentially the same."[34] Another comment—made to Leopold directly this time—came from Charles Piersall of the Izaak Walton League: "I consider your report to be the most factual and scientifically arrived at that I have ever read on the subject.... I accept the report because of the fact that the individual members of the Advisory Board have visited and personally experienced the varied climatic and topographical conditions contributing to the Northern Yellowstone elk situation, and at the same time weighed and evaluated the scientific data compiled by other competent biological and ecological authorities."[35] While elk reduction was halted—for political reasons—a few years after the report came out, Leopold's position on the issue did not waver and was never really at odds with the scientific community.

While most biologists—Leopold included—had some difficulty with his recommendation to manage the parks to maintain or restore "primitive" biotic associations, the issues were not unusual ones for biologists to be grappling with in the 1960s. Leopold based the recommendations of his committee on a report issued by a committee of the First World Conference on National Parks entitled "Management of National Parks and Equivalent Areas." This report advocated managing national parks based on scientific research to maintain "biotic communities in accordance with the conservation plan of a national park." Management, for this committee—as for Leopold's committee—could involve "active manipulation of the plant and animal communities, or protection from modification or external influences."[36]

Some might argue that Leopold did not have a realistic appraisal of ecological relationships if he could advocate trying to restore or maintain a particular biotic association. But Leopold's ecological sense was not out of line for his time. And he knew that there were limitations to what scientists at that or any time could accomplish. "In essence, we are calling for a set of ecologic skills unknown in this country today," he acknowledged.[37] And he felt that he took ecological principles into account when he made his recommendations. For example, Leopold recognized the difficulty of dealing with ecological communities when he told the Park Service that "A reasonable illusion of primitive America could be recreated, using the utmost in skill, judgment, and ecological sensitivity."[38] What Leopold really wanted was for the Park Service, as he put it, to "recognize the enormous complexity of ecologic communities and the diversity of management procedures required to preserve them."[39]

What Leopold feared was a policy of over-protection instead of active management. "Reluctance to undertake biotic management," he wrote, "can never lead to a realistic presentation of primitive America, much of which supported successional communities that were maintained by fires, floods, hurricanes, and other natural forces."[40]

Adolph Murie, the well-known naturalist on the staff of the National Park Service, was so pleased with the report that he hesitated to, as he put it, "make any comments that deviate from full agreement." But comment he did. Protection was what the parks needed, not management. "I believe," he wrote in a review of the report for *Living Wilderness*, "that our attitude should be to protect parks with the minimum necessary management." After offering a hint of criticism, Murie backed off and chalked it up to "phraseology." "My comments," he conceded, "are in great part a matter of different phraseology. I am certain that fundamentally there is agreement that our national parks should be preserved in a natural state, as free as possible from all intrusions and manipulations."[41] But he did take issue with the idea of maintaining "biotic associations within each park ... as nearly as possible in the condition that prevailed when the area was first visited by white man."[42] Natural conditions cannot be "maintained," Murie argued correctly. Change, as Leopold well knew, is an integral part of any natural community. "This goal," complained Murie, "suggests that we freeze the environment at a certain primitive stage. This implies a static condition. Although the committee may not have meant this, it has been so interpreted and accepted by some administrators."[43]

Bob Linn, who as a Park Service employee was responsible for implementing the Leopold Report, also "realized" this major "flaw" in the Leopold Report. "[T]he statement as written," Linn wrote years later, "implies that an ecological condition can (and should) be frozen in time." When Linn and his colleagues came up with a more ecologically correct expression of the same idea, the Leopold committee, according to Linn, responded by declaring: "Of course that's what we meant."[44]

Conservationists and biologists applauded Leopold's recommendations for minimizing artificiality and human intrusions. "We urge the National Park Service to reverse its policy of permitting ... non-conforming uses," Leopold wrote for his committee. "Above all other policies, the maintenance of naturalness should prevail," he wrote.[45] Such recommendations were considered "inspired" and "startling" by conservation journals. Bruce Kilgore wrote the following for the *Sierra Club Bulletin*: "The Leopold Report is one of the most significant reaffirmations of national park policy since the establishment of the National Park Service.... [T]he great significance of this report is that it sets forth at an extremely high political level the basic ecological principles which Muir, Olmsted, Leopold, the Sierra Club, and others have been urging down through the years."[46]

