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Background

The Aldo Leopold Wilderness Research Institute was established in 1993 as an interagency effort to bring national and international focus to ecological and human dimensions research relevant to understanding and managing wilderness and other protected areas. The Institute, located on the campus of the University of Montana in Missoula, is an outgrowth of the USDA Forest Service's Wilderness Management Research Work Unit of the Intermountain Research Station (now the Rocky Mountain Research Station), which was created in 1967. With a mandate to both develop and provide information, the Leopold Institute aims to conduct and support scientifically rigorous research as well as apply research findings to management needs.

The goals of the Institute are: (1) to provide leadership in development and communication of the knowledge needed to protect and preserve wilderness and the ecological and social values derived from wilderness, and (2) to facilitate the application of this knowledge within the wilderness management agencies and other organizations. The Institute is committed to forging closer interactive ties between managers and scientists. These goals are accomplished by coordinating efforts between agencies; conducting and expanding wilderness research through a variety of partnerships with agencies, universities, and non-governmental organizations; and increasing the application of new and existing knowledge and information.

The Leopold Institute is supported by an Interagency Memorandum of Understanding signed by the USDA Forest Service, the USDI Bureau of Land Management, National Park Service, Fish and Wildlife Service, and U.S. Geological Survey. Representatives of each of these agencies work with the Leopold Institute to provide support and direction.

Building on a strategic planning effort completed in 1996, our research program today focuses largely around the following areas:

- Understanding the effects of recreation use and recreation management strategies on wilderness attributes and visitor experiences.
- Developing the understanding necessary to manage and restore fire as a natural process to wilderness and similarly protected wildlands.
- Understanding the effects of non-native species and their management in wilderness.

Additional emphasis is given to such issues as the role of wilderness in the face of changing societal demographics, mitigating conflicts among users, the meaning of naturalness, public values, the role of science in defining wilderness management objectives, the development of monitoring protocols, and the evaluation of the impact of scientific activities in wilderness.

GENERAL HIGHLIGHTS: FY 2004

- ◆ The Leopold Institute organized and hosted its 10-year Program Review in April, 2004. Approximately 60 Institute partners participated from throughout the Forest Service, DOI agencies and universities to review and discuss the Institute's program of work and proposed priorities for the coming 5-10 years. There was overwhelming endorsement of the importance of the work and general agreement on the proposed 5 Problems for the new Charter. The revised Program Charter was submitted to the Rocky Mountain Research Station and Washington Office for approval in September 2004.
- ◆ The Leopold Institute took the lead in producing the 40th Anniversