

THE CANON NATIONAL PARKS SCIENCE SCHOLARS PROGRAM

Training the Next Generation of Conservation Scientists



2 Letter of Introduction

Dear Friends,

Throughout the Americas and the world, there is an urgent need to better understand how to preserve the natural and cultural resources of national parks for future generations. Hence, there is vital responsibility to educate and prepare the next generation of conservation scientists. It is these scientists who will learn, discover, invent, and create solutions to preserve the national parks in the 21st century. The Canon National Parks Science Scholars Program addresses both these important challenges.

Over the years, it has been an honor and a privilege to serve this unique program. It exists because of Canon's corporate philosophy of *kyosei* (described later in this report), and the enthusiastic participation of the American Association for the Advancement of Science and the US National Park Service. Working together, they have created an educational program with an ambitious goal: *to encourage the best and brightest graduate students in all relevant disciplines to conduct research important to the future of the national parks.*

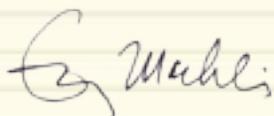
At the Opening Ceremony of the 2003 Vth World Parks Congress, former President Nelson Mandela reminded the participants of an important truth. Speaking to an audience of 3,000 conservation experts from around the world, Mr. Mandela quietly noted:

"I have been asked in my address to reflect on the challenges for the 21st century as it affects conservation and protected areas. You may very well be a little curious to hear what an old man without a job, office, power or influence, and with his roots far in the past, is going to say about challenges for the future! The future is after all, in the hands of the youth.

If this seems ironical, I know that I am not alone in this situation. It is well known that, among those who are preoccupied with the future of protected areas, there are a great many grey heads and far too few youthful ones....This is of course a matter for concern because without the involvement of the youth, the future cannot be secured."

The Canon National Parks Science Scholars Program provides support to outstanding graduate students and enables them to conduct innovative science in national parks throughout the Americas. Without the involvement of these young scientists today, the future of national parks cannot be secured. I am delighted to introduce the Canon Scholars and their work in this report.

It is a pleasure and joy to be engaged with this program, its sponsoring partners, and these extraordinary young people. I never stop being amazed by their commitment, enthusiasm, and dedication. They give me a renewed sense of hope for the future of national parks.



Dr. Gary E. Machlis
Program Coordinator,
Canon National Parks Science Scholars Program
and
Visiting Senior Scientist,
US National Park Service
15 April 2005



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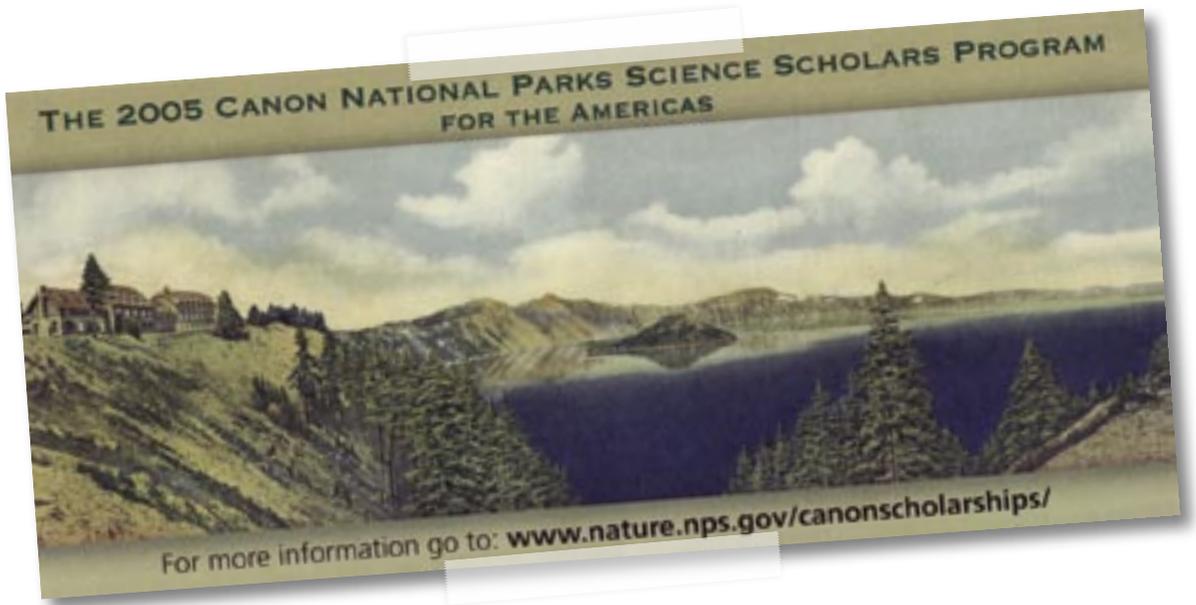
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6 Introduction: *Kyosei*, Science, and the National Parks

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 national park management. The program is underwritten and supported by Canon U.S.A., Inc., in a collaborative partnership with the American Association for the Advancement of Science (AAAS), and the US National Park Service (NPS). The program unites the power of *kyosei*—Canon’s corporate principle that encourages working together for the common good—with the advancement of science and the preservation of national parks unimpaired for future generations.

The Canon National Parks Science Scholars Program is the first and only of its kind to encourage graduate students to conduct innovative research on problems critical to national parks. It is these young scientists who will learn, discover, invent, and create solutions to preserve national parks in the 21st century. The program focuses on a central goal: *to encourage the best and brightest graduate students in all relevant disciplines to conduct research important to the future of national parks.*

This report describes the growth and development of the program. It outlines how the program works, and how Canon, AAAS, and the NPS contribute toward their common goal of developing the next generation of conservation scientists. The report introduces each of the past and current Canon Scholars, and highlights many of the parks where their research has been conducted or is underway. Activities of the program—from the annual scholarship competitions to retreats that bring together the Canon Scholars for important leadership training—are also described. The report includes a bibliography of selected scientific articles and presentations by Canon Scholars—testament to their skill, growing expertise, and contribution to the advance of human knowledge. Designed in the style of a “field notebook,” the report reflects a key theme: supporting talented young scientists to conduct research in the national parks and thereby contributing to the preservation of these unique and special places. This theme is echoed in the relationship between *kyosei*, science, and the national parks.

“There is an enormous need to understand how the natural and cultural resources of national parks can be preserved in a developing world. Canon U.S.A., Inc. is making a significant contribution to science, and the future of our national parks.”

—Dr. Michael Soukup, Associate Director,
Natural Resource Stewardship and Science,
US National Park Service



Kyosei

The Canon National Parks Science Scholars Program embodies the concept of *kyosei*, the corporate philosophy of Canon. The president and CEO of Canon Inc., Mr. Fujio Mitarai describes how *kyosei* was adopted by Canon:

“In 1998, a year after the company marked the 50th anniversary of its founding and was looking ahead towards the next 50 years of business, Canon established *kyosei* as its corporate philosophy. It was around this time that “pollution problems” were newly recognized as “environmental problems.” *Kyosei* was not a new concept, but in this case it embodied the beliefs of the founders of Canon, who sought to develop the company by cooperating with and contributing to society. Specifically, *kyosei* stated concisely is “living and working together for the common good,” and a broader definition is “all people, regardless of race, religion or culture, harmoniously living and working together into the future.” The ideal behind *kyosei* is the same as that for a sustainable society.”

—Fujio Mitarai, President and CEO,
Canon Inc.,
Canon Sustainability Report 2004

Program partners from the private sector, the scientific community, government, and higher education are working together for the common benefit of the program and its students. Canon Scholars in many scientific fields—from anthropology to zoology—are together contributing toward the advancement of environmental science and conservation. Canon Scholarships are available to students pursuing doctoral degrees in all 36 countries of the Americas—encouraging international understanding and scientific collaboration. In addition to their scientific work, Canon Scholars are expected to write popular articles on their research, give presentations to the general public, and participate in leadership training to prepare them to become leaders in their fields. All these elements embody *kyosei*.





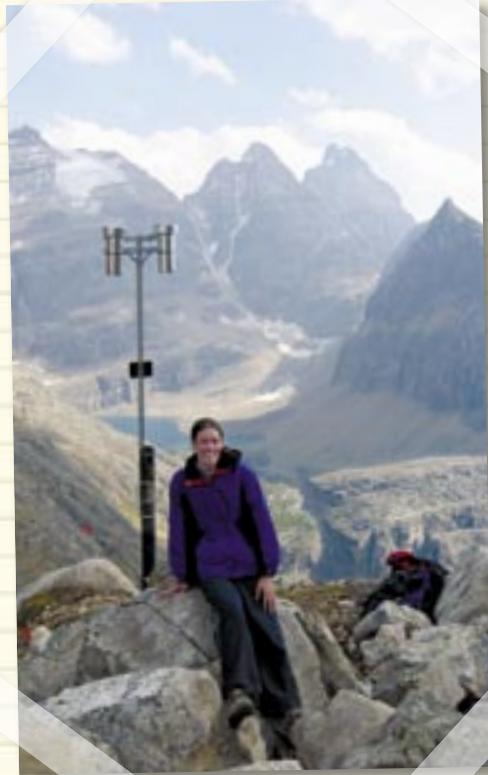
“Specifically, kyosei stated concisely is ‘living and working together for the common good,’ and a broader definition is ‘all people, regardless of race, religion or culture, harmoniously living and working together into the future.’ The ideal behind kyosei is the same as that for a sustainable society.”

—Fujio Mitarai, President and CEO, Canon Inc.,
Canon Sustainability Report 2004

Science

Science plays an increasingly critical role in modern society. Advances in health, technology, and communications depend upon both basic and applied scientific disciplines. Stewardship of environmental resources depends upon having sound science on which to make important resource management decisions. And the scientific advance of human knowledge has value for its own sake—to better understand the world around us.

The Canon National Parks Science Scholars Program supports outstanding young scientists in several ways. The annual scholarship competition provides an opportunity to develop their proposal-writing and research skills. Those selected as Canon Scholars receive a generous scholarship that supports necessary fieldwork and dissertation research. Their research is published in scientific journals and presented at scientific conferences, contributing to the growth of numerous scientific fields. Canon Scholars gain research and leadership skills at the program's periodic science symposia and retreats and form a community of scientists working toward a common goal of conserving national parks.



“We are able to support our interests in career development and exploration for young scientists as well as the AAAS mission to encourage science in the service of humankind. Our National Parks represent a tremendous opportunity to learn and to teach about science.”

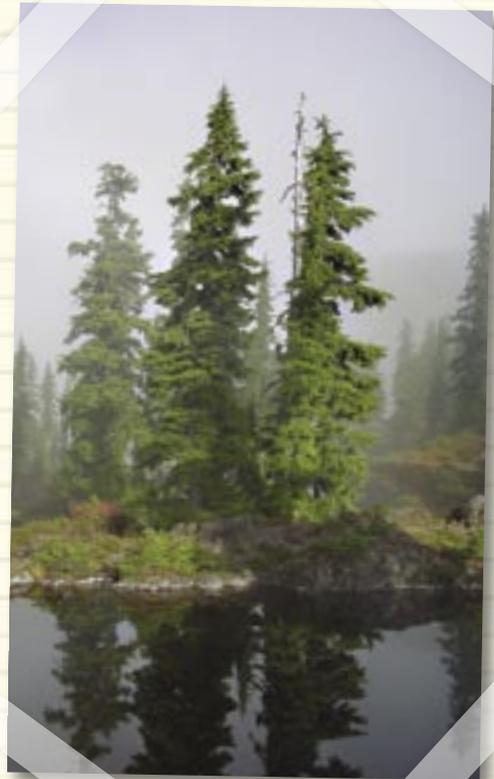
— Dr. Shirley Malcom, Head of Education
and Human Resources, AAAS

National Parks

National parks play an important role in the world's future environmental health. National parks protect lands and waters of outstanding biological diversity and extraordinary scientific beauty. They provide places where visitors can experience nature and understand more clearly their own role in the natural world. They often protect cultural resources such as historical sites and archaeological finds that might otherwise be lost to time.

In the Americas, there are currently over 650 officially designated National Parks. They range from Quttinirpaaq National Park in Northern Canada to Tierra del Fuego National Park in Patagonia; from Nelson's Dockyard National Park in the Caribbean, to Rapa Nui National Park in the Pacific. Some are small, such as Black Sound Cay National Park in the Bahamas (only 1 hectare in size). Others are immense, such as Wood Buffalo National Park in Canada (4,539,023 hectares). There are desert parks (Sierra de San Pedro Martir National Park in Mexico), tropical forest parks (La Amistad National Park in Panama), coastal parks (Isla Guambelin National Park in Chile) and representatives of numerous other ecosystems. Some include significant wilderness areas, such as Parima-Tapirapécó National Park in Venezuela. Others commemorate cultural events or indigenous peoples (Mesa Verde National Park in the US). The 'grand diversity' of national parks within the hemisphere is both compelling and challenging.

For scientists, national parks serve as important outdoor laboratories for science. The many unusual or rare features that led to the creation of national parks make them outstanding locations for research. In many cases, the ability to study plants, animals, and biophysical systems in the relatively undisturbed landscape of a park is essential to understand how human actions are transforming the earth. Science is also essential for the long-term preservation of national parks. The variety, scope, and complexity of park resources require sophisticated knowledge and expertise in order to manage wisely, and preserve national parks for the future. Hence, the Canon National Parks Science Scholars Program supports the NPS goal of "parks for science" as well as "science for parks."



History of the Program

In 1996, the US National Park Service began an extraordinary effort to increase its support for science and advance the role of science in managing the national parks. Attracting faculty and the best students to do research in parks, and creating the next generation of conservation scientists, were high priorities. NPS leaders began to search for partners to make this idea possible. At the same time, Canon U.S.A., Inc. was seeking ways to support the preservation of national parks, as part of its Clean Earth Campaign. The opportunity to contribute to the advancement of science and preservation of national parks, and to do so within the corporate philosophy of *kyosei*, was compelling.

Critical to the program was the participation of the American Association for the Advancement of Science (AAAS). As the world's largest general scientific society, the AAAS could spread awareness of the program through the scientific community, and play an essential role in evaluating proposals and assisting the young scientists selected for scholarship. AAAS was approached as a possible participant, and the reaction was overwhelmingly positive. The program was a natural fit with AAAS' science education efforts.

"The development of findings from innovative scientific research is a significant goal of this effort. The parks are national treasures that need our support. We hope our investment in this program will make a positive impact on the environment for years to come—a Canon legacy."

—Haruo Murase, President and CEO,
Canon U.S.A., Inc. (1993—1999)



“Canon U.S.A., Inc. and the Canon National Parks Science Scholars Program support a unique opportunity for PhD students to conduct ecological research. The program provides an invaluable service of connecting new researchers to our national parks, their ecosystems, and their management needs. We deeply appreciate the contribution that Canon U.S.A., Inc. is making to conservation.”

—Mary Barber, Director,
Science Program Office,
Ecological Society of America

The Canon National Parks Science Scholars Program was initiated in 1997, with a five-year, US\$2.6 million commitment from Canon U.S.A., Inc. Originally, the program supported graduate students studying in national parks in the United States. During its first five-year cycle (1997–2002), 37 Canon Scholars were selected and went through the program. Park managers began to see the benefits of the student research and to apply their findings to improve park management. Since then, these young scientists have gone on to successful scientific and conservation careers.

In 2002, Canon U.S.A., Inc. renewed and expanded its commitment by providing an additional US\$2.98 million for 2002–2006 and significantly expanding the program to all the countries of the Americas. As of 2004, 54 young scientists have been selected as Canon Scholars, and they have conducted research in over 69 national parks across the Americas.

“The Canon National Parks Science Scholars Program is one of the most exciting programs our agency is privileged to be a part of. This valued partnership, consisting of students, universities, Canon U.S.A., Inc., the AAAS and the NPS provides a wonderful opportunity to recognize these young scientists. The research they conduct is vital to the preservation and understanding of national park resources.”

—Fran P. Mainella, Director,
US National Park Service

The Partners

Canon U.S.A., Inc., the American Association for the Advancement of Science, the US National Park Service, and universities across the Americas all work together to support the Canon National Parks Science Scholars Program. The program draws together the worlds of business, non-profit organizations, government, and higher education in a unique and innovative collaboration. This section of the report describes the sponsoring partners and their program responsibilities.

The Canon logo is written in a bold, red, sans-serif font.The AAAS logo features a blue square with white diagonal lines to the left of the letters "AAAS" in a blue, serif font. Below the letters is the tagline "ADVANCING SCIENCE. SERVING SOCIETY" in a smaller, blue, sans-serif font.

AAAS
ADVANCING SCIENCE. SERVING SOCIETY



Canon U.S.A., Inc.

Canon U.S.A., Inc. is a subsidiary of Canon Inc. The company delivers consumer, business-to-business, and industrial imaging solutions. Since 1990, the company's environmental philanthropy has exceeded US\$30 million, establishing Canon as one of the largest corporate supporters of environmental education and conservation. Canon's activities include the Canon Envirothon (North America's largest high school environmental education competition), the PBS television series *Nature*, programs at Yellowstone National Park, the Canon National Parks Science Scholars Program, and many additional local programs.