Many of the ideas in the Leopold Report were not new to the Park Service. Historians of the National Parks have documented that biologists such as Joseph Grinnell and his students George Wright and Joseph Dixon had argued vociferously for management of the parks to preserve the primitive.[47] The reports issued by these biologists are clear testimony to their philosophical and scientific belief in the need to preserve the primitive. "The old phrase, `let nature take its course,' applies rightly to National Parks, if to no other areas in our land," wrote Grinnell to the superintendent of Yosemite in 1925. Nine years earlier Grinnell had written: "Herein lies the feature of supreme value in national parks. They furnish samples of the earth as it was before the advent of the white man."[48] And in 1935, as part of the series *Fauna of the National Parks of the United States,* George M. Wright wrote: "Maintenance of wildlife in the primitive state is ... inherent in the national-park concept."[49]

No doubt Leopold knew about the Fauna series, for he had a copy of the series in his possession during his drafting of the report. No doubt he had done his homework before putting together his own report. And no doubt he shared their scientific perspective. He was, after all, Grinnell's student and a product of the same philosophical tradition as George Wright and Joseph Dixon. That his report supports the findings and conclusions of the Fauna series

comes as no surprise.

It is clear that the Leopold Report reaffirmed ideas promulgated in the 1930s. But the impact the report had on Park Service policy was decidedly its own. While the words of Wright and others influenced a few biologists and concerned citizens, the Leopold Report influenced public policy. In May 1963 Secretary of Interior Udall sent a memorandum to Conrad Wirth, director of the Park Service. "The report of the Advisory Board on Wildlife Management of the National Parks ... has been reviewed.... You should, accordingly, take such steps as appropriate to incorporate the philosophy and the basic findings into the administration of the National Park System."[50] Five years later, the Leopold Report was incorporated into the "first [National Park Service] comprehensive policy manuals."[51]

What was so different about the Leopold Report was the context within which it was received. That the report was written in the environmentally conscious 1960s and that it was commissioned by the secretary of the interior meant that its message would get heard. The Park Service in 1963—unlike in the 1930s—seemed ready to listen to science.

Another angle from which to view the Leopold Report is how it indirectly helped resolve the dilemma posed by the Park Service's Organic Act—a dilemma recognized by Leopold's predecessors. "The conclusion," wrote George Wright in volume two of the Fauna series, "is undeniable that failure to maintain the natural status of national parks fauna in spite of the presence of large populations of visitors would also be failure of the whole national parks idea."[52]

By defining the "goals" of wildlife management in the parks as being to "represent a vignette of primitive America," Leopold joined the two primary functions of the Park Service: preservation of nature and use (or enjoyment) by people. Now the Park Service could comfortably argue that the use or enjoyment part of their mandate was dependent on the successful restoration of, as Leopold had written in the report, "a reasonable illusion of primitive America." Director Wirth picked up on this aspect of the Leopold Report. "The report provides an excellent framework within which to carry out the management and conservation of park resources," he wrote to Udall in August 1963. "The *use* objective should be stated in similar broad and long-range terms and in a way consistent with the conservation principle." He continued, "If we are to conserve parks as `vignettes of primitive America,' it follows that the parks should be presented and *used* primarily as `vignettes of primitive America.' This is to say, use should be such as to capitalize upon the distinctive qualities and special scien-

tific, educational, and aesthetic values of these areas.... This is where our emphasis, in managing public use of parks, should be."[53]

In this way Leopold took biological ideas—past and present, his and others—into the political arena. The report became policy, was to varying degrees enforced, and has remained a topic of discussion in numerous circles. According to Frederic Wagner, writing in *Wildlife Policies in the U.S. National Parks,* the report had a decisive influence on Park Service policy. First, "it strengthened NPS policy resolve to manage biological resources in the parks by focusing attention on preserving samples of ecosystems in the conditions that prevailed at the time of European contact." Second, its emphasis on active management was "incorporated into the 1968 natural-area policy manual." Third, "it made a firm case for a sound, scientific basis for park management and recommended a strong research program" in the National Park Service.[54] Leopold's abilities as a communicator helped him turn biological convictions into political realities.

Endnotes

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27. Leopold et al., 29-30.
28. Ibid., 37.
29. Rydell, 195-196 and 186.
30. Thomas L. Kimball to Lemuel A. Garrison, 9 October 1962, Mammoth, Wyoming, Yellowstone National Park Archives (hereafter YNPA), Box N-8, f. N16 secretary's Advisory Board (Committee) on Wildlife Management 1962.
31. "Discussion," after Leopold et al., 45.
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33. Ibid., 1-2.
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45. Leopold et al., 35
46. B.M.K. [Bruce Kilgore], "The Uneasy Chair," *Sierra Club Bulletin* 48 (March 1963), 3.
47. See, for example, Alfred Runte, "Joseph Grinnell and Yosemite: Rediscovering the Legacy of a California Conservationist," *California History* 69 (Summer 1990), 170-181; Richard West Sellars, *Preserving Nature in the National Parks: A History* (New Haven: Yale University Press, 1997); James A. Pritchard, "Preserving Natural Conditions: Science and the Perception of Nature in Yellowstone National Park," Ph.D. dissertation, University of Kansas, 1996.
48. As quoted in Runte, 176 and 180.
49. George M. Wright, "Men and Mammals in Joint Occupation of National Parks," pp. 13-25 in George M. Wright and Ben H. Thompson, *Fauna of the National Parks of the United States: Wildlife Management in the National Parks,* Fauna Series no. 2 (Washington, D.C.: U.S. Government Printing Office, 1935), 13.

50. As quoted in Frederic H. Wagner et al., *Wildlife Policies in the U.S. National Parks* (Washington, D.C.: Island Press, 1995), 30.
51. Ibid., 30-31.
52. Wright, 13.
53. Conrad L. Wirth to secretary of the interior, 9 August 1963, YNPA, Box N-8, f. N16, secretary's Advisory Board (Committee) on Wildlife Management 1963-1964.
54. Wagner et al., 32.

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Close Cousins Consider Landscapes: Comparative Notes on Cultural Landscape Work in Australia and the United States

"A Sunburnt Country," "The Lucky Country," "Tjukurpa" (Aboriginal traditional law), "My Extended Family"—these are some of the ways Australians describe their land, and their relationship with the land. Examples of Australian cultural landscapes range from rural pastoral areas such as Wingecarribee Shire, extensive desert landscapes such as Mungo National Park, to well known cultural symbols such as Sydney Harbour Bridge. Australia and the USA are close cousins by virtue of similar geographic scales and colonial histories. While cultural landscape issues in Australia are very similar to those in the USA, variations in the natural and cultural environment give cultural landscapes a different texture.

This paper is based on research completed during a six-month stay in southeastern Australia during 1996. I offer here comparative notes rather than a definitive or comprehensive evaluation. While I mention indigenous values and places, I leave a fuller discussion to Aboriginal writers who can provide an indigenous perspective (Tjamiwa 1992; Bates and Witter 1992).

Cultural Landscape Work in Australia

As in the USA, agencies and organizations from the local to the national level are involved in landscape preservation efforts. Ken Taylor and Peter James provide excellent summaries of the Australian heritage conservation (historic preservation) system and Australia–USA comparisons (Taylor 1996; James 1996). Often, the definition of what a cultural landscape is and is not—whether a certain landscape is acknowledged to have cultural associations—influences the degree of threat to significant landscape resources, and the degree to which cultural landscape resources are preserved. This is sometimes the case within national parks, where large-scale development pressures may not be present, but where lack of recognition of cultural associations may threaten cultural landscape integrity.

Some shire (county) councils focus conservation efforts on prominent town and landscape structures, while others, such as Wingecarribee Shire, consider heritage at a landscape scale. Wingecarribee Shire, located in east-central New South

Wales, consists of small-scale dairy farms within larger-scale pastoral properties, which, in turn, have been overlain onto the indigenous landscape ("Wingecarribee" is an Aboriginal word meaning "water to the west"). Small patches of semi-tropical rainforest, present on a large scale prior to European settlement, remain on hill tops. The shire council funded a "Historic Cultural Landscape Assessment and Evaluation" report (Landscan Pty. Ltd. and Taylor 1991) which identifies key historic landscape units, and key features within the units, for specific preservation attention (Taylor and Tallents 1996). By recognizing the shire as a cultural landscape, larger-scale changes such as residential subdivisions can be kept out of sensitive historic areas, in addition to smaller-scale historic features being preserved.