Canon U.S.A.'s parent company Canon Inc., is a top patent-holder of technology, ranking third overall in the US in 2004, with global revenues of US\$29.9 billion. Canon U.S.A., Inc. employs more than 10,000 people at over 30 locations. Canon is a global leader in sustainable development and is committed to the protection of the global environment. For more information, visit www.usa.canon.com. For more details about the company's corporate social responsibility initiative, visit www.canon.com/environment.

Canon underwrites the Canon National Parks Science Scholars Program, providing funds for student scholarships and program activities that enrich the student's scientific and leadership training. Canon employees participate in the program retreats, provide training in the use of Canon camera and optic technology, and loan Canon Scholars specialized equipment when appropriate to the student's research.



"As a global leader in environmentally conscious management and technological innovation, we value the importance of scientific exploration and the protection of the global environment. We are proud to be a founder of this unique scholarship program. The work accomplished by all these outstanding students and their important findings will benefit our world and its citizens for generations."

—Kinya Uchida, President and CEO,
Canon U.S.A., Inc. (1999—2005)

The American Association for the Advancement of Science

The American Association for the Advancement of Science (AAAS) is the world's largest general scientific society and publisher of the weekly journal *Science*. The AAAS is dedicated to fostering scientific freedom and responsibility, improving the effectiveness of science in the promotion of human welfare, advancing education in science, and increasing the public's understanding and appreciation of the promise of scientific methods in human progress.

Founded in 1848, the AAAS includes 262 affiliated societies and academies of science, serving 10 million individuals worldwide. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world, with an estimated total readership of one million. The non-profit AAAS is open for membership to all and fulfills its mission to "advance science and serve society" through initiatives in science policy, international programs, science education, and more.

The AAAS contributes to the Canon National Parks Science Scholars Program in several essential ways. The AAAS widely distributes announcements through its program affiliates and in *Science*. The AAAS draws on its members to serve on an international panel of scientists that review and evaluate student proposals. On the basis of the panel's recommendation, the AAAS selects the winning students. AAAS professionals provide guidance and advice to the program, participate in the program retreats, offer professional development opportunities for interested Canon Scholars, and sponsor a Canon Scholars workshop at selected AAAS annual meetings. For more information, visit www.aaas.org.



"The Canon National Parks Science Scholars Program is an extraordinary program that produces exceptional results. We believe that the program continues to select outstanding scholars who will advance science and innovation throughout the world for the benefit of all people."

—Dr. Alan I. Leshner, CEO,
American Association for the
Advancement of Science and
Executive Publisher, *Science*

US National Park Service

The National Park Service's mission is to conserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of future generations. The NPS cooperates with partners to extend the benefits of natural and cultural heritage conservation and outdoor recreation throughout the Americas and the world. The National Park Service has over 20,000 employees—rangers, natural resource managers, archaeologists, historians, interpreters, landscape architects, engineers, and planners—who all work toward achieving the mission of the NPS.

Established in 1916 by an act of Congress, the National Park System comprises 388 areas covering roughly 84 million acres that are located in 49 States, the District of Columbia, American Samoa, Guam, Puerto Rico, Saipan, and the Virgin Islands. These areas of national significance include parks, monuments, seashores, battlefields and other cultural and recreational sites, and collectively account for over 275 million visits annually.

“...to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

—From the US National
Park Service Organic Act,
1916



The variety, scope, complexity, and size of the parks managed by the NPS require scientific knowledge and expertise in cultural and natural resource management. To enhance scientific understanding and knowledge of the resources that they are mandated to protect, national parks serve as natural laboratories, classrooms, and libraries for the study of physical, biological, and cultural systems and their components. For Canon Scholars, national parks represent unique opportunities to conduct their dissertation research and to benefit from the expertise of National Park Service staff, and to contribute to protecting the nation's heritage. For more information, visit www.nps.gov.

The NPS contributes to the Canon National Parks Science Scholars Program in important ways. The NPS provides one of its senior scientists to serve as Program Coordinator, and together with NPS-funded staff, the Program Coordinator oversees the program, organizes the annual scholarship competitions, science symposia, retreats, and other activities of the program. The Program Coordinator monitors each Canon Scholar's progress. The NPS also hosts the program's website www.nature.nps.gov/canonscholarships/. NPS leaders mentor Canon Scholars and participate in the science symposia and retreats.

The Program

The Canon National Parks Science Scholars Program provides scholarship awards to doctoral students throughout the Americas to conduct scientific research in national parks throughout the region. This section of the report describes how the program operates, how the Canon Scholars are selected, and their responsibilities during their time as Canon Scholars.

Much of the science important to the future of national parks crosses traditional academic disciplines, from anthropology to zoology. Hence, the program awards scholarships in four broad categories: 1) the biological sciences, 2) the physical sciences, 3) the social/cultural sciences, and 4) technology innovation in support of conservation science.

Students in the *biological sciences* might re-search the population dynamics of a wildlife species, or the impacts of invasive species on native ecosystems. Students in the *physical sciences* could study issues related to air and water quality, or they might evaluate the consequences of climate change on park resources. Students in the *social/cultural sciences* could explore areas and artifacts associated with ancestral human cultures to better understand their relationship with the natural landscape; or they could analyze the local, social, and political processes that contribute to effective park management. Students in the field of *technology innovation in support of conservation science* might use remote sensing technology to evaluate changes in forest composition in response to land use; or they could track the movement of a wildlife species across the landscape using radio telemetry and geographic positioning systems.



A significant portion of a student's research must be in, or directly relevant to, a national park. National parks are those protected areas officially recognized and identified as *national parks and/or units of a national park system by the national government of a country*. The World Conservation Union—IUCN provides a formal definition:

"A natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible."

—From *Guidelines for Protected Areas Management Categories*.

IUCN, Cambridge, UK and Gland, Switzerland,
1994

National parks are designated to conserve unimpaired and in perpetuity cultural resources and ecosystem integrity, as well as to provide opportunities for recreation, visitor enjoyment, and scientific and educational activities. National parks are managed to protect from human development or occupancy an area consisting of one or more terrestrial or aquatic ecosystems, native species, geological features, remarkable natural scenery, and cultural resources associated with ancestral human cultures. National parks are protected domestically through legal and other effective means at the highest government level.



The program awards scholarships to doctoral students from throughout the Americas—Canada, the United States, Mexico, the countries of Central and South America, and the countries of the Caribbean. Eight Canon National Parks Science Scholarships are awarded each year. Four Canon National Parks Science Scholars are selected from students studying at universities in the United States—one winner in each of the categories described above. Four Canon National Parks Science Scholars are selected from students studying at universities throughout the Americas, but outside the United States—one winner in each of the categories described above. In addition, four Honorable Mentions are selected from students throughout all of the Americas.

Each Canon Scholar is awarded a scholarship of US\$78,000 in support of his or her doctoral dissertation research. The dissertation research is to be completed within three years of receiving the scholarship award. Scholarship funds can be used for tuition, books, fieldwork expenses such as research assistants, equipment and supplies needed to complete the research project, laboratory expenses, travel to field sites and scientific meetings, and a student stipend (set by the university). Each Honorable Mention winner receives an award of US\$1,000.



“My opportunity to participate in the Canon National Parks Science Scholars Program came at precisely the right time in pursuing my dissertation research. With this fellowship I was able to conduct all the analyses needed for a research product that contributes in the fields of archaeology, geology, geochemistry, and forest fire management. With support like this, doing science is more than challenging and rewarding: doing science is fun.”

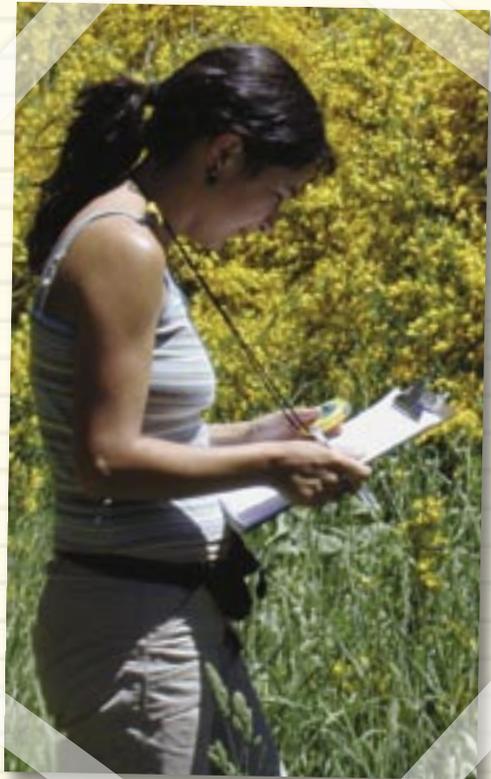
—Anastasia Steffen, Canon Scholar '00

How the Program Works

Each fall, a new annual cycle of the program begins. Application procedures and materials for the upcoming scholarship competition are posted on the US National Park Service website at www.nature.nps.gov/canonscholarships/. Information about the new scholarship competition is widely disseminated to ensure that students throughout the Americas are aware of the opportunity. Program announcements in English and Spanish are sent to all higher-degree granting universities across the Americas. Announcements are also sent to relevant conservation organizations throughout the region. In addition, announcements are distributed through several electronic mailing lists to interested individuals and institutions. The program also is advertised in several scientific publications and posted on several websites. The AAAS provides a full-page announcement in *Science*, read by over one million science professionals each week.

All applicants must meet specific criteria of eligibility in order to be considered for a Canon National Parks Science Scholarship. Applicants must be citizens of a country in the Americas. They must be students enrolled in a PhD (Doctor of Philosophy) graduate program at an accredited university within the Americas, and have completed a majority of their coursework. A student's dissertation research proposal must already have been submitted and approved by his or her dissertation committee. At least *some* portion of the proposed research must take place in—or be significantly and specifically relevant to—one or more national parks in the student's country of citizenship.

Eligible applicants submit an application package by the spring deadline. The most important element is the student's dissertation proposal. The proposal must include a discussion of the research problem and information such as relevant scientific literature, supporting theory, research methods (including data collection and analysis of results), the name of the national park(s) in which the research will take place, and relevance of the proposed research to national park conservation and/or management. Students are strongly encouraged to discuss their proposed project with national park staff prior to submitting their proposal, although this is not a requirement of the application process.



Once received, all applications are carefully reviewed to ensure that all the eligibility requirements are met. All qualifying applications are then sent to the AAAS, which administers the review, evaluation, and selection process. The involvement of the AAAS is an essential element of the success of the program and greatly benefits the applicants and their research. As the world's largest general scientific society, and as a federation of affiliated societies, the AAAS provides professional affiliation for 10 million scientists worldwide. The AAAS engages international scientific experts in a broad range of relevant disciplines to serve on review panels that evaluate all eligible applications.

The contributions of the AAAS review panels to the program are two-fold: 1) they ensure a rigorous evaluation process that upholds the highest standards of scientific excellence, and 2) they assist students in improving their doctoral dissertation research proposals by providing detailed evaluations. Constructive criticism and insightful suggestions provided by the review panels help all applicants, not just those selected to become Canon Scholars.



“This is an excellent proposal. I am wondering a bit about the experiment with mangrove seedlings and marsh species – the pots seem very small unless the PI can rationalize that this is a realistic regeneration substrate in terms of space and resource availability (how many seedlings per pot?). Also, can we expect that the number of replicates used here will be reasonable for quantifying the response of interest?”

—Reviewer’s Comment, 2001 AAAS Scientific Review Panel

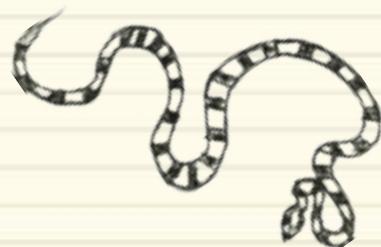
Each application is initially evaluated by several scientists for appropriate fields of study from throughout the Americas. They carefully evaluate each proposal and recommend the most promising ones for future review. A scientific review panel is then convened by the AAAS. This panel reviews each of the top proposals, ranks and discusses them, and selects the winners and Honorable Mentions. The scientific review panel also acts as an advisory group and provides expert advice and suggestions for improving the program. Since 1997, over 100 reviewers from a wide range of scientific fields have provided preliminary reviews, and 72 distinguished scientists have volunteered to serve on the scientific review panels for the Canon National Parks Science Scholars Program.

Evaluation criteria emphasize scientific merit and creativity. Research proposals are evaluated for the extent to which existing scientific theory has been considered and integrated, and the contributions that the research can make to the advancement of science. Study design and analysis are evaluated in terms of appropriateness to addressing the research problem and innovation in the use of existing or new methods. The significance and contributions of the research to national park conservation and management, as well as the feasibility of conducting the research in a national park, are important criteria. The capacity of the student to successfully complete the research within a limited time frame also is considered.

Once the scientific review panel selects the scholarship awardees, winning students are notified of their selection. The AAAS transfers scholarship funds, provided by Canon U.S.A., Inc., to each student's university.

During their participation in the program as Canon Scholars, students conduct their fieldwork and research, analyze the results, and write their doctoral dissertation. In addition, they are expected to participate in program activities such as the awards ceremonies, science symposia, and retreats. Students submit periodic progress reports on their research. They also prepare an article for the general public on the significance of their research to the management and conservation of national parks. Students defend their doctoral research and (once successful) are granted a PhD by their university. They submit a copy of their dissertation thesis to all the program partners, thus completing their Canon Scholarship. Past and present Canon Scholars stay in contact through websites, correspondence, and periodic updates on the program.

Since its inception, the program has grown to become one of the world's most prestigious awards in the field of conservation and national park management. The scholarship competition attracts each year a large number of very qualified applicants from all over the Americas. Both the application and selection processes are rigorous. In 2004, 133 dissertation proposals were received, with only the top 8 receiving Canon Scholarships—a 14% acceptance rate. Appendix 1 at the end of this report provides key facts about the program, the Canon Scholars, and their work.



The Canon Scholars

The Canon National Parks Science Scholars Program brings together an extraordinary group of students, all sharing a deep commitment and dedication to science and conserving national parks. Eight classes of Canon Scholars, at various stages of completion of their doctorate, have been or currently are involved with the program. They are exploring a wide spectrum of research topics that help park managers develop more effective conservation strategies for national parks across the Americas.

Most of the members of the first five classes of Canon Scholars (selected in 1997–2001) have completed their doctorate. Current Canon Scholars (the classes selected in 2002–2003) are making significant progress in their research and will be completing their degree within the next few years. The most recently selected Canon Scholars (the class of 2004) are just beginning their dissertation research. This section of the report profiles each of the Canon Scholars and describes their research activities.

1997 Canon Scholars



Ilene Grossman-Bailey

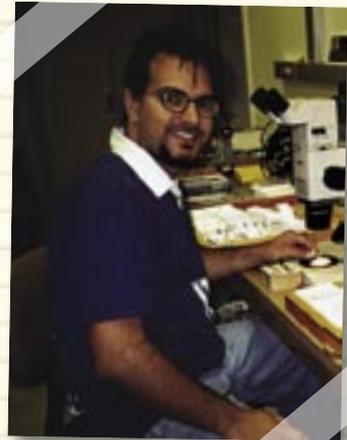
Ilene Grossman-Bailey completed her PhD in 2001 at Temple University. Her dissertation is titled *The People who Lived by the Ocean: Native American Resource Use and Settlement in the Outer Coastal Plain of New Jersey*. She conducted her research along the **New Jersey Coastal Heritage Trail Route** and in the Pinelands National Reserve. She identified and analyzed prehistoric Native American settlement and resource use patterns in the New Jersey Outer Coastal Plain. The purpose of her research was to understand the dynamic relationship between human populations and the changing landscape over the past 11,000 years. Her findings provide historical information relevant to the conservation and interpretation of sites associated with these groups of Native Americans. Dr. Grossman-Bailey is now a Senior Archaeologist at Richard Grubb & Associates in New Jersey.



Thomas Meixner

Studying at the University of Arizona, **Thomas Meixner** completed his PhD in 1999. His dissertation is entitled *Alpine Biogeochemical Modeling: Case Studies, Improvements, and Parameter Estimation*. He conducted his research in **Kings Canyon National Park, Rocky Mountain National Park, and Sequoia National Park**. He investigated changes in the biogeochemical and hydrologic processes of alpine watersheds in parks. The purpose of his research was to assess the susceptibility of alpine regions to increases in atmospherically-deposited nitrogen and sulfate, and acidity as a result of a park's close proximity to rapidly developing areas. His findings provide park managers with an increased understanding of watershed processes. Dr. Meixner is now an Assistant Professor of Hydrology in the Department of Environmental Sciences at the University of California, Riverside. He has developed a research program in watershed biogeochemistry that focuses on the impacts of atmospheric deposition, land use history, and geologic controls on surface water quality in southern California.

Andrew Suarez completed his PhD in 2000 at the University of California, San Diego. His dissertation research, entitled *Causes and Consequences of Biological Invasions: the Argentine Ant in Southern California*, was conducted in **Cabrillo National Monument**. He investigated the susceptibility of natural areas to be invaded by exotic species and the subsequent impacts of exotic species on various components of the ecosystem. His findings provide a better understanding of the mechanisms behind biological invasions and how invasive species impact natural systems. His work is useful for park managers in developing effective strategies that will help prevent the establishment of exotic species in national parks. Dr. Suarez is now an Assistant Professor in the Department of Entomology and the Department of Animal Biology at the University of Illinois, Urbana-Champaign. His research interests include the effects of habitat fragmentation and the consequences and mechanisms of success in biological invasions.