In Australia, responsibility for developing and implementing conservation policy lies at the state level. Australian planning is based on the British planning system and so heritage protection is often undertaken through planning legislation (Taylor 1996, personal communication). Lanyon Homestead, near Canberra (Figure 1), was the first landscape listed on the Register of the National Estate for its historic and social values rather than for scenic values. Listing saved Lanyon from being engulfed by suburban development (Taylor 1996, personal communication). The Australian Alps Liaison Committee is an example of national park agencies from three states joining to address management issues within the Australian Alps parks. The committee funded a cultural landscape report which outlines the analysis and evaluation process and offers guidelines for specific elements such as native and exotic plants (Lennon and Matthews 1996). Recognizing the Australian Alps as a cultural landscape is a contentious issue. High-country graziers support preservation of both homestead complexes and grazing in traditional grazing areas, while nature conservationists support removal of all evidence of European historical activity. While grazing has been banned within the parks, some of the cattlemen's huts remain (Egloff and Fingleton 1994).

Federal departments are also involved. The Australian Heritage Commission, which manages the Register of the National Estate and has an advisory relationship with the states, has developed standards and criteria for cultural landscape nominations. The Australian World Heritage Unit administers the eleven existing World Heritage properties, which include Uluṟu-Kata Tjuṯa (formerly known as Ayer's Rock and the Olgas) and Kakadu national parks. The Sydney Opera House in its landscape setting (Figure 2) is currently being evaluated for World Heritage Status and, if listed, would be the first in Australia to be nominated for primarily European cultural values (Read 1996, personal communication).

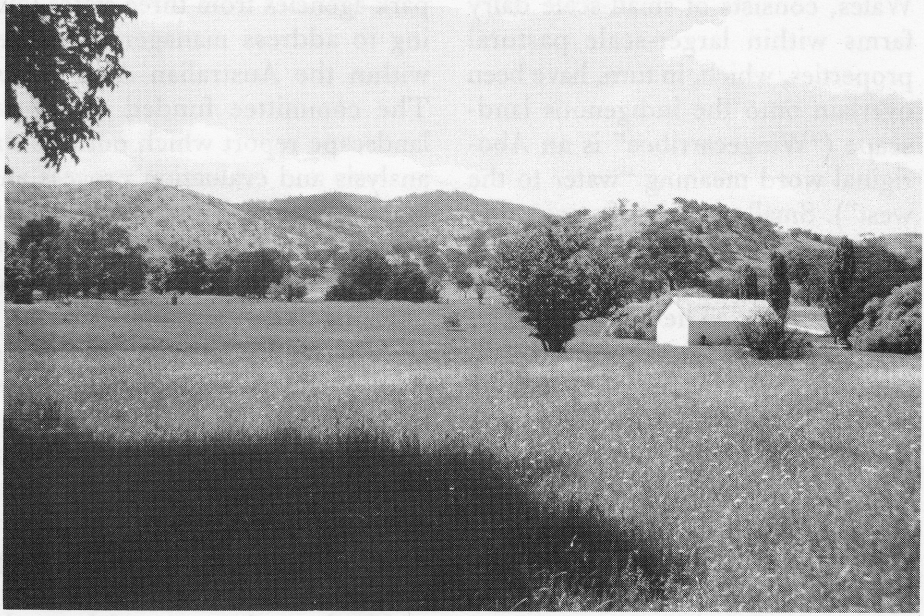

Figure 1. Lanyon homestead, Australian Capital Territory

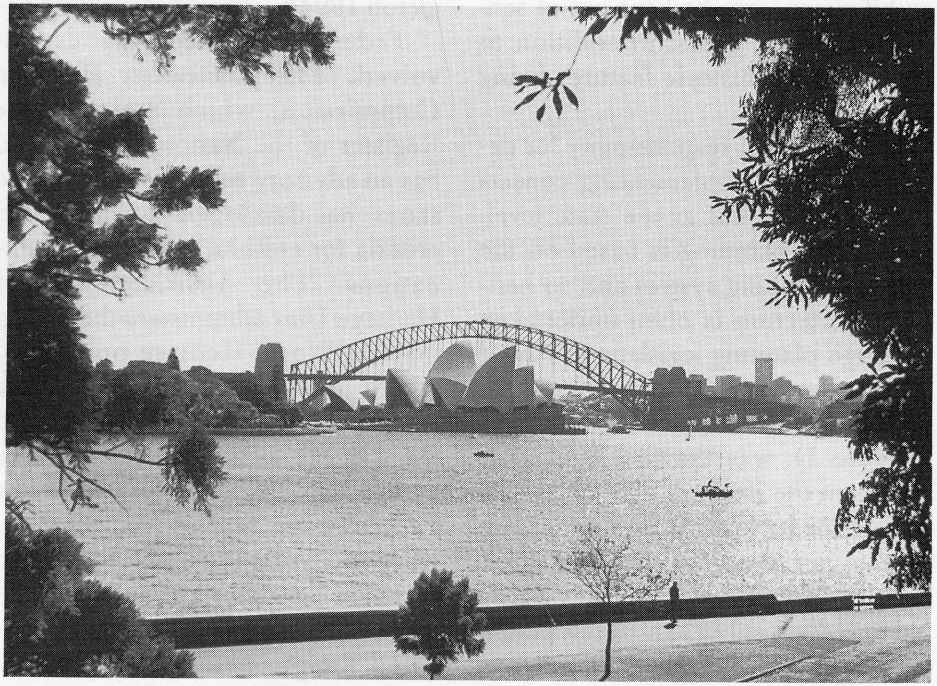

Figure 2. Sydney Harbour, with bridge and opera house, Sydney, New South Wales

The two countries share successes in the recognition of cultural landscapes and the development of specific policies within some resource management agencies; common concerns, such as the need for landscape theme studies; and the gap between professional preservation language and community members' ways of expressing what is significant to them. In Australia, cultural landscapes are one kind of heritage place which can be nominated to the Register of the National Estate, in contrast to the U.S. National Register, where cultural landscapes can be nominated as sites, districts, multiple properties, or traditional cultural properties.

Along with focusing on European history, the 1988 Australian bicentennial also brought new attention to the dispossession of Aboriginal people. Related to this, a major issue within cultural landscape discussions in Australia is the need for cultural landscape studies to be collaborative efforts between communities (indigenous, settler, and migrant communities) and heritage professionals. This was identified as the overriding issue by participants at the 1996 Australia International Council on Monuments and Sites (ICOMOS) Cultural Landscapes Conference. Other areas of concern include: (1) focusing on preserving special landscapes within protected areas versus preserving historic elements throughout whole regions (Jacques 1995); (2) the inclusion and accurate representation of women's heritage (Anderson 1993; Bickford 1992); and (3) whether professional heritage activity is the latest version of imperialism (Sullivan 1993).

Cultural Landscapes as a Vehicle for Sustainability

The application of indigenous traditional ecological knowledge to the management of landscapes in protected areas is an excellent example of promoting sustainability by recognizing a landscape as cultural. Australia was not a vast wilderness when European settlers arrived: it was a vast indigenous cultural landscape, where flora and fauna coevolved with indigenous people for over 40,000 years (Lennon and Matthews 1996). No longer are Aboriginal sites additional dots on a map to be considered for heritage protection; rather, the Aboriginal landscape, with its complex relationships of tribal areas, nodes, and linkages (du Cros 1996; Kneebone 1996) becomes the map itself.

Near Mungo National Park in western New South Wales (Figure 3), evidence of Aboriginal occupation dating back 30,000 or more years was found in 1969 when archeologists found Aboriginal skeletal remains in this area. Mungo also contains evidence of European pastoral activity (Australian Heritage Commission 1980). The Mungo cultural landscape has strong ethnographic significance for contemporary Aboriginal people for whom the archeological findings have major implications for their place in con-

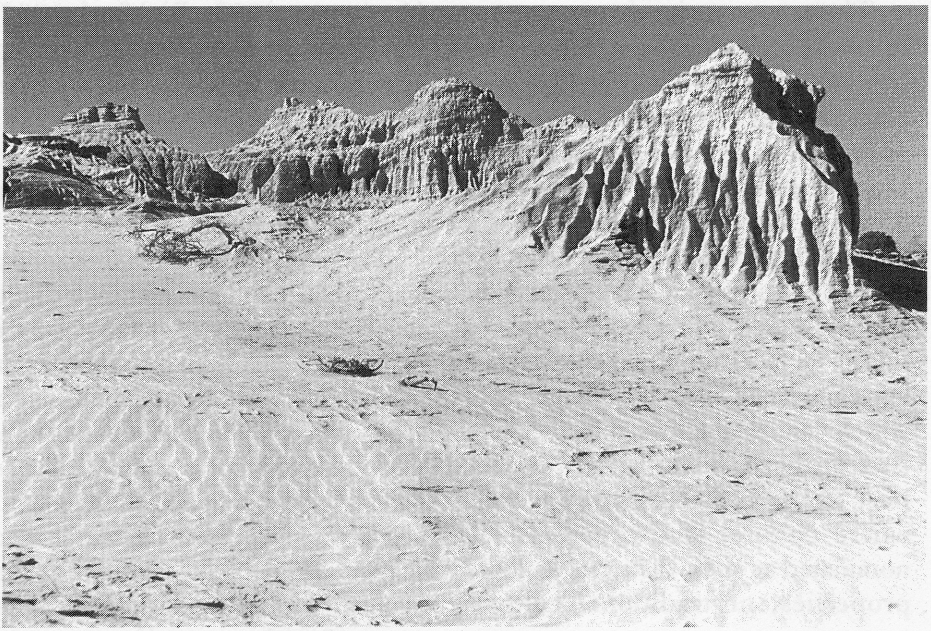

Figure 3. Mungo National Park, New South Wales

temporary Australian society.