Andrew Suarez

1998 Canon Scholars

Elizabeth Barrie studied at Indiana University and completed her PhD in 2001. The title of her dissertation is *Meaningful Interpretive Experiences from the Participants' Perspective*. Her research was conducted in **Yellowstone National Park** and the Smithsonian National Museum of American History in Washington, DC. She investigated the importance of interpretive activities such as informative talks, guided walks, and museum exhibits, to creating meaningful experiences for visitors in national parks and other sites. Her findings provide insight into the elements that are necessary for meaningful interpretive experiences for park visitors and help park managers in the creation and evaluation of interpretive programs. Dr. Barrie currently works with the Resource Interpretation Program at Stephen F. Austin State University in Texas. Her work includes reviewing interpretive products for the US National Park Service.



Elizabeth Barrie



Kurt Menning

Kurt Menning attended the University of California, Berkeley and completed his PhD in 2003. He conducted research in **Sequoia National Park** for his dissertation entitled *Heterogeneity in Forest Structure Prior to Restoration by Fire*. He examined the structure, pattern, and composition of mixed conifer forest in three time periods (historic, pre-fire, and post-fire) across several spatial scales (individual tree, patch, and landscape). His research helps better understand current forest conditions and how they are affected by the reintroduction of fire. His findings are valuable to park managers for evaluating the objectives and methods of reintroducing fire to a mixed conifer forest. Dr. Menning is now conducting postdoctoral research at the University of California, Berkeley and is assessing the risks and consequences of landscape-scale fires.



Karen Short

Studying at the University of Montana, Missoula, **Karen Short** completed her PhD in 2003. Her dissertation is entitled *Complexity and Variation in the Effects of Low-Severity Fires on Forest Biota*. She conducted her research in **Grand Canyon National Park, Saguaro National Park, and Walnut Canyon National Monument**. She examined bird and arthropod populations in ponderosa pine forests before and after frequent, low-severity fires, to identify habitat attributes that influence avian use. She studied changes in abundance of the Yellow-eyed Junco in relation to changes in the availability of foraging and nest sites after a fire. Her findings help park managers understand the effects of prescribed burns on fauna. Dr. Short is currently managing the LANDFIRE Database at the Fire Sciences Laboratory of the US Forest Service in Montana. She is responsible for compiling data that characterizes vegetation and fire fuels, which is used to generate predictive models for fuel treatment and restoration projects.

1999 Canon Scholars

Helen Neville Arsenault studied at the University of Nevada, Reno and completed her PhD in 2003. Her research was located in Marys River basin, managed by the US Forest Service. The title of her dissertation is *Genetic Assessment of Complex Dynamics in an Interior Salmonid Metapopulation*. She analyzed the population genetics of a threatened species of trout to assess their dispersal dynamics throughout various parts of a high-desert river system. Her research evaluated the distribution of groups of individual trout belonging to the same population in relation to isolated areas of suitable habitat. The purpose of Helen's research was to determine the effects of isolation and habitat fragmentation on the viability of threatened trout populations. Her findings are useful to natural park managers in developing management plans and designing reserves that conserve trout and salmon species. Dr. Neville Arsenault is a postdoctoral researcher in Nevada, in a joint position between the Rocky Mountain Research Station of the US Forest Service in Idaho and the University of Nevada, Reno. She is conducting research on salmon and trout genetics.



Helen Neville Arsenault

Attending North Carolina State University, **Daiwen Kang** completed his PhD in 2001. Entitled *Measurement, Modeling, and Analysis of Non-Methane Hydrocarbons and Ozone in the Southeast United States National Parks*, his dissertation research was based on data collected in **Great Smoky Mountains National Park, Mammoth Cave National Park, and Shenandoah National Park**. Utilizing measurements of the concentration of volatile organic compounds (VOCs) in the air above national parks, he analyzed VOC composition. Based on his findings, he identified sources of VOC emission to determine how these sources impact park air quality. His research helps park managers develop management strategies to meet the clean air quality standards of parks. Dr. Kang now works as a scientist at the US Environmental Protection Agency in North Carolina.



Daiwen Kang



Richard Makopondo

Richard Makopondo completed his PhD in 2004 at the University of Illinois, Urbana-Champaign. He conducted his research in **Boston Harbor Islands National Recreation Area**. The title of his dissertation is *Collaboration, Partnerships, and the Involvement of Racial/Ethnic Minorities with Public Outdoor Recreation Resources*. He analyzed participation of minority communities in the planning, development, and use of recreation resources, facilities, and services in the national recreation area. The purpose of his research was to identify some of the socioeconomic, cultural, environmental, and other institutional factors that affect the efforts of park partnerships intended to promote local involvement in decision-making on recreation resources. Dr. Makopondo is now the Coordinator for Tourism, Commercial Recreation and Leisure Studies at San Jose State University in California.

Derek Martin is a student at the University of California, Irvine. He is conducting his research in **Rocky Mountain National Park**. He is exploring the attitudes and social influences of African Americans and Whites that create behavioral differences in visiting national parks and participating in leisure activities. The purpose of his research is to better understand the social processes and influences that contribute to stimulating or deterring participation of African Americans and Whites in outdoor activities and shape their attitudes regarding national parks. His findings will provide guidance to park managers in designing programs that attract a diversity of visitors to national parks.



Derek Martin



Koren Nydick

Attending Colorado State University, **Koren Nydick** completed her PhD in 2003. Her research sites were located in **Rocky Mountain National Park**, and the title of her dissertation is *Mountain Lake Responses to Elevated Nitrogen Deposition in the West: Algal Productivity and Nitrogen Retention*. She studied the effects of nitrogen and other nutrients on nutrient cycling, algal plant productivity, and aquatic communities and food webs in high elevation lakes. Nitrogen is deposited in the lakes through rain mixed with agricultural, automotive, and industrial emissions. Park managers use Koren's findings to mitigate the ecological impacts of air pollution on park resources. Dr. Nydick is now the Research and Education Director for the Mountain Studies Institute in Colorado.



Bibit Traut completed her PhD in 2003 at the University of California, Davis. She completed her research in **Point Reyes National Seashore**. Her dissertation is entitled *The High Salt Marsh: A Model for Ecotone and Metacommunity Theories*. She measured vegetation patterns, chemical conditions, and spatial configurations of salt marshes. She assessed the impacts of grazing and nitrogen addition on salt marsh community dynamics. Plant communities in the marine/terrestrial transition zone provide essential ecological functions that mediate nitrogen retention and removal. Her findings are helpful to policy-makers and managers in their efforts to protect and restore salt marshes. Dr. Traut is a Postdoctoral Research Fellow at the University of California, Berkeley. She continues to examine the relationship between plant species composition and nitrogen cycling in the marine/terrestrial transition zone in Point Reyes National Seashore.



Bibit Traut



Laura Watt

Laura Watt attended the University of California, Berkeley and completed her PhD in 2001. Entitled *Managing Cultural Landscapes: Reconciling Local Preservation and Institutional Ideology in the National Park Service*, her dissertation research was conducted in **Point Reyes National Seashore**. She examined the impact of the National Park Service on the landscapes and resources it manages, as well as on local communities and cultures. The purpose of her research was to assess the extent to which the process of preservation and management by the National Park Service reshapes cultural landscapes, away from the distinctive cultural characteristics that initially were designated for preservation. Her findings provide a better understanding to park managers about the effects of the institutional ideas of the US National Park Service on the resources that parks are designed to protect. Dr. Watt is now an Environmental Planner at EDAW, Inc. in California.

A student at the University of Colorado, Boulder, **Alice Wondrak Biel** completed her PhD in 2002. She conducted her research in **Yellowstone National Park**, and the title of her dissertation is *(Do Not) Feed the Bears: A Cultural History of Bears and People in Yellowstone National Park*. She explored the history of bear management at Yellowstone National Park and how this has affected visitor experience. She examined the ways in which environmental history and cultural change have impacted the US National Park Service, both in favor as well as against its mission. Her findings help park managers develop interpretive and educational strategies to better explain and promote the park and its policies. As a Canon Scholar, she was a keynote speaker and judge at the Canon Envirothon in 2002. Dr. Wondrak Biel is now a writer-editor for the Yellowstone Center for Resources at Yellowstone National Park in Wyoming. Her work involves communicating scientific information to the general public.



Alice Wondrak Biel

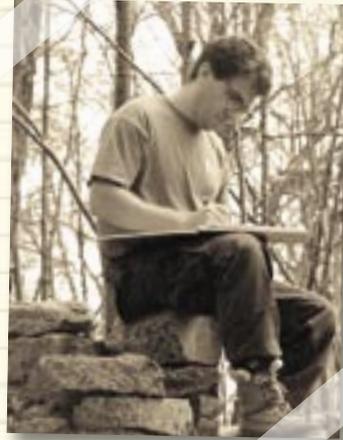
2000 Canon Scholars



Nichole Barger

Attending Colorado State University, **Nichole Barger** completed her PhD in 2003. She conducted her research in **Canyonlands National Park**, and the title of her dissertation is *Impacts of Biological Soil Crusts on Ecosystem N Cycling in Canyonlands National Park*. She studied the contribution of biological soil crusts to nitrogen flows in terrestrial ecosystems. Nichole's findings help land managers understand the scientific basis of using biological soil crusts as indicators of physical resource condition and ecosystem integrity. Dr. Barger is a Postdoctoral Research Scientist at the Institute of Arctic and Alpine Research at the University of Colorado, Boulder. She is researching the effect of climate and livestock grazing on the expansion of pinyon-juniper woodlands on the Colorado Plateau.

James Battin completed his PhD in 2003 at Northern Arizona University. Entitled *Modeling the Population Dynamics of Migratory Birds and Butterflies under Ponderosa Pine Forest Restoration*, his dissertation research was conducted in **Grand Canyon National Park** and **Parashant National Monument**. He examined the effects of removing smaller trees and introducing regular prescribed burns in ponderosa pine forest on habitat selection choices of breeding bird and butterfly species. The purpose of his research was to assess the impacts of forestry practices designed to reduce fire risk on wildlife population dynamics. His findings were used to develop a computer model that enables park managers to predict the impacts of different fire reintroduction scenarios on wildlife. Dr. Battin currently holds a postdoctoral research position at the National Marine Fisheries Service's Northwest Fisheries Science Center in Washington. His work involves modeling the impact of potential habitat restoration actions on threatened and endangered salmon populations under different future threat scenarios.



James Battin



Brent Buenger

Completing his PhD in 2003, **Brent Buenger** attended the University of Kansas. Entitled *The Impact of Wildland and Prescribed Fire on Archaeological Resources*, his dissertation research was conducted in **Badlands National Park**, **Rocky Mountain National Park** and **Wind Cave National Park**. He studied the effects of thermal alteration of archaeological resources, in order to identify factors that impact their preservation. His findings are being used to make predictions about the impact of wildfire and prescribed fires on archaeological resources. This will be useful to park managers in determining how landscape fire has affected the formation, preservation, and interpretation of archaeological sites. Dr. Buenger now works at an archaeology consulting company in Wyoming.

A student at Colorado State University, **Veronica Estelle** is conducting her research in **Golden Gate National Recreation Area, Point Reyes National Seashore,** and Bodega Harbor. She is investigating the potential indirect effects of an introduced crab species on migratory and wintering shorebirds. The introduced European green crab consumes many of the same prey species that shorebirds require for their migrations and winter seasons. Veronica's research will assess the effects of competition for food with crabs on shorebirds. Her findings will contribute to better understanding the impacts of non-native species in marine systems.



Veronica Estelle



Susan Prichard

Studying at the University of Washington, Seattle, **Susan Prichard** completed her PhD in 2003. She conducted her research in **North Cascades National Park**. The title of her dissertation is *Spatial and Temporal Dynamics of Fire and Vegetation Change in Thunder Creek Watershed, North Cascades National Park, Washington*. She analyzed charcoal and plant fossil records, distributions of forest patches and current forest species assemblages. This allowed Susan to construct a record of past fire events, including extent and severity, and associated changes in forest ecosystems. The findings of her research are being used by park resource managers to develop effective fire management plans and help guide the park's long-term ecological monitoring program. Dr. Prichard is now a Research Ecologist with the US Forest Service's Fire and Environmental Research Applications Team at the Pacific Northwest Research Station in Oregon.



Anastasia Steffen is a student at the University of New Mexico. Her research sites are located in **Bandelier National Monument** and Santa Fe National Forest. She is studying the effects of forest fires on obsidian-containing artifacts found at archaeological sites. Heat damage to obsidian interferes with an archaeologist's ability to use obsidian for hydration dating, by altering its chemical composition. A better understanding of how heat affects obsidian will be helpful for interpreting more accurately the results of the obsidian hydration dating method, when applied to archaeological resources subjected to prescribed and natural fires. Anastasia's research could also lead to new applications of obsidian analysis in studying past forest fire frequencies. Her work will provide useful information for reconstructing past climates and environmental conditions.



Anastasia Steffen



Martin Wilmking

Martin Wilmking completed his PhD in 2003 at the University of Alaska, Fairbanks. His research sites were located in **Denali National Park and Preserve** and **Gates of the Arctic National Park**. The title of his dissertation is *The Treeline Ecotone in Interior Alaska—From Theory to Planning and the Ecology in Between*. He studied changes in growth rate of white spruce along the treeline that separates boreal forest from alpine or arctic tundra. Martin's findings help natural resource managers make predictions based on prevailing site conditions about future forest and tundra coverage in response to changing global climatic conditions. Dr. Wilmking is now a NOAA/UCAR Postdoctoral Fellow at the Lamont Doherty Tree Ring Laboratory at Columbia University in New York, jointly with the US Geological Survey in California. He is also an Affiliate Assistant Professor in the Forest Science Department of the University of Alaska, Fairbanks.

2001 Canon Scholars

Emily Brown completed her PhD in 2005 at Columbia University. Her research sites were located in **Aztec Ruins National Monument, Bandelier National Monument, Canyon de Chelly National Monument, Casa Grande Ruins National Monument, Chaco Culture National Historical Park, El Morro National Monument, Gila Cliff Dwellings National Monument, Mesa Verde National Park, Montezuma Castle National Monument, Pecos National Historical Park, Petrified Forest National Park, Salinas Pueblo Missions National Monument, Tuzigoot National Monument, and Wupatki National Monument.** Her dissertation is *Instruments of Power: Musical Performance in Rituals of the Ancestral Puebloans of the American Southwest*. She researched ancestral musical instruments used by inhabitants of the southwestern pueblos in ritual ceremonies during the late 19th and early 20th centuries. The archaeological sites at which these instruments were excavated suggest that pueblo inhabitants performed rituals asking for rain, bountiful harvests, and other blessings. Her findings will provide a better understanding of the history and social context of ritual ceremonies among prehistoric southwestern peoples. Dr. Brown works as an archaeologist at the Intermountain Regional Office of the US National Park Service in New Mexico.



Emily Brown





Elizabeth Brusati

Elizabeth Brusati completed her PhD in 2004 at the University of California, Davis. She conducted her research in **Point Reyes National Seashore** and San Francisco Bay. The title of her dissertation is *Effects of Native and Hybrid Cordgrass on Benthic Invertebrate Communities and Food Webs*. She investigated the effects of exotic cordgrass on native marsh communities, in particular invertebrates, and how cordgrass contributes to habitat change. Habitat change, especially in estuaries, represents a threat to migrating shorebirds. Her findings help park managers prepare for and reduce impacts of exotic cordgrass in estuarine habitats that are used by migrating shorebirds. Dr. Brusati is now a project manager with the California Invasive Plant Council. She is involved with compiling an inventory of invasive plants in California and educating the public on alternatives to using invasive plants for home landscaping.

Andrew Bunn completed his PhD in 2004 at Montana State University, Bozeman. His dissertation research, entitled *Temporal and Spatial Patterns at Alpine Treeline in the Sierra Nevada USA: Implications for Global Change*, was conducted in **Sequoia National Park**, **Yellowstone National Park**, and **Yosemite National Park**. His research focused on investigating the relationship between treeline dynamics and global climate variability. His findings contribute to better understanding how patterns in climatic variation affect ecological processes in addition to when and where these occur. This is helpful to improve the ability of natural resource managers to forecast the effects of global climate change on alpine ecosystems. Dr. Bunn currently holds a postdoctoral research position at the Woods Hole Research Center in Massachusetts.



Andrew Bunn



Robert Hale

Robert Hale completed his PhD in 2004 at the University of Oklahoma. The title of his dissertation is *Alterations in Land Surface-Atmosphere Processes Resulting from the 1988 Greater Yellowstone Area Fires*. He conducted his research in **Yellowstone National Park**. In his research, he quantified the long-term impact of fire-induced vegetation changes on the amount of moisture in the soil. Long-term modifications of soil moisture in the Greater Yellowstone area could have significant implications for regional climate, agriculture, and ecosystem management.

Ruth Lambert is a student at the University of New Mexico. Her research sites are located in **Wupatki National Monument**. She is conducting excavations in small structures and prehistoric trash areas of the monument. Botanical and soils data, together with surface mapping of structures, artifacts, and environmental features will be used to understand how and when these sites were used in the past and in relation to large inhabited sites. These findings will be useful for determining prehistoric use of the area and settlement patterns at the monument.



Ruth Lambert



Wendy Palen

Wendy Palen is a student at the University of Washington, Seattle. She is conducting her research in **Olympic National Park**. She is studying the population dynamics of amphibian species in alpine ponds as a function of variation in ultraviolet radiation due to pond clarity, and differences in physiological sensitivity of species to ultraviolet exposure. The purpose of her research is to better understand the distribution of amphibian species as a result of exposure to increasing levels of ultraviolet radiation. With Wendy's findings, natural resource managers will be able to forecast amphibian species distributions, and assess future threats from stratospheric ozone deterioration and predicted change in climate regimes on amphibian species of concern.



Susan Rupp

Susan Rupp is a student at Texas Tech University. She is conducting her research in **Bandelier National Monument** and Santa Fe National Forest. Her research focuses on developing an ecosystem model of vegetation recovery processes following a large-scale fire. This will be integrated with a model of elk distribution and movement patterns in order to assess the relationship in terms of space and time between habitat variables and elk occurrence. This can be used for predicting potential changes in the movement and distribution of a free-ranging elk herd in an altered landscape. The outcome of Susan's research will be a useful tool for identifying management options for multiple natural resource agencies involved with mitigating the ecological impacts of elk on the landscape.

Kenwyn Blake Suttle is a student at the University of California, Berkeley. His research is taking place in **Redwood National Park**, Redwood State Park, and Angelo Coast Range Reserve. He is studying the effects of increased and reduced rainfall during different seasons on plant and arthropod species interactions, population growth rates, nutrient cycling, and community diversity in grasslands. The purpose of his research is to determine the effect of changing precipitation regimes on food webs, and subsequent impacts on native grasslands. An understanding of this is necessary to anticipate the consequences of climate change and develop appropriate management strategies that protect these grasslands.



Kenwyn Blake Suttle



2002 Canon Scholars



Linda "Rikki" Grober-Dunsmore

Linda "Rikki" Grober-Dunsmore is a student at the University of Florida. She is conducting her research in **Virgin Islands National Park**. Her research is focused on using large-scale ecosystem patterns and habitat features to predict reef fish abundance and diversity so that resource managers can create marine protected areas in these locations. Her findings are critical for developing effective management strategies to protect coral reef ecosystems worldwide from deterioration due to loss of hard corals, declines in reef fishes, and reduced biological diversity.

Mark Hebblewhite is studying at the University of Alberta in Canada. He is conducting his research in **Banff National Park**. He is examining predator-prey and foraging dynamics of elk to determine the underlying causes of change in their migration patterns across the park boundary. A better understanding of this is necessary to develop effective management strategies for wildlife that move across park boundaries. The administrative boundaries of parks often do not match ecological boundaries or park size is smaller than the ecological processes that parks are mandated to protect. This research can help address the transboundary management challenges faced by national parks.



Mark Hebblewhite



Patricia Illoldi

Patricia Illoldi is a student at the National Autonomous University of Mexico. She is conducting her research in **Benito Juárez National Park**, **Huatulco National Park**, **Lagunas de Chacahua National Park**, Tehuacán-Cuicatlán Biosphere Reserve, and Yagul Natural Monument in Mexico. Her research focuses on collecting data on occurrence of mammal species. Her findings, together with data on environmental factors such as temperature, precipitation, vegetation types, and elevation, will be used to develop a model for predicting mammal species distributions. This will be a useful tool for evaluating the extent to which existing protected areas overlap with species distributions and will help identify additional areas that need to be protected to ensure species conservation.

Studying at the University of California, San Diego, **Jessica Lundquist** completed her PhD in 2004. The title of her dissertation is *The Pulse of the Mountains: Diurnal Cycles in Western Streamflow*. She conducted her research in **Yosemite National Park**. She measured the magnitude and timing of daily fluctuations in streamflow in relation with the location and rate of snowmelt in a river basin. Her findings yield a better understanding of where and when snow melts, and how it travels through the river network. An understanding of this is critical in light of the potential impacts of global warming on snowmelt processes. Her work will help park managers anticipate and plan for the severity and distribution of pollution, the timing and danger of floods, and the impact on mountain fauna and flora as a result of snowmelt. Jessica presented her work at the 2004 Canon Envirothon. Dr. Lundquist is now a CIRES Postdoctoral Fellow in a joint position between the University of Colorado, Boulder and the NOAA Climate Diagnostics Laboratory and Environmental Technology Laboratory in Colorado. She is investigating issues that relate to climate and mountain water supply in the West.



Jessica Lundquist

Ramona Maraj is a student at the University of Calgary in Canada. Her research sites are located in **Kluane National Park and Reserve** and **Wrangell-St. Elias National Park and Preserve**. She is studying changes in grizzly bear populations in relation to ecological changes in habitat. The purpose of her research is to identify, protect, and manage areas that constitute prime grizzly bear habitat to ensure grizzly bear conservation, given the large home range of bears and competing human land-use needs. This type of information is essential for natural resource managers to foresee and prevent loss of prime grizzly bear habitat and to gain a better understanding of the effects of human land-use on grizzly bear populations.



Ramona Maraj



Carolina Morales

Carolina Morales is studying at the Universidad Nacional del Comahue in Argentina. Her research takes place in **Nahuel Huapi National Park** in Argentina. The purpose of her research is to find out if habitat disturbance promotes the invasion of alien plant species and if these alien plant species interfere with pollination of native plants. Disruption of the reproductive process of native plants may have profound consequences for the long-term survival of native species. A better understanding of the relationship between habitat disturbance and invasion of alien plant species, as well as the process through which these species impact native ecosystems, is required. Her research will help park managers better manage native plant communities and to develop management strategies that effectively address the threat of alien species.



Ashley Morris

Ashley Morris is a student at the University of Florida. Her research is taking place in **Great Smoky Mountains National Park**. She is assessing the historical population distributions as well as the evolutionary processes in response to historical climate change of American beech, witch-hazel, anise-tree, and sweetgum in the eastern United States. Her findings will be integrated into models that attempt to predict the future distribution of long-lived species under various scenarios of climate change. This will be useful to more accurately predict the future responses of these organisms to global warming and enable park managers to take appropriate resource management actions.

Marc Stern is a student at Yale University. His research takes place in **Great Smoky Mountains National Park**, **Podocarpus National Park** in Ecuador, and **Virgin Islands National Park**. He is analyzing the impacts to local communities of park management initiatives. His findings will help understand the outreach components that are required for developing park management strategies that better incorporate the needs, rights, and talents of local residents and mitigate conflicts between parks and their neighbors. Knowledge of this is essential if natural resource conservation approaches such as protected areas are to accomplish their goals of improved biodiversity preservation and sustainable livelihoods of local communities.



Marc Stern



2003 Canon Scholars

Gillian Daly is studying at the University of Toronto in Canada. Her research sites are located in **Banff National Park** and **Mount Revelstoke National Park**. She is studying the fate and transport of persistent organic pollutants in mountain regions in order to develop a computer model of the distribution patterns of these pollutants. Her work will help predict areas of accumulation of persistent organic pollutants and be useful for evaluating potential impacts on and threats to humans and alpine ecosystems.



Gillian Daly



Claudia Figueiredo

Claudia Figueiredo is studying at Ohio State University. Her research is conducted in **Abrolhos Marine National Park**, **Caparaó National Park**, **Serra da Capivara National Park**, and **Serra dos Orgaos National Park** in Brazil. She is developing case studies to understand how these parks secured financial resources, and to determine the characteristics of their management strategies, the role of the local community, and the role of site leadership. Her study will provide insight into the conditions that are necessary for developing policies and actions that ensure adequate and effective management strategies to achieve conservation goals in Brazil and other countries.

Renata Mobley is a student at Cornell University. She is conducting her research in **Abrolhos Marine National Park** in Brazil. She is monitoring the vocal activity of male humpback whales during the breeding season to determine their distribution patterns in space and time, and in response to boat traffic. Together with estimates of male size, this research will contribute to overall understanding of humpback whale breeding behavior. The implications of her research will help in evaluating the potential impacts of whale watching activities on humpback whale reproductive success and in formulating management plans for species conservation.



Renata Mobley



Sarah Nelson

Sarah Nelson is a student at the University of Maine, Orono. Her research is taking place in **Acadia National Park**. She is measuring inputs through precipitation of dissolved substances such as mercury, sulfate, chloride and sodium to a land area drained by a stream or lake, in order to compare these to measurements of export of those same substances from the stream or lake. These measurements will indicate whether a substance is being stored in watershed soils, vegetation, or biota, or drained out of the watershed. Changes in patterns of bioaccumulation of toxic substances can reveal to park managers important changes that might be occurring outside park boundaries, such as in emissions of mercury and acidifying substances, as well as inside park boundaries, such as in fire or forest type.



Gabriela Nunez-Iturri

Gabriela Nunez-Iturri is a student at the University of Illinois, Chicago. Her research is taking place in **Manú National Park** in Peru. She is studying the relationship between mammals such as large primates and seed predation and dispersal, in order to assess potential impacts on forest diversity and regeneration. An understanding of this relationship is necessary to evaluate the effects of hunting these mammals on plant diversity and regeneration in Amazonian rainforests. Her work will help natural resource managers develop conservation strategies for protected areas that also consider the needs of surrounding communities while at the same time protecting biodiversity.

Valeria Ojeda is studying at the Universidad Nacional del Comahue in Argentina. Her research is being conducted in **Lanín National Park**, **Los Alerces National Park** and **Nahuel Huapi National Park** in Argentina. She is studying the nesting and roosting habitat requirements of Magellanic woodpeckers. Increased knowledge of these requirements is essential for developing management strategies that reverse habitat alterations such as native forest fragmentation and large-scale substitution by plantations of alien tree species. The lack of sufficient suitable habitat threatens not only the existence of Magellanic woodpeckers but also other wildlife species that make secondary use of woodpecker nests.



Valeria Ojeda



Saudiel Ramírez-Sánchez is a student at Simon Fraser University in Canada. His research is taking place in **Bahia de Loreto National Park** in Mexico. He is investigating the communicative interactions of local fishermen with respect to sustainable resource use and conservation. The purpose of his research is to evaluate the contributions of local fishing communities as social institutions to addressing marine use and conservation dilemmas. His findings will be helpful to park managers to develop better mechanisms for integrating fishing communities into the cooperative management of natural resources in the park.



Saudiel Ramírez-Sánchez



Daniel Somma

Daniel Somma is studying at the Universidad de Buenos Aires in Argentina. He is conducting his research in the areas that surround **Baritú National Park** and **Calilegua National Park** in Argentina. He is analyzing the distribution pattern of habitat patches such as national and provincial parks, and other protected areas in the landscape. His work will help identify corridors that connect these habitat patches, to ensure that protected areas are not isolated from one another. Knowledge of this is essential to formulate comprehensive conservation approaches that are necessary to protect a region's biodiversity.



2004 Canon Scholars

Douglas Clark is studying at Wilfrid Laurier University in Canada. His research sites are located in **Ivvavik National Park, Jasper National Park, and Kluane National Park**. His study aims to better understand the human aspects of grizzly bear management. Resource management decisions often result in conflict among people at local and regional scales. Understanding the human dynamics that lead to—or inhibit—conflict in conservation efforts will be of significant practical value to a broad range of people involved with national park conservation plans and programs.



Douglas Clark



Suzanne Cox Griffin

Suzanne Cox Griffin is studying at the University of Montana, Missoula. She is conducting her research in **Olympic National Park**. She is exploring the influence of landscape structure and habitat use on the population interactions and movement of Olympic marmots. Her findings will be useful for predicting future size and distribution of marmot populations, for example, in response to climate change at high elevations. In anticipation of these effects, park managers can use Suzanne's research to develop an effective marmot management plan for the park.



Carolyn Finney is a student at Clark University. Her research is focused on human communities near **Big Cypress National Preserve, Biscayne National Park and Everglades National Park**. She is exploring the attitudes and perceptions of African Americans toward the environment and national parks in particular. By better understanding how race influences environmental practices and use of national parks by African Americans, park managers can improve participation of African Americans in the use and governance of national parks.



Carolyn Finney



Emily Gonzales is attending the University of British Columbia in Canada. Her research sites are located in **Gulf Islands National Park Reserve**. She is collecting data on current ecosystem conditions in order to measure and assess the effects of change as a result of invasion of exotic grasses and the impacts of herbivores. Her work in understanding change in an ecosystem is essential for developing effective management plans that protect and restore natural resources in national parks.

Emily Gonzales

A student at Washington University, **Jennifer Neuwald** is conducting her research in the **Ozark National Scenic Riverways**. She is studying changes in population genetics of eastern collared lizards in response to forest fire management in the Missouri Ozark Mountains. Her work will contribute to a better understanding of how resource management decisions such as prescribed forest fires can help maintain genetic and biological diversity in national parks.



Jennifer Neuwald



Barbara Pickup

Barbara Pickup is a student at the University of Arkansas. She is conducting her research at **Yellowstone National Park**. Her research examines changes in the shoreline of Yellowstone Lake as a result of processes such as erosion and water level. Her research will contribute to an increased understanding of the effects of those active shoreline processes on the surrounding landscape. This will help park managers in developing conservation plans for shoreline resources including archaeological sites and endangered species.

Daniel Sayers is a student at the College of William and Mary. He is conducting his research at the Great Dismal Swamp National Wildlife Refuge, which is part of the National Park Service's **Underground Railroad Network to Freedom**. The Network ties together sites used by African Americans escaping slavery in the South prior to the Civil War. Daniel's work focuses on understanding how the Great Dismal Swamp was used by African Americans during that time. His findings will provide historical information relevant to the conservation and interpretation of sites associated with these groups of African Americans.



Daniel Sayers



Laura Triplett

Laura Triplett is a student at the University of Minnesota. She is conducting her research in the **Saint Croix National Scenic Riverway**. Based on sediment data collected in the Riverway, Laura is identifying pollutant sources and analyzing regional trends that are adversely impacting the Riverway's ecosystem. Knowledge of sources of pollution and impacts to the ecosystem can help Riverway managers more effectively target and formulate their protection efforts.

The National Parks

Canon National Parks Science Scholars have conducted research or are currently conducting research in over 69 national parks throughout the Americas. The research interests of Canon Scholars are as diverse as the national parks in which they work. This section of the report identifies the parks that have benefited from the program and profiles a selection of these unique and special places. Additional information on how to find out more about any of these parks can be found in the Appendix.