Bob Randall, an indigenous Australian who grew up in Uluṟu country, describes "country" (the land and all living things) as his family (Randall 1990). In her recent book *Nourishing Terrains,* which is based on many years studying with Aboriginal people, Deborah Bird Rose characterizes the indigenous landscape, or "country," as "a place that gives and receives life.... People talk about country in the same way that they would talk about a person: they speak to country ... worry about country ... and long for country.... Country is a living entity, with a consciousness, and a will toward life." (Rose 1996, 7)

One of the major ways to care for country is to burn it. The European term "fire-stick farming" has been given to Aboriginal peoples' conscious and deliberate use of fire to promote the well-being of particular types of ecosystems (Jones 1973). In contrast to large, intense bushfires, traditional burning (by women and men) involves a series of low-intensity fires lit to create "a fine-scaled mosaic of vegetation of different ages" (DEST 1994, 29). For Aboriginal people, country that has been burned in the right way at the right time is referred to as clean and cared for, as opposed to unburned country, which is wild and unclean. Effective burning depends on detailed knowledge of soils, water sources, wind patterns, vegetation growth patterns, and animal behavior, and plays a role in maintaining social re-

lationships, as when used in ceremonies. For example, rings of over-mature inedible spinifex grass need to be burned to allow other edible plants to take hold, while the low-intensity fire doesn't harm small mammals who take cover in their underground burrows (Breeden 1994). Research has shown that fire-stick farming keeps flora and fauna healthy and diverse, and that it is a sustainable practice (Rose 1996; Lewis 1992).

The landscape of large eucalyptus trees scattered within open grassland, which early settlers mistook to be Australia's "natural" ideal pastoral landscape, is actually the result of thousands of years of active Aboriginal land management. While Aboriginal people also feel ambivalent about fire and fear its destructive powers, they traditionally took the approach of working with fire rather than suppressing it, as European settlers have often done.

Uluṟu-Kata Tjuṯa National Park, located in the Northern Territory, is jointly managed between the Anangu people and the Australian Nature Conservation Agency. Uluṟu-Kata Tjuṯa has recently been renominated for World Heritage status "as a cultural landscape reflecting 'specific techniques of sustainable land-use' and 'a specific spiritual relation to nature' that can 'contribute to modern techniques of sustainable land-use' and 'support biological diversity'" (DEST 1994, 21). "Specific techniques of sustainable land-use" include fire-stick farming along with cleaning out water holes and other traditional practices (DEST 1994, 22). According to the World Heritage Renomination, patch burning, which is modeled after traditional fire-stick farming, "has been encouraged by Park management since 1985.... Major wildfires in the summer of 1990-91 ... started outside the Park but were contained with little effort once they ran into the patch-burns in the Park" (DEST 1994, 30). Not only does traditional burning enhance ecological health of the land, it also sustains the close relationship between Anangu people and their country. By acknowledging the role of traditional land management practices, Anangu country is recognized as a cultural landscape, and the preservation of both cultural and natural landscape systems is enhanced.

Conclusion

Getting to know Australian cultural landscapes and those concerned with their preservation reminded me of some basic ideas which I carry back to my U.S. National Park Service work. First, we must continue to question our existing historic preservation system and underlying patterns of thinking in order to broaden and refine what historic preservation means. Continuing efforts to collaborate with communities and reinforcing women's perspectives are two ways we can do this. Second, the recognition of an area as having cultural values and associations is the first step in cultural landscape preservation.

And third, we need to keep in mind, as we proceed with inventories and analyses, that symbolic meanings of the landscape, and emotional associations with the landscape, play a large role in how and why people have modified their environment (Taylor 1992). A quintessentially Australian example is people's relationship with fire as a landscape-changing force, from an emotional response of fear and avoidance to a relationship with fire as a tool to clean and care for the land.

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