North America

Canada

- 1 Banff National Park
- 2 Gulf Islands National Park Reserve
- 3 Ivvavik National Park
- 4 Jasper National Park
- 5 Kluane National Park and Reserve
- 6 Mount Revelstoke National Park

Mexico

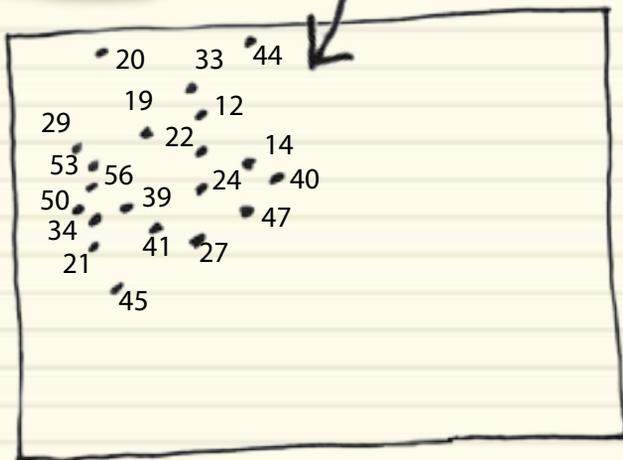
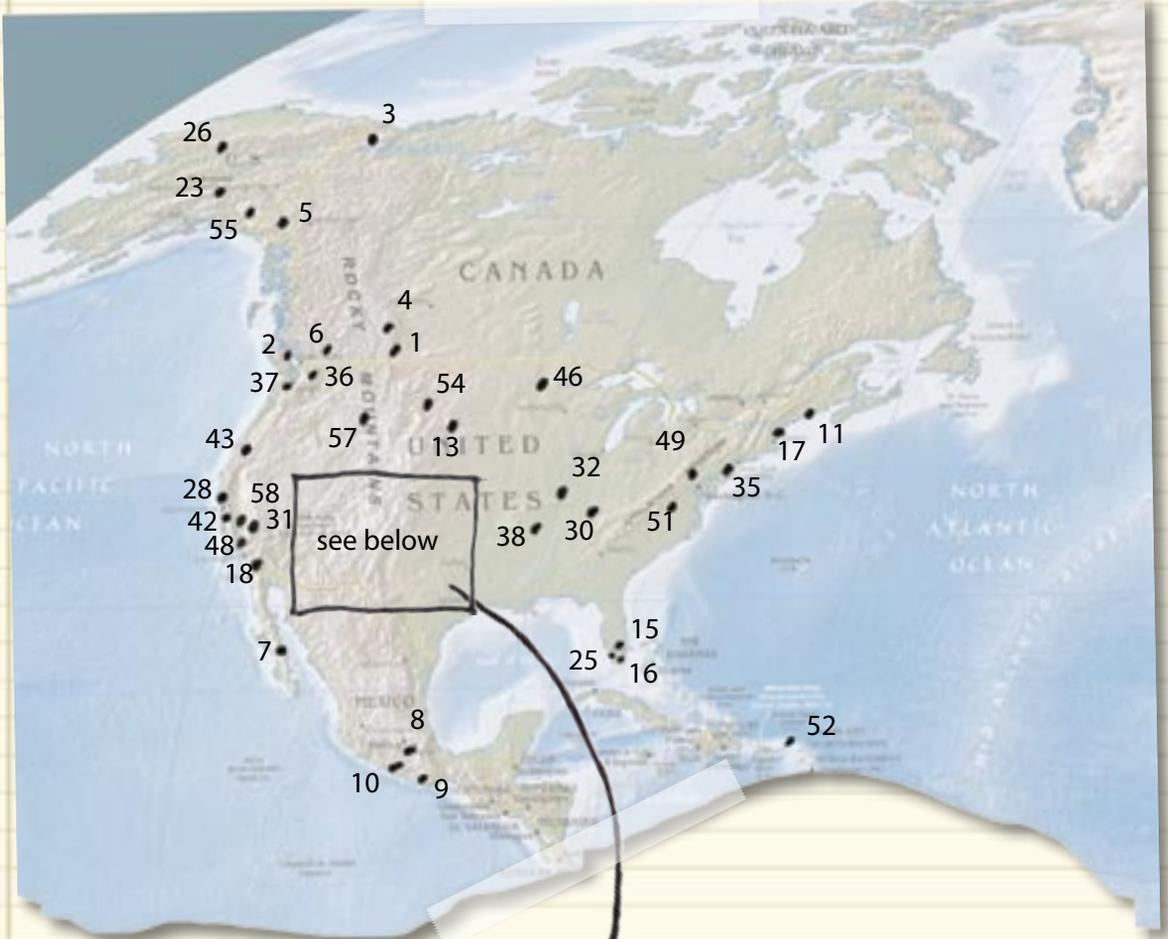
- 7 Bahia de Loreto National Park
- 8 Benito Juárez National Park
- 9 Huatulco National Park
- 10 Lagunas de Chacahua National Park

USA

- 11 Acadia National Park
- 12 Aztec Ruins National Monument
- 13 Badlands National Park
- 14 Bandelier National Monument
- 15 Big Cypress National Preserve
- 16 Biscayne National Park
- 17 Boston Harbor Islands National Recreation Area
- 18 Cabrillo National Monument
- 19 Canyon de Chelly National Monument
- 20 Canyonlands National Park
- 21 Casa Grande Ruins National Monument
- 22 Chaco Culture National Historical Park
- 23 Denali National Park and Preserve
- 24 El Morro National Monument
- 25 Everglades National Park
- 26 Gates of the Arctic National Park

- 27 Gila Cliff Dwellings National Monument
- 28 Golden Gate National Recreation Area
- 29 Grand Canyon National Park
- 30 Great Smoky Mountains National Park
- 31 Kings Canyon National Park
- 32 Mammoth Cave National Park
- 33 Mesa Verde National Park
- 34 Montezuma Castle National Monument
- 35 New Jersey Coastal Heritage Trail Route
- 36 North Cascades National Park
- 37 Olympic National Park
- 38 Ozark National Scenic Riverways
- 39 Parashant National Monument
- 40 Pecos National Historical Park
- 41 Petrified Forest National Park
- 42 Point Reyes National Seashore
- 43 Redwood National Park
- 44 Rocky Mountain National Park
- 45 Saguaro National Park
- 46 Saint Croix National Scenic Riverway
- 47 Salinas Pueblo Missions National Monument
- 48 Sequoia National Park
- 49 Shenandoah National Park
- 50 Tuzigoot National Monument
- 51 Underground Railroad Network to Freedom
- 52 Virgin Islands National Park
- 53 Walnut Canyon National Monument
- 54 Wind Cave National Park
- 55 Wrangell-St. Elias National Park and Preserve
- 56 Wupatki National Monument
- 57 Yellowstone National Park
- 58 Yosemite National Park

— continued pg 52



South America

Argentina

- 59 Baritú National Park
- 60 Calilegua National Park
- 61 Lanín National Park
- 62 Los Alerces National Park
- 63 Nahuel Huapi National Park

Brazil

- 64 Abrolhos Marine National Park
- 65 Caparaó National Park
- 66 Serra dos Orgaos National Park
- 67 Serra da Capivara National Park

Ecuador

- 68 Podocarpus National Park

Peru

- 69 Manú National Park



Selected National Parks Where Canon Scholars Have Conducted Research

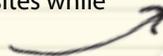
Canon Scholars have conducted research in national parks throughout the Americas. To provide a sense of the unique significance, scientific importance, and beauty of some of these places, a selection of national parks where Canon Scholars have conducted research is presented below.



Abrolhos Marine National Park is located on the southeast coast of Brazil in Bahia. Off the coast, the park consists of an archipelago and reef, kelp, seagrass beds, and open ocean. The park protects coral species found nowhere else in the world and provides habitat for migrating humpback whales as well as nursing grounds for many fish species. The islands are covered with small herbaceous vegetation and provide habitat for endemic Booby birds and sea turtles. **Claudia Figueiredo** and **Renata Mobley** are currently conducting their research in this park.

Aztec Ruins National Monument is located in the southwest region of the US in New Mexico. The monument preserves an extensive community of multi-story structures, smaller residential buildings, roadways, ceremonial kivas, earthworks, and artifacts. The site was built and used by one of the largest ancestral pueblo communities in the region from the 1100s through 1200s. The monument encompasses a riparian corridor, pinyon-juniper woodland areas, as well as lands that were historically irrigated for pasture and fruit trees but have now been converted back to desert scrub native vegetation. This monument was one of **Dr. Emily Brown's** research sites while a Canon Scholar.

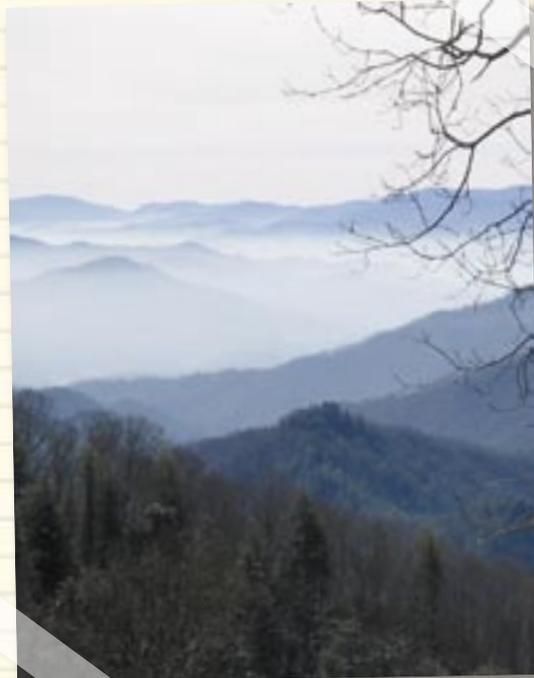
Banff National Park is located in the western region of Canada in Alberta. The park encompasses valleys, mountains, glaciers, rivers, lakes, thermal springs, and caves. Habitats vary from forests, grasslands, and wetlands at lower elevations to dwarf-shrub meadows, unvegetated rock, and ice at higher elevations. Endangered wildlife such as woodland caribou and the Banff springs snail found nowhere else in the world thrive in the park, along with elk, bighorn sheep, bears, and wolves. The park also preserves historical structures from the late 1800s associated with early approaches to promoting park visitation and interpreting natural history. **Gillian Daly** and **Mark Hebblewhite** are currently conducting their research in this park.



Denali National Park and Preserve is located in the most northwest region of the US in Alaska. Dominated by North America's highest peak, Mount McKinley, the park includes a perpetually snow-covered mountain range, glaciers, tundra with permafrost ground, boreal forest, scattered lakes and ponds, and glacial rivers in wide floodplains. Conditions in the park support a subarctic ecosystem that provides habitat for grizzly bears, wolves, Dall sheep, moose, caribou, eagles, and salmon. Plant species such as mosses, lichens, fungi, and algae thrive on the slopes and valleys of the park. The park preserves evidence of subsistence hunting-gathering activities of nomadic Athabaskan Indians and their ancestors, ranging from 11,000 years ago to the 1850s. While a PhD student and Canon Scholar, **Dr. Martin Wilmking** conducted a portion of his research in this park.

Great Smoky Mountains National Park is located in the southeast region of the US in Tennessee and North Carolina. The park preserves a rich plant and animal diversity including such species as the American black bear and lungless salamander. The park encompasses a variety of distinct habitats due to elevation ranges within the park from warm lowlands to cool mountains and glaciers, abundant rainfall and humidity, and its latitudinal extent. Most of the park is covered with deciduous temperate forest, including one of the largest blocks of old-growth in North America. Cultural resources include structural remnants of Southern Appalachian mountain culture. As a Canon Scholar, **Dr. Daiwen Kang** used data collected in this park to conduct his PhD research. **Ashley Morris** and **Marc Stern** are currently collecting data in this park for their research.

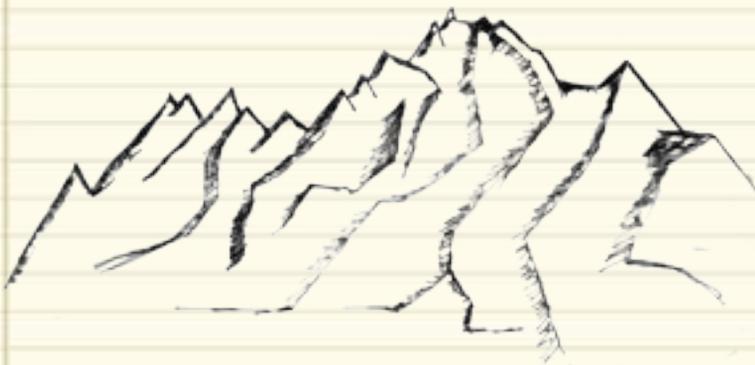
Gulf Islands National Park Reserve is located on the west coast of Canada in British Columbia. The reserve encompasses parts of islands, numerous small islets and reef areas, and extends through the intertidal zone to the surrounding ocean waters. Forests and meadows on hilltops, coastal bluffs, and rocky coves together with sandy beaches provide habitat for a variety of shore and sea birds and marine mammals. First Nations groups have used the islands for thousands of years, depending on fish and shellfish for subsistence. The reserve conserves evidence of their daily life and ceremonial traditions. **Emily Gonzales** recently has been selected as a Canon Scholar and is conducting her research in this park.



Kluane National Park and Reserve is located in the western region of Canada in Yukon. The reserve contains glacial lakes, the world's largest non-polar ice fields, and lush valleys surrounded by high mountains that are dominated by Canada's highest peak, Mount Logan. Habitats range from forests in the lower valleys to alpine meadows and tundra with low-growing shrub at higher elevations. Wildlife such as Dall sheep, grizzly bear and wolf thrive in the reserve. First Nations groups have inhabited the area over the past 10,000 years, and their descendants are now contributing their rich local knowledge of the area to co-managing the reserve. As a recently selected Canon Scholar, **Douglas Clark** will conduct his research in this park. **Ramona Maraj** already has been conducting her research in this park for several years.

Lagunas de Chacahua National Park is located in the southwestern region of Mexico in Oaxaca. The park encompasses interconnected lagoons, bamboo groves, mangrove swamps, dry forest, sand dunes, and a beach shoreline. Endangered plants including the golden trumpet, zenate, and several species of mangrove are preserved in the park. The park provides habitat for wildlife such as the American crocodile, tapir, jaguar, and marine turtles. This is one of the parks in which **Patricia Illoldi** is currently conducting her research.

Manú National Park is located in the southeastern region of Peru in Manú and Paucartambo. Extending from the Amazon River basin at almost sea-level up the mountain slopes of the Andes, the park encompasses rivers, lakes, lowland hills, and tropical forest at lower elevations, and puna grasslands and cloud forest at higher elevations. Approximately 15% of all the bird species in the world and rare species such as the giant otter, black caiman, and ocelot are found in the park. Integrated with the park's natural system, nomadic native groups inhabit the area and continue to live off the land in a sustainable way. **Gabriela Nunez-Iturri** is currently collecting data for her research in this park.



Nahuel Huapi National Park is located in the central western region of Argentina in Neuquén and Rio Negro. Extending from the Patagonian steppe at low elevation to the high elevation of the Andes, the park includes high mountains, glaciers, deep valleys, a large lake and river system fed by abundant rains and melting snow, cold forest with damp undergrowth at higher elevations, and lowland forest and dry grasslands at lower elevations. This range of habitats hosts a variety of species such as native perch, guanaco, and Andean geese at lower elevations, and condor and puma at higher elevations. The park also preserves historical artifacts that are evidence of past cultures that inhabited the area 10,000 years ago. **Carolina Morales** and **Valeria Ojeda** currently are conducting their research in this park.



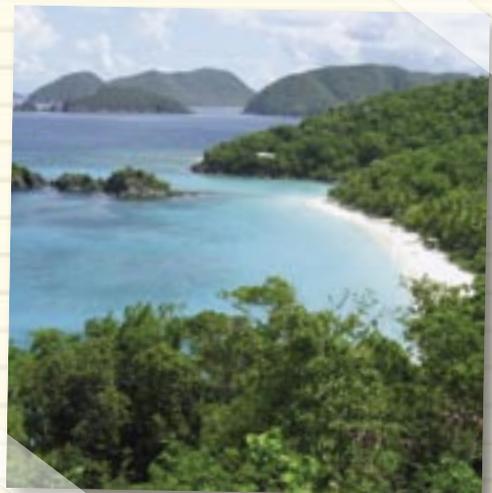
Podocarpus National Park is located in the southern region of Ecuador in Loja and Zamora Chinchipe. Extending from high elevations in the Andes to the lower elevations of the Amazon Basin, the park includes mountains, numerous alpine lakes, hillsides covered with cloud forest, lowland rainforest, waterfalls, rivers and river valleys. The park is home to thousands of endemic plant species, including the country's only native conifer, the Romerillo tree. The park provides habitat for endangered species such as the spectacled bear, mountain tapir, puma, and jaguar. A rich diversity of bird species also abounds in the park. This is one of the parks in which **Marc Stern** currently is conducting his research.

Point Reyes National Seashore is located on the west coast of the US in California. Situated along coastal headlands and exposed to ocean wind, the seashore encompasses beaches, salt and freshwater marshes, coastal scrub grasslands, and coniferous forests. A multitude of avian species thrives in the seashore as well as Tule elk and elephant seals. The seashore also preserves evidence of human use as long as 5,000 years ago. Villages inhabited by the Coast Miwok Indians, ranchos established by Mexican land grantees in the early 1800s, and lighthouses established in the late 1800s and early 1900s are highlights of the seashore's cultural resources. As Canon Scholars, **Dr. Elizabeth Brusati**, **Dr. Bibit Traut**, and **Dr. Laura Watt** conducted their PhD research in the seashore. Some of **Veronica Estelle's** research sites are located in the seashore.

Saint Croix National Scenic Riverway is located in the Midwest region of the US in Wisconsin and Minnesota. Situated in the upper Mississippi River System, the Riverway consists of the flowing waters of the Saint Croix and Namekagon rivers through forests, wet meadows, and prairies. These provide habitat for wildlife such as eagles, black bear, gray wolves, beavers, turtles, and freshwater mussels, and are also an important route for migrating birds. The Riverway also preserves traces of earlier river use by Native Americans as long as 10,000 years ago. Historical structures such as burial mounds, campsites, and rock art can be found along the banks of the rivers. There is also evidence of the fur trade, logging activities and early settlement by Europeans in the mid-1800s. As a recently selected Canon Scholar, **Laura Triplett** is conducting her research in the Riverway.

Virgin Islands National Park is located in the Caribbean territories of the US in the U.S. Virgin Islands. The park includes most of two tropical islands consisting of hilly terrain, as well as extending out to the surrounding ocean waters. It encompasses coral reefs, seagrass beds, mangrove forests, white sandy beaches, and tropical forests. Significant cultural resources include artifacts from the pre-Colombian Amerindian civilization and structural remains of Danish colonial sugar plantations. **Linda "Rikki" Grober-Dunsmore** and **Marc Stern** currently are conducting their research in this park.

Yellowstone National Park is located in the western region of the US in Wyoming, Idaho, and Montana. The park encompasses habitats ranging from high alpine meadows to sagebrush country, geysers and hot springs, river gorges, waterfalls, lakes, forests, and grasslands. These account for a rich diversity of species ranging from microorganisms in hot springs, to herbivores such as elk and bison, and carnivores such as wolves and bears. The park experiences periodic large-scale fires that help maintain forest regeneration and nutrient cycling in the summer and deep snow and cold temperatures in the winter. Cultural resources found in the park include artifacts such as spear points and archaeological sites associated with Native American groups who inhabited the park 10,000 years ago. Historical structures from the late 1800s associated with early park management and visitation are also preserved in the park. As Canon Scholars, **Dr. Elizabeth Barrie**, **Dr. Andrew Bunn**, **Dr. Robert Hale**, and **Dr. Alice Wondrak Biel** conducted their PhD research in this park. **Barbara Pickup** has just been selected as a Canon Scholar and is conducting her research in this park.



Program Activities

In addition to providing scholarship funding for dissertation research, the Canon National Parks Science Scholars Program includes awards ceremonies, science symposia, workshops at scientific meetings, and retreats held at locations important to conservation across the Americas. These activities provide opportunities for Canon Scholars to be recognized for their achievements, share their research findings, interact with one another, meet with conservation experts, gain first-hand knowledge of critical conservation issues, and gain valuable leadership skills. More than just a funded scholarship, the program provides students with an opportunity to join a “community of scholars” and develop a deeper understanding of conservation. This section of the report highlights these activities.

1997 Awards Ceremony

The first Canon National Parks Science Scholars Awards Ceremony was held 22 October 1997 at the AAAS headquarters in Washington, DC. Its purpose was to inaugurate the program and recognize the first class of Canon Scholars. The first Canon Scholars attended, along with Mr. Haruo Murase, then President and CEO of Canon U.S.A., Inc.; the Honorable Bruce Babbitt, Secretary of the Interior; Dr. Richard Nicholson, the Executive Officer of the AAAS; and Mr. Robert Stanton, Director of the US National Park Service.

Together, Mr. Murase and Secretary Babbitt presented the 1997 scholarship awards to each Canon Scholar. The Canon Scholars presented Mr. Murase with small gifts from their respective universities. A dinner and celebration followed, with NPS Director Stanton delivering the keynote speech.

“As a technological innovator Canon understands the power of science; this is why we are so proud to be a founder of the Canon National Parks Science Scholars Program. The work these brilliant students accomplish will benefit the national parks and citizens of nations throughout the Americas for decades to come.”

—Kinya Uchida, President and CEO,
Canon U.S.A., Inc. (1999—2005)



1998 Canon Scholars Symposium

The 1998 Canon National Parks Science Scholars Symposium was held 13–14 November 1998 in Washington, DC. The purposes of the event were to recognize the 1998 Canon Scholars, advance public understanding of the role of national parks in science, and recognize Canon U.S.A., Inc. and its partners for their support of the program. Attending were Mr. Haruo Murase, then President and CEO of Canon U.S.A., Inc.; Assistant Secretary of the Interior Donald J. Barry; Dr. Richard Nicholson, Executive Officer of the AAAS; and NPS Director Robert Stanton.

The first Canon Lecture on Science and the National Parks was delivered by Dr. Daniel Janzen to a full auditorium at the AAAS headquarters. Dr. Janzen is a distinguished conservation biologist and a winner of both a MacArthur Fellowship and the Kyoto Prize, Japan's highest environmental science award. The title of his lecture was *The Role of Technology in Biodiversity Protection*. His lecture described the relationship between science and the national parks and the role of technology in biodiversity protection.

Canon Scholars had an opportunity to meet with Dr. Janzen and held their symposium at AAAS. Canon Scholars presented their research projects and met with officials from both the AAAS and the NPS.



1999 Canon Scholars Symposium

The 1999 Canon National Parks Science Scholars Symposium was held 8–9 November 1999 in Washington, DC. The 1999 Canon Scholars were recognized during a reception at the historic Decatur House. All Canon Scholars, including the 1997, 1998, and 1999 classes attended the event.



The 1999 Canon Lecture on Science and the National Parks was given by Dr. Richard Sellars, a historian with the National Park Service and then president of the George Wright Society, an organization dedicated to the protection, preservation, and management of cultural and natural parks and preserves. Dr. Sellars is the author of the acclaimed book, *Preserving Nature in the National Parks: A History* (Yale University Press, 1997). His lecture was entitled *Scenery or Science: Conflicting Values in the National Parks*.

Canon Scholars shared their research projects with Canon, NPS, AAAS staff, and each other, and held discussions with Dr. Sellars on the importance of conservation science for preservation of parks.

2000 Yellowstone National Park Retreat

The 2000 Canon National Parks Science Scholars Retreat was held 11–14 May 2000 in Big Sky, Montana and Yellowstone National Park. The purpose of the retreat was to bring together representatives of Canon U.S.A., Inc., the NPS, and the Canon Scholars, to explore a particular topic of relevance to science in the parks. The focus of the retreat was on the relationship between science and the media. Presentations given included those by professionals from Canon U.S.A., Inc., members of the media, and representatives of the NPS.

The keynote presentation was given by award-winning author and journalist William Dietrich. In 1990, Dietrich shared a Pulitzer Prize in national reporting for coverage of the Exxon Valdez oil spill. Mr. Dietrich's presentation was titled *Communicating Science to the Public*. Canon Scholars working with Canon and media professionals practiced communicating through science to the general public. They also toured Yellowstone National Park, met with park staff, and learned about the national vision for Yellowstone National Park in the year ahead.



2000 Canon Scholars Symposium

The 2000 Canon National Parks Science Scholars Symposium was held 21–24 October 2000 at Colonial Williamsburg, Virginia, and Washington, DC. The 2000 Canon Scholars were recognized and joined by the 1997–1999 Canon Scholars. The Canon Scholars toured Canon U.S.A., Inc. facilities in the area, including the laser printer and cartridge assembly facility in Newport News, Virginia, and the cartridge and copier remanufacturing facility in Gloucester, Virginia. They met with Canon employees at each facility and learned first-hand about Canon's Clean Earth Campaign. The Canon Scholars also toured Colonial Williamsburg and shared their research projects with Canon, NPS, AAAS, and Colonial Williamsburg staff.



The Canon Lecture on Science and the National Parks was delivered by Dr. John McNeill. Dr. McNeill is a professor of History at Georgetown University and is the author of the best-selling book *Something New Under the Sun: An Environmental History of the 20th Century* (W.W. Norton, 2000). His lecture was based on the book and entitled *Something Under the Sun: Life on Earth in the Twentieth Century*.

2001–2002 Canon Scholars Symposium

The 2001–2002 Canon National Parks Science Scholars Awards Ceremony and Symposium was held 20–21 February 2002 in Washington, DC. The 2001 Canon Scholars were recognized and joined by the previous four classes of Canon Scholars at an awards ceremony and reception hosted by the AAAS at its headquarters. Attending were Mr. Seymour Liebman, Vice President of Canon U.S.A., Inc.; the Honorable Gale A. Norton, Secretary of the Interior; Dr. Alan Leshner, CEO of the AAAS; and Fran P. Mainella, Director of the US National Park Service. Mr. Liebman announced a significant expansion of the Canon National Parks Science Scholars Program, enabling students from throughout the Americas to participate in the program and increasing the number of scholarships provided each year.

Secretary Norton, NPS Director Mainella, and Dr. Michael Soukup, NPS Associate Director, Natural Resource Stewardship and Science, presented Canon U.S.A., Inc. with a special Director's Award recognizing Canon's contribution to science and the national parks.

The Canon Scholars participated in a Congressional Breakfast in the Rayburn House Office Building at the Capitol, to recognize their achievements and introduce interested Congressional staff members to the program.

The Canon Lecture on Science and the National Parks was given by Dr. J. Michael Scott of the US Geological Survey. Dr. Scott is the author of numerous books and scientific papers on conservation biology. His most recent book is *Predicting Species Occurrences: Issues of Accuracy and Scale* (Island Press, 2001). The title of his lecture was *Conserving America's Biological Resources in the 21st Century*. Canon Scholars had an opportunity to interact with Dr. Scott and share their research projects with AAAS and NPS professionals.



2003 Vth World Parks Congress

In 2003, the Vth World Parks Congress in Durban, South Africa, gathered over 3,000 of the world's conservation and national park leaders. The Canon National Parks Science Scholars Program sponsored and organized a special event at the Congress, entitled *Benefits Beyond Generations: A Reception Celebrating Young Conservationists*.

Among those attending the special event were representatives of the International Ranger Federation, the European Junior Ranger Program, the Europarc Federation, the South African Junior Ranger Program, and several Canon Scholars. Also attending were former US National Park Service Director Mr. Robert Stanton (who also served as Ambassador-at-Large for the Vth World Parks Congress); Mr. Gian Devallier, President of Canon South Africa; Dr. Shirley Malcom, Head of Education and Human Resources, AAAS; NPS Director Fran P. Mainella; Parks Canada CEO Mr. Alan Latourelle; and Dr. Michael Soukup, NPS Associate Director, Natural Resource Stewardship and Science.

"Canon Scholars are ambassadors of Canon's commitment to conservation. We are honored to have these talented young scientists recognized at the Vth World Parks Congress, and for the role this program plays in furthering scientific understanding of protected areas around the globe."

— Kinya Uchida, President and CEO,
Canon U.S.A., Inc. (1999—2005)





To mark Canon's support of youth programs concerned with sustainability, Mr. Devallier presented a Canon digital camera to the Student Conservation Association. NPS Director Mainella announced the beginning of the 2004 scholarship competition. Dr. Kenton Miller, then Chair of the World Commission on Protected Areas and a key organizer of the Vth World Parks Congress, also attended the reception during his busy schedule and congratulated Canon and its partners for the program's achievements. Young conservationists from around the world enjoyed the chance to meet their counterparts, to talk with Canon Scholars about the program, and to visit with senior leaders in conservation and national park management from many countries.

In addition, Ms. Debra Epstein, Canon U.S.A., Inc. Vice President and General Manager of Corporate Communications, was an invited presenter at one of the Congress' plenary sessions. She described Canon's various efforts to contribute toward the goal of establishing an environmentally and economically sustainable society, and Canon's support for science and the national parks through the Canon National Parks Science Scholars Program.

"The Canon National Parks Science Scholars Program is an outstanding illustration of corporate donors strengthening the capacity and effectiveness of protected areas leaders. These scholars will one day be leaders in the pursuit of worldwide conservation and the ecologically sustainable use of nature and natural resources. Their research and leadership will definitely provide benefits beyond boundaries, the theme of the Vth World Parks Congress."

— Kenton Miller, former Chair of the
World Commission on Protected Areas

2003 Vieques Lessons Project

The 2003 Canon National Parks Science Scholars Retreat was held 3–7 December 2003 on the island of Vieques, Puerto Rico. The purpose of the retreat was to bring together representatives of Canon U.S.A., Inc., the NPS, AAAS, and the Canon Scholars, and to learn about one of the grand challenges of conservation—the ecological restoration of lands and waters formerly used for military training. Organized as the *Vieques Lessons Project*, the retreat enabled Canon Scholars to meet with key leaders and environmental advocates on Vieques, to learn about the natural and cultural history of the island, and to gain an understanding of the challenges and opportunities facing conservation in the Caribbean region. An all-day field trip provided first-hand observation of local conditions, as well as an introduction to Vieques history, ecology, culture, and politics. Two well-attended community forums provided Canon Scholars with an opportunity to learn from local leaders.

The Canon Lecture on Science and the National Parks was presented by Dr. William R. Burch, Jr., Hixon Professor of Natural Resource Management at Yale University. The title of his presentation was *Vieques as a Unique Guide to the Future of Biodiversity Protection and Human Livelihoods*. Dr. Burch met with the Canon Scholars, and accompanied them on their field trips and community forums. Canon Scholars also shared their research projects with each other, as well as with local citizens and resource professionals.

“The history of Vieques is fascinating and complex at the same time. We had to open our ears, eyes, minds, and hearts in order to get the whole picture. I would love to actively participate in the restoration process and in the decision making process about the future of those lands one day.”

—Carolina Morales, Canon Scholar '02



2005 Baja California Sur, Mexico Retreat

The 2005 Canon Scholars Retreat was held 9–13 April 2005 at Danzante, an ecotourism facility on the coast of the Sea of Cortez in Baja California Sur, Mexico. The purpose of the retreat was to bring together the Canon Scholars (including the new class of 2004), representatives of Canon U.S.A., Inc., the AAAS, and the NPS and to learn about a unique region and ecosystem critical to global conservation. The group met with representatives of the newly created Bahia de Loreto National Park, as well as with leaders of local communities and conservation groups. Field trips into the desert mountains and to islands in the Sea of Cortez provided first-hand knowledge of Baja's unique natural history.

Other Activities

In addition to the awards ceremonies, science symposia, and retreats, other activities are occasionally undertaken on behalf of the program. Several Canon Scholars have participated as judges at the Canon Envirothon, North America's largest high school environmental education competition. Program Coordinator Dr. Machlis, along with several Canon Scholars, have presented workshops at several universities and at two national meetings of the AAAS. The workshops focus on the professional development of young scientists and opportunities available to them through the program. Canon Scholars have given numerous public and professional presentations of their research (see Appendix for a list of selected presentations).



Conclusion: A Legacy for the Future

This report highlights many of the activities and accomplishments of the Canon National Parks Science Scholars Program. None of these would have been possible without the collective contributions of all the partner organizations, the many individuals who have contributed their leadership and support, and of course, the Canon Scholars. Very much like an ecosystem, the program's successes are due to the unique and essential role that each contributor performs. The program is a demonstration of *kyosei* in action.

What of the future? A new class of Canon Scholars will be selected in 2005. Each new Canon Scholar brings his or her unique perspective, background, and insight to a new research question on a critical park issue. Each class of Canon Scholars expands the role of science in conserving national parks.

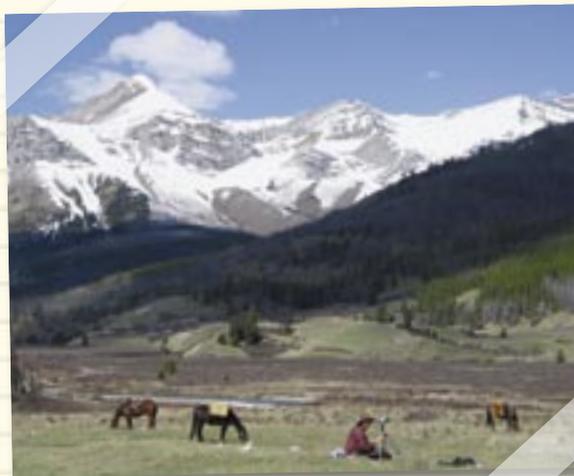
Over the next few years, many of the current students will complete their research. These Canon Scholars will subsequently assume positions in which they continue to influence park managers and/or mentor other young scientists. National park managers will be able to use the findings generated by these Canon Scholars to help them develop more effective conservation strategies. Collectively, the work of Canon Scholars will contribute to the advancement of science and create solutions for improving the management of national parks in the 21st century.





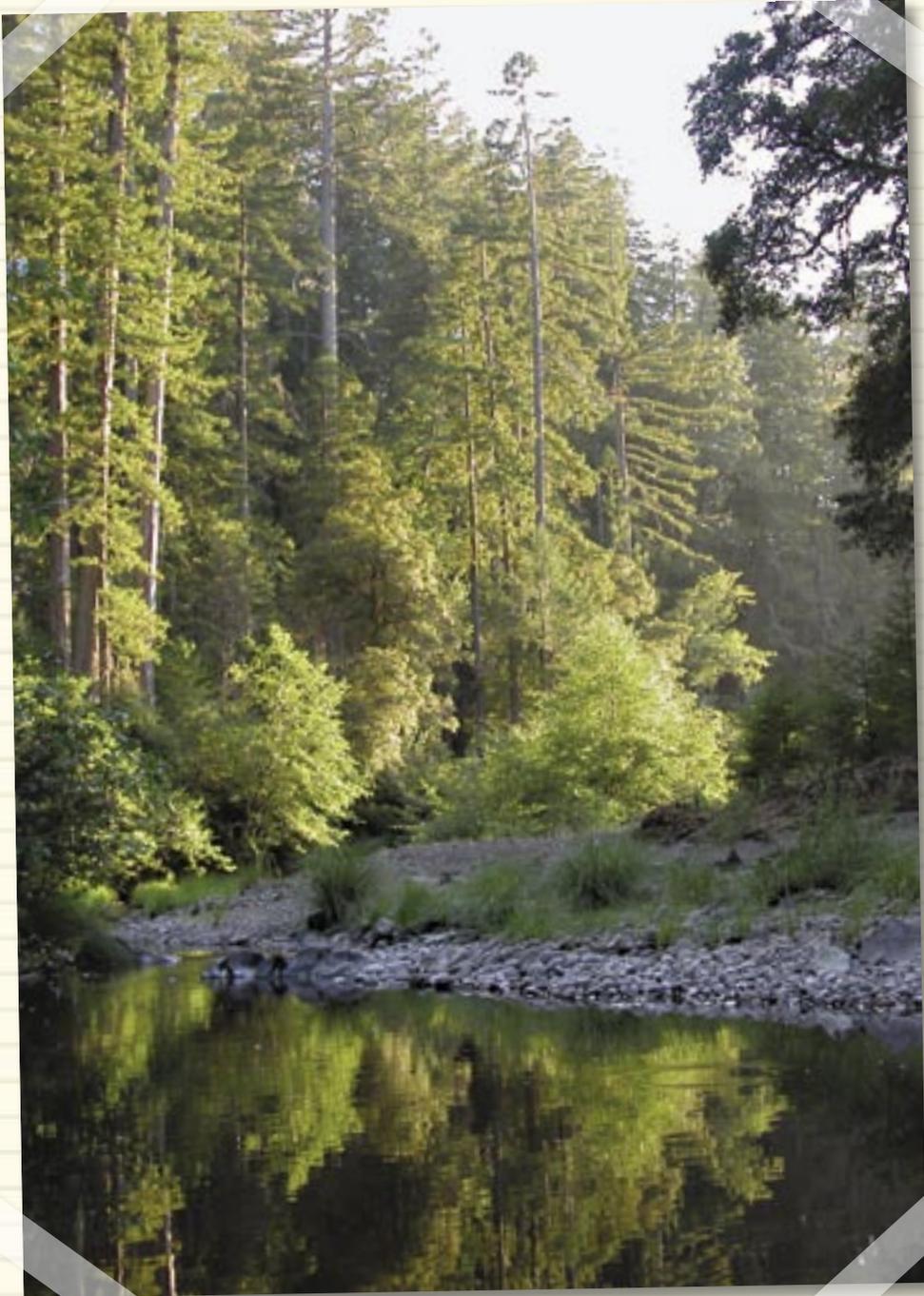
The program's legacy, however, reaches much further into the future. This legacy consists of many outcomes, some tangible and described in this report, others as yet undiscovered. Canon Scholars will likely assume leadership positions within park management agencies, universities, and the international scientific community. In turn, some will have their own students to train and mentor. In the 2004 scholarship competition, the program received the first proposal from a student whose professor was one of the original Canon Scholars—a sure sign of a long-term legacy.

The Canon National Parks Science Scholars Program will continue to be one of the world's most prestigious scholarships for young scientists in the fields of conservation, environmental science, and park management. In doing so, it embodies the philosophy of *kyosei*, and creates a legacy of science for national parks in the 21st century.



“What’s most important is not what this program has meant to our lives so far. What’s most important is what we will do from here, and what that will mean for the Park Service, for the future students of many of our scholars, and for the environment and world that those future students live in. I can think of no nobler aspiration, especially right now, than building partnerships of international goodwill that will allow more of the world in on the kind of future that all of us will help to create here.”

— Dr. Alice Wondrak Biel, Canon Scholar ‘99



70 Appendices

Appendix 1. Facts about the Program

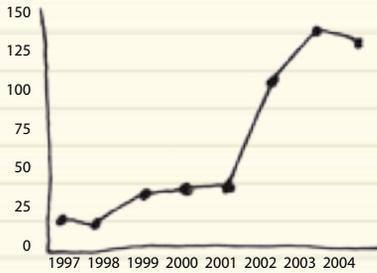


Figure 1. Number of applicants, per year



Figure 4. Number of Canon Scholars completing the program, cumulative

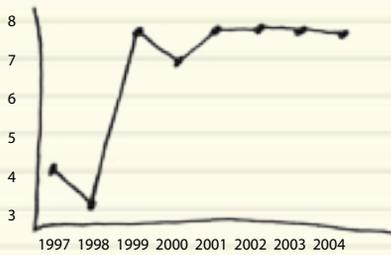
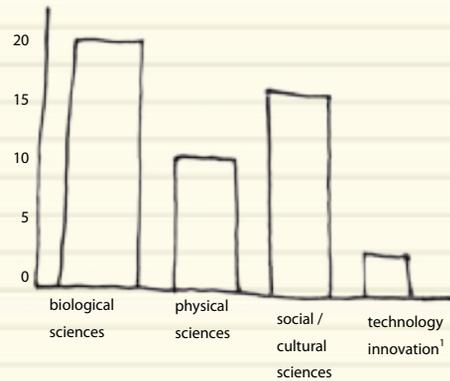


Figure 2. Number of Canon Scholarships awarded, per year



¹ A new category established in 2002

Figure 5. Number of Canon Scholars, by scientific discipline

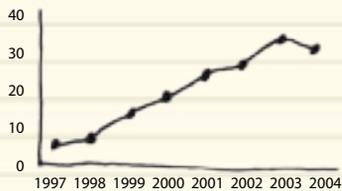


Figure 3. Number of Canon Scholars active in program, per year

Appendix 2. Universities Participating in the Program

Clark University	University of Washington, Seattle
College of William and Mary	Washington University
Colorado State University	Wilfrid Laurier University, Canada
Columbia University	Yale University
Cornell University	
Indiana University	
Montana State University, Bozeman	
National Autonomous University of Mexico	
North Carolina State University	
Northern Arizona University	
Ohio State University	
Simon Fraser University, Canada	
Temple University	
Texas Tech University	
Universidad de Buenos Aires, Argentina	
Universidad Nacional del Comahue, Argentina	
University of Alaska, Fairbanks	
University of Alberta, Canada	
University of Arizona	
University of Arkansas	
University of British Columbia, Canada	
University of Calgary, Canada	
University of California, Berkeley	
University of California, Davis	
University of California, Irvine	
University of California, San Diego	
University of Colorado, Boulder	
University of Florida	
University of Illinois, Chicago	
University of Illinois, Urbana-Champaign	
University of Kansas	
University of Maine, Orono	
University of Minnesota	
University of Montana, Missoula	
University of Nevada, Reno	
University of New Mexico	
University of Oklahoma	
University of Toronto, Canada	

Appendix 3. Canon National Parks Science Scholars Program Honorable Mentions, by Year

1997

Sebastian Interlandi, Drexel University
Sue Greenhalgh, Ohio State University
Ruth Lambert, University of New Mexico
Craig Tobias, The College of William and Mary

1998

No Honorable Mentions awarded

1999

Elizabeth Erickson, West Virginia University
Steve Jordan, University of Connecticut
Neil Maher, New York University

2000

Denise Meringolo, George Washington University
Derek Sjostrom, Dartmouth College
Jennifer White, University of Missouri, Columbia

2001

Scott Bretthauer, University of Illinois, Urbana-Champaign
Diane Contente Curwitz, Washington State University
Eric DeChaine, University of Colorado
James A. Goodman, University of California, Davis
Amber Jessen Keyser, University of Georgia
Ashley B. Morris, University of Florida
Lara Rachowicz, University of California, Berkeley

2002

James Forester, University of Wisconsin, Madison
Bradford Martin, Northwestern University
Monique Rocca, Duke University
Brigitte Vlaswinkel, University of Miami

2003

Helen Rowe, Colorado State University
Kaele B. Beauclerc, Trent University, Canada
Suzanne Cox Griffin, University of Montana, Missoula
Robert Powell, Yale University

2004

Leonardo Mario Buria, Universidad Nacional del Comahue, Argentina
 Anita T. Morzillo, Michigan State University
 Gervasio Piñeiro Guerra, Universidad de Buenos Aires, Argentina
 Joleen Timko, University of British Columbia, Canada

Appendix 4. AAAS Scientific Review Panels, by Year

Since 1997, 178 scientists from over 100 institutions in 10 countries have participated in the review and evaluation of applications to the Canon National Parks Science Scholars Program. They represent over 20 areas of scientific expertise. Their commitment and contributions to the success of the program have been invaluable. The following scientists participated in AAAS scientific review panels and dedicated their time and insights to selecting the best graduate students in the Americas for a Canon scholarship.

1997 Canon Scholarship Competition

Dr. Arthur Chappelka, Auburn University
 Dr. Hester Davis, Arkansas Archaeological Survey
 Dr. John Duffield, University of Montana
 Dr. John Horowitz, University of Maryland
 Dr. Benita J. Howell, University of Tennessee
 Dr. Gwilym S. Jones, Northeastern University
 Dr. Robert Kohut, Boyce Thompson Institute
 Mr. William B. Mills, TetraTech, Inc.
 Dr. Howard Neufeld, Appalachian State University
 Dr. Robert Ulanowicz, Chesapeake Biological Laboratory

1998 Canon Scholarship Competition

Dr. Joseph Breen, The Green Chemistry Institute
 Dr. Norman Christensen, Duke University
 Dr. Tom Goodale, George Mason University
 Dr. Gwilym S. Jones, Northeastern University
 Dr. Martha C. Monroe, University of Florida
 Dr. Gary W. Mullins, Ohio State University
 Dr. Philip N. Omi, Colorado State University
 Dr. Scott Stephens, Cal Polytech State University

1999 Canon Scholarship Competition

Mr. Richard Batiuk, Chesapeake Bay Program Office Environmental Protection Agency
 Dr. Brian Black, Skidmore College
 Dr. Robert D. Blair, Miami University

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Dr. Robert Bixler, Clemson University
Dr. Michael Brown, Old Dominion University/Bureau of Land Management
Dr. Monica J. Casper, University of California, Santa Cruz
Dr. Gary Chick, Penn State University
Dr. Joseph Delfino, University of Florida
Dr. Peggy Fiedler, San Francisco State University
Dr. Michael Gilpin, University of California, San Diego
Dr. Scott Mills, University of Montana
Dr. William Richkus, Versar, Inc.
Dr. Hal Rothman, University of Nevada, Las Vegas
Dr. Gordon Uno, National Science Foundation
Dr. Judith Weis, Rutgers University
Dr. Elizabeth A. Zimmer, National Museum of Natural History, Smithsonian Institute

2000 Canon Scholarship Competition

Dr. Jane Bock, University of Colorado, Boulder
Dr. Elizabeth Chornesky, The Nature Conservancy
Dr. Sean Connin, Adirondack Aquatic Institute
Dr. Robert Curry, Villanova University
Dr. Frank Dobbin, Princeton University
Dr. Joan Ehrenfeld, Rutgers University
Dr. Bettye Eidemiller, Society of Toxicology
Dr. Thomas Frost, University of Wisconsin, Madison
Dr. Mark Mizruchi, University of Michigan
Dr. Michael Reed, Tufts University
Dr. William Richkus, Versar, Inc.
Dr. Patricia Stokowski, University of Vermont

2001 Canon Scholarship Competition

Dr. Mary Barber, Ecological Society of America
Dr. Tara Barrett, University of Montana
Dr. Suzanne K. Fish, Arizona State Museum, University of Arizona
Dr. Alicia M. Gonzales, National Museum of the American Indian, Smithsonian Museum
Dr. David Inouye, University of Maryland
Dr. Stephen T. Jackson, University of Wyoming
Dr. Joy Nystrom Mast, Northern Arizona University
Dr. David L. Peterson, University of Washington
Dr. Bruce D. Smith, National Museum of Natural History, Smithsonian Institution
Dr. Dean L. Urban, Duke University
Dr. John W. Wyckoff, University of Colorado at Denver

2002 Canon Scholarship Competition

Dr. Ann Bartuska, The Nature Conservancy
 Dr. Terence P. Boyle, Colorado State University
 Dr. Linda E. Duguay, University of Southern California
 Mr. Robert Fri, Resources for the Future
 Dr. Pedro Jacobi, University of São Paulo, Brazil
 Dr. Juan José Neiff, National Council of Scientific and Technical Investigations of Argentina
 Dr. Robert Paine, University of Washington

2003 Canon Scholarship Competition

Dr. Terence P. Boyle, Colorado State University
 Dr. Heitor Coutinho, Brazilian Agricultural Research Enterprise
 Dr. Linda E. Duguay, University of Southern California
 Dr. Lucy E. Edwards, U.S. Geological Survey
 Dr. Cecilia Guerra, National Science Council of Panama
 Dr. Robert Paine, University of Washington
 Dr. Phil Young, University of Oregon

2004 Canon Scholarship Competition

Dr. Terence P. Boyle, Colorado State University
 Dr. Heitor Coutinho, Brazilian Agricultural Research Enterprise
 Dr. Linda E. Duguay, University of Southern California
 Dr. Lucy E. Edwards, U.S. Geological Survey
 Dr. Cecilia Guerra, National Science Council of Panama
 Dr. Robert Paine, University of Washington
 Dr. Liette Vasseur, University of Moncton, Canada
 Dr. Phil Young, University of Oregon

Over the years, many additional scientists have contributed their time and effort to the review of applications to the Canon National Parks Science Scholars Program. The following scientists provided valuable review comments:

Sandy Aldeman, Sara Alexander, Allen Allison, Alice Altesor, Jorge Are, Jay Arnone, Catherine Badgley, Cem Baseman, Aaron Bauer, Suzanne Bayley, Susan Beatty, Larry Beck, Fred Benfield, Harold Berkson, Estela Bonino, Mark Boroush, Michael Bowers, Daniel Brumbaugh, Enrique Bucher, Sabina Cabrera, Georgia Carvalho, Ted Case, Sandra Caziani, Erve Chambers, Jon Chase, Nicholas Christie-Blick, Roberto Lindig Cisneros, Phil Crossley, Marymegan Daly, Rafael de Sa, Edmundo Drago, Kathy Roler Durand, Jose Farina, Donald Feener, Don Field, William Fitt, Erica Fleishman, H. Paul Friesema, Holly Ganz, Helene Gaonac'h, William Gardner, Martin Gibbs, Rosanna Ginnochio, Barry Gold, James Gramann, Karl Gustavson, Robyn Hannigan, Kelley Hays-Gilpin, Susanna Hecht, Ken Hon, Peter Houde, Paul F. Hudson, Don Jackson, John Jaenicke, Fran James, Jisuo Jin, Miriam Kahn, Eric Kasischke, Pamela Klassen, Stanley Krugman, Tom Kunz, Lydia Ladah, Jonathan Franco Lopez, Jennifer Lyman, Miguel Marini, Robin Matthews, Bill McDowell, Bruce McPheron, Barbara Mills, Matthew Moran, Darla Munroe, Alan Murray, Wayne Myers, Karl Offen, Mary Orland, Adrian Oviedo, Nancy Parezo, Jose M. Paruelo, Mike Patterson, Iris Peralta, Max Pfeffer, Mai Phillips, Steve Plog, Eric Post, James Potter, Thomas Ranker, Rick Relyea, Forest Rohwer, Rudy Rudran, Gareth Russell, Jedu Sagarnara, Robert Schmidt, Juan J. Schmitter-Soto, John Shelhas, Adalene Silva, Pam Silver, Jack Sites, Doug Soltis, Taylor Stein, Judy Stone, Andy Suarez, Florence Thomas, Susan Trumbore, Lucia Wadt, Barbara Whitlock, Bruce Wiersma, Martin Willison, Grace Wyngaard, Jason Yeagar, Shep Zedaker, and Melinda Zeder.

Appendix 5. Selected Canon Scholar Publications

Collectively, Canon Scholars have written or co-authored 219 scientific articles related to their research since joining the program. The following bibliography represents only a partial selection of the scientific articles authored or co-authored by Canon Scholars. The Canon Scholar's name is in bold.

Barger, N.N., C.M. D'Antonio, T. Ghneim, K. Brink, and E. Cuevas. 2002. Nutrient limitation to primary productivity in a secondary savanna in Venezuela. *Biotropica* 34(4):493–501.

Barger, N.N., C.M. D'Antonio, E. Cuevas, and T. Ghneim. 2003. Constraints to colonization of an African pasture grass (*Melinis minutiflora*) in a Venezuelan savanna. *Plant Ecology* 167:31–43.

Barger, N.N., D.S. Ojima, J. Belnap, W. Shiping, W. Yanfen, and Z. Chen. 2004. Changes in plant functional groups, litter quality, and soil C and N mineralization with sheep grazing in an Inner Mongolian grassland. *Journal of Range Management*.

Knapp, D.H., and E.R. **Barrie**. 2000. Content evaluation of an environmental science field trip. *Journal of Science Education and Technology*.

Knapp, D.H., and E.R. **Barrie**. 1998. Ecology versus issue interpretation: the analysis of two different messages. *Journal of Interpretation Research* 3(1).

Battin, J. In press. When good animals love bad habitats: ecological traps and the conservation of animal populations. *Conservation Biology*.

Battin, J., and T.D. Sisk. 2003. Assessing landscape-level influences of forest restoration on animal populations. In: Friederici, P. and W.W. Covington, editors. *Ecological restoration of Southwestern ponderosa pine forests*. Covelo, CA: Island Press. p. 175–190.

(**Brown**) **Donald**, E. 2003. The archaeology of music and performance in the prehistoric Southwest. In: Jameson, J., J. Ehrenhard, and C. Finn, editors. *Archaeology and the Muse*. Tuscaloosa, AL: University of Alabama Press.

Brusati, E.D., P.J. DuBow, and T.E. Lacher, Jr. 2001. Comparing ecological functions of natural and created wetlands for shorebirds in Texas. *Waterbirds* 24(3):371–380.

Bunn, A.G., L.J. Graumlich, and D.L. Urban. In press. Interpreting the climatic significance of trends in twentieth-century tree growth at high elevations. *The Holocene* 15.

Lawrence, R.L., A.G. **Bunn**, S. Powell, and M. Zambon. 2004. Classification of remotely sensed imagery using stochastic gradient boosting as a refinement of classification tree analysis. *Remote Sensing of Environment* 90:331–336.

- Bunn, A. G., R.L. Lawrence, G.J. Bellante, L.A. Waggoner, and L.J. Graumlich.** 2003. Spatial variation in distribution and growth patterns of old growth strip-bark pines. *Arctic, Antarctic and Alpine Research* 35:323–330.
- Daly, G.L., and F. Wania.** 2004. Simulating the impact of a seasonal snow pack on the environmental behavior of organic contaminants. *Environmental Science and Technology* 38(15):4176–4186.
- Li, N., F. Wania, Y.D. Lei, and G.L. **Daly.** 2003. A comprehensive and critical compilation, evaluation and selection of physical chemical property data for selected polychlorinated biphenyls. *Journal of Physical Chemical Reference Data* 32(4):1545–1590.
- Grossman-Bailey, I.** 2001. Toward a history of archaeological research in the Outer Coastal Plain of New Jersey. *Bulletin of the Archaeological Society of New Jersey* 6:22–31.
- Hebblewhite, M., P.C. Paquet, D.H. Pletscher, R.J. Lessard, and C. Callaghan.** 2003. Development and application of a ratio-estimator to estimate wolf-killing rates and variance in a multi-prey ecosystem. *Wildlife Society Bulletin* 31(4):933–945.
- Hebblewhite, M., M. Percy, and R. Serrouya.** 2003. Black bear survival and demography in the Bow Valley of Banff National Park. *Biological Conservation* 112(3):415–425.
- Hebblewhite, M., D.H. Pletscher, and P.C. Paquet.** 2003. Elk population dynamics following wolf recolonization of the Bow Valley of Banff National Park. *Parks Canada Research Links* 11(1):10–12.
- Hebblewhite, M., D.H. Pletscher, and P.C. Paquet.** 2002. Factors affecting elk population growth rate in areas with and without predation by recolonizing wolves in Banff National Park. *Canadian Journal of Zoology* 80:789–799.
- Illoldi-Rangel, P., and V. Sánchez-Cordero.** 2004. Predicting distributions of Mexican mammals using ecological niche modeling. *Journal of Mammalogy* 85(4).
- Kang, D., V. Aneja, M. Das, and R. Seila.** 2004. Measurements of air-surface exchange rates of volatile organic compounds. *International Journal of Environment and Pollution* 22(5).
- Kang, D., V. Aneja, R. Mathur, and J. Ray.** 2004. Observed and modeled VOC chemistry under high VOC/NOX conditions in the Southeast United States national parks. *Atmospheric Environment* 38:4969–4974.
- Kang, D., V. Aneja, R. Mathur, and J. Ray.** 2003. Non-methane hydrocarbons and ozone in the rural southeast United States national parks: a model sensitivity analysis and its comparison with measurement. *Journal of Geophysical Research* 108:4604.
- Lundquist, J., D. Cayan, and M. Dettinger.** 2004. Spring onset in the Sierra Nevada: when is snowmelt independent of elevation? *Journal of Hydrometeorology* 5:325–340.
- Lundquist, J., and D. Cayan.** 2002. Seasonal and spatial patterns in diurnal cycles in streamflow in the Western United States. *Journal of Hydrometeorology* 3:591–603.

- Lundquist, J.**, and D. Cayan. 2003. Diurnal cycles in streamflow in the Western United States. *Bulletin of the American Meteorology Society* 84:16–17.
- Meixner, T.**, E.B. Allen, K. Tonnessen, M. Fenn, and M. Poth. 2002. Atmospheric nitrogen deposition: implications for park managers of western U.S. parks. *Park Science* 21(2):30–33.
- Morales, C.L.**, and L. Galetto. 2003. Influence of compatibility system and life form on plant reproductive success. *Plant Biology* 5:567–573.
- Morales, C.L.**, and M.A. Aizen. 2002. Does invasion of exotic plants promote invasion of exotic flower visitors? A case of study from the temperate forests of the southern Andes. *Biological Invasions* 4:87–100.
- Morris, A.B.**, R.L. Small, and M.B. Cruzan. 2004. Variation in frequency of clonal reproduction among populations of *Fagus grandifolia* in response to disturbance. *Castanea* 69(1):38–51.
- Morris, A.B.**, R.L. Small, and M.B. Cruzan. 2002. Investigating the relationship between *Cryptococcus fagisuga* and *Fagus grandifolia* in Great Smoky Mountains National Park. *Southeastern Naturalist* 1(4):415–424.
- Morris, A.B.**, R.S. Baucom, and M.B. Cruzan. 2002. Stratified analysis of the soil seed bank in the cedar glade endemic *Astragalus bibullatus*: evidence for historical changes in genetic structure. *American Journal of Botany* 89 (1):29–36.
- Lafrancois, B.M., K.R. **Nydick**, and B. Caruso. 2003. Phytoplankton nitrogen limitation in lakes of the Snowy Range (Wyoming, USA): a comparative study. *Arctic, Antarctic, and Alpine Research* 35:499–508.
- Nydick, K.R.**, B.M. Lafrancois, J.S. Baron, and B.M. Johnson. 2003. Lake-specific responses to elevated atmospheric nitrogen deposition in the Colorado Rocky Mountains, USA. *Hydrobiologia* 510:103–114.
- Fenn, M.E., J.S. Baron, E.B. Allen, H.M. Rueth, K.R. **Nydick**, L. Geiser, W.D. Bowman, J.O. Sickman, T. **Meixner**, and D.W. Johnson. 2002. Ecological effects of nitrogen deposition in the western United States. *BioScience* 53: 404–421.
- Baron, J.S., H.M. Rueth, A.M. Wolfe, K.R. **Nydick**, E.J. Allstott, J.T. Minear, and B. Moraska. 2000. Ecosystem responses to nitrogen deposition in the Colorado Front Range. *Ecosystems* 3:352–368.
- Ojeda, V.** 2003. Magellanic Woodpecker frugivory and predation on a lizard. *Wilson Bulletin* 115(2):208–210.
- Ojeda, V.** 2003. Pardela de cabeza negra (*Puffinus gravis*) en el Noroeste Patagónico. (Great Shearwater (*Puffinus gravis*) recorded in northern Andean Patagonia). *Nuestras Aves* 46:32–35.
- Ojeda, V.** 2004. Breeding biology and social behaviour of Magellanic Woodpeckers (*Campephilus magellanicus*) in Argentine Patagonia. *European Journal of Wildlife Research* 50(1):18–24.

- Trejo, A., V. **Ojeda**, L. Sympson, and M. Gelain. 2004. Breeding biology and nest site characteristics of the White-throated Hawk (*Buteo albigula*) in northwestern Argentine Patagonia. *Journal of Raptor Research* 38(1):1–8.
- Trejo, A., and V. **Ojeda**. 2004. Diet of Barn Owls (*Tyto alba*) in forested habitats of northwestern Argentine Patagonia. *Ornithología Neotropical* 15:307–311.
- Palen**, W.J., D.E. Schindler, M.J. Adams, C.A. Pearl, R.B. Bury, and S.A. Diamond. 2002. Optical characteristics of natural waters protect amphibians from UV-B in the U.S. Pacific Northwest. *Ecology* 83(11):2951–2957.
- Peterson, D.L., S.J. **Prichard**, and D. McKenzie. 2000. Disturbance in mountain forests. In: Price, M.F. and N. Butt, editors. *Forests in Sustainable Mountain Development: a State of Knowledge Report for 2000*. UK: CABI Publishing.
- Rupp**, S.P., M.C. Wallace, D. Wester, S. Fettig, and R. Mitchell. 2001. Effects of simulated elk grazing and trampling (I): Intensity. *Alces* 37(1):129–146.
- Rupp**, S.P., M.C. Wallace, D. Wester, S. Fettig, and R. Mitchell. 2001. Effects of simulated elk grazing and trampling (II): Frequency. *Alces* 37(1):147–161.
- Short**, K.C., and J.F. Negron. 2003. Arthropod responses: a functional approach. In: Friederici, P., ed. *Ecological Restoration of Southwestern Ponderosa Pine Forests*. Covelo, CA: Island Press. p. 286–305.
- LeTourneau, P.D., and A. **Steffen**. 2003. Field Investigations at a likely source for New Mexico obsidian Folsom artifacts. *Current Research on the Pleistocene* 19.
- Steffen**, A. 2002. The Dome Fire Pilot Project: Extreme obsidian fire effects in the Jemez Mountains. In: Loyd, J.M., T.M. Origer, and D.A. Fredrickson, editors. *The Effects of Fire/Heat on Obsidian*. United States Department of the Interior, Bureau of Land Management, Cultural Resources Publication, Anthropology - Fire History. p. 159–201.
- Lanfer, A.G., U.M. Goodale, and M.J. **Stern**. 2003. The viability of transboundary protected areas. *Journal of Sustainable Forestry* 17(1/2).
- Goodale, U.M., A.G. Lanfer, M.J. **Stern**, C. Margoluis, and M. Fladeland, editors. 2003. *Transboundary Protected Areas: The Viability of Regional Conservation Strategies*. West Hazelton, PA: Haworth Press, Inc.
- Stern**, M.J., C. Margoluis, A.G. Lanfer, and U.M. Goodale. 2003. The goals and challenges of the March 30-31, 2001 Yale ISTF Conference entitled *Transboundary Protected Areas: The Viability of Regional Conservation Strategies*. *Journal of Sustainable Forestry* 17(1/2).
- Suarez**, A.V., and N.D. Tsutsui. 2004. The value of museum collections to research and society. *Bioscience* 54:66–74.
- Crooks, K.R., A.V. **Suarez**, and D.T. Bolger. 2004. Avian assemblages along a gradient of urbanization in a highly fragmented landscape. *Biological Conservation* 115:451–462.

- Tsutsui, N.D., and A.V. **Suarez**. 2003. The colony structure and population biology of invasive ants. *Conservation Biology* 17:48–58.
- Holway, D.A., L. Lach, A.V. **Suarez**, N.D. Tsutsui, and T.J. Case. 2002. The ecological causes and consequences of ant invasions. *Annual Review of Ecology and Systematics* 33:181–233.
- Holway, D.A., A.V. **Suarez**, and T.J. Case. 1998. Loss of intraspecific aggression underlies the success of a widespread invasive social insect. *Science* 282:949–952.
- Suarez**, A.V., D.T. Bolger, and T.J. Case. 1998. Effects of fragmentation and invasion on native ant communities in coastal southern California. *Ecology* 79:2041–2056.
- Suarez**, A.V., M. Benard, N.D. Tsutsui, T.A. Blackledge, K. Copren, E.M. Sarnat, A.L. Wild, W.M. Getz, P.T. Starks, K. Will, P.J. Palsbøll, M.E. Hauber, C. Moritz, and A.D. Richman. 2002. Correspondence: Conflicts around a study of Mexican crops. *Nature* 417:897.
- Suttle**, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. *Ecological Applications* 14:969–974.
- Suttle**, K.B. 2003. Pollinators as mediators of top-down effects on plants. *Ecology Letters* 6:688–694.
- Suttle**, K.B. 2003. Burrow use in a northern California population of the wolf spider *Schizocosa mccooki* (Araneae, Lycosidae). *Journal of Arachnology* 33:433–436.
- Schmitz, O.J., and K.B. **Suttle**. 2001. Effect of top predator species on direct and indirect interactions in a food web. *Ecology* 82:2072–2081.
- Traut**, B.H. 2001. A naturalist's critique of ecology. *Prairie Naturalist* 33(2):126.
- Traut**, B.H., and P.S. Muir. 2000. Effects of variation in ecosystem carryover on vascular undergrowth communities in the Western Cascades. *Northwest Science* 74(3):212–223.
- Watt**, L.A., L. Raymond, and M.L. Eschen. 2004. On preserving ecological and cultural landscapes. *Environmental History* 9:620–647.
- Watt**, L.A. 2002. The trouble with preservation, or, getting back to the wrong term for wilderness protection: a case study at Point Reyes National Seashore. *The Yearbook of the Association of Pacific Coast Geographers* 64:55–72.
- Wilmking**, M., G.P. Juday, V.A. Barber, and H.S.J. Zald. 2004. Recent climate warming forces opposite growth responses of white spruce at treeline in Alaska through temperature thresholds. *Global Change Biology* 10(10):1724–1736.
- Wilmking**, M., and J. Ibendorf. 2004. An early treeline experiment by a wilderness advocate: Bob Marshall's legacy in the Brooks Range, Alaska. *Arctic* 57(1):106–113.

Barber, V.A., G.P. Juday, B.P. Finney, and M. **Wilmking**. 2004. Reconstruction of summer temperatures in Interior Alaska from tree ring proxies: evidence for changing synoptic climate regimes. *Climatic Change* 63(1–2):91–120.

Juday, G.P., V.A. Barber, S. Rupp, J. Zasada, and M. **Wilmking**. 2003. A 200-year perspective of climate variability and the response of white spruce in Interior Alaska. In: Greenland, D., D. Goodin, and R. Smith, editors. *Climate Variability and Ecosystem Response at Long-Term Ecological Research (LTER) Sites*. Oxford University Press. Chapter 13.

Wondrak Biel, A. Wrestling with Horace Albright: Edmund Rogers, visitors, and bears in Yellowstone, part I. 2002. *Montana the Magazine of Western History* 52(3).

Wondrak Biel, A. Wrestling with Horace Albright: Edmund Rogers, visitors, and bears in Yellowstone, part II. 2002. *Montana the Magazine of Western History* 52(4).

Appendix 6. Selected Canon Scholar Presentations

Collectively, Canon Scholars have made over 200 scientific and public presentations related to their research. The following list represents only a partial selection of scientific presentations presented or co-presented by Canon Scholars. The Canon Scholar's name is in bold.

Barger, N.N., D.S. Ojima, and J. Belnap. 2001. Influence of nitrogen-fixing biological soil crusts on N gas fluxes in Canyonlands National Park, Utah STET. At: American Geophysical Union. December 2001. San Francisco, CA.

Barrie, E.R. 2000. Interpretive impacts from the participants' perspective [abstract]. In: Central States Anthropological Society: 77th Annual Meeting. Bloomington, IN: Indiana University.

Brown, E. 2001. Instruments of power: the archaeology of music and performance in the American Southwest [paper]. At: Annual Meeting of the Society for American Archaeology. April 22, 2001. New Orleans, LA.

Brusati, E.D., and E.D. Grosholz. 2004. Invasion of hybrid cordgrass (*S. alterniflora* x *S. foliosa*) in San Francisco Bay: effects on tidal marsh invertebrates [presentation]. At: Society of Wetland Scientists. Seattle, WA.

Bunn, A.G. 2003. Merging time and space: variability in tree-ring widths and the physical template [presentation]. At: Annual Meeting of the International Association of Landscape Ecologists. April 2003. Banff, AB, Canada.

Bunn, A.G. 2001. A multivariate analysis of tree growth at high elevations [presentation]. At: Annual Meeting of the Ecological Society of America. August 2001. Madison, WI.

Clark, D., and D.S. Slocombe. 2004. Re-negotiating science and protected areas: lessons from grizzly bear conservation in the southwest Yukon, Canada [presentation]. At: Presenting and Representing the Natural Environment: the Response of the Arts and Sciences: an Interdisciplinary Conference. Canadian Studies in Wales Group. March 13, 2004. Gregynog Hall, Newtown Wales, United Kingdom: University of Wales.

Daly, G.L., F. Wania, Y.D. Lei, L. Shen, D. Muir, and L. Castillo. 2004. Organic contaminants in mountains [presentation]. At: SETAC Europe Workshop: the role of high mountains in the global transport of persistent organic pollutants. July 1–3, 2004. Milan, Italy.

Daly, G.L., F. Wania, Y.D. Lei, L. Shen, D. Muir, and L. Castillo. 2004. Organic contaminants in mountains. [presentation]. At: 14th Annual Society of Environmental Toxicology and Chemistry Europe meeting. April 18–22, 2004. Prague, Czech Republic.

Wania, F., G.L. Daly, and Y. Su. 2003. Understanding the global transport behaviour of persistent organic pollutants [oral presentation]. At: Canadian Arctic Contaminants Assessment Symposium. March 4–7, 2003. Ottawa, ON, Canada.

Börkan, B., Y. Capa, and C. Figueiredo. 2003. Using Rasch measurement to evaluate the Organizational Climate Index [conference paper]. In: MWERA Annual Meeting 2003. Columbus, OH.

Gonzales, E.K. 2004. Factors in the decline of Garry oak ecosystems [presentation]. At: International Conference of Ecological Restoration. Victoria, BC, Canada.

Grober-Dunsmore, R., and T.K. Frazer. 2004. Habitat linkages in coral reef ecosystems: implications for the design of MPAs [presentation]. At: 10th International Coral Reef Symposium. June 2004. Okinawa, Japan.

Grober-Dunsmore, R., T. Frazer, J. Beets, and N. Funicelli. 2002. The significance of adjacent habitats on reef fish assemblage structure: are relationships detectable and quantifiable at a landscape scale? [presentation]. In: Proceedings of the 55th Gulf and Caribbean Fisheries Institute Meetings. November 2002. Xel Ha, Mexico.

Hebblewhite, M., and E.H. Merrill. 2003. Applying RSFs to modeling predator-prey dynamics [presentation]. At: Alberta Chapter of the Wildlife Society. March 2003. Red Deer, AB, Canada.

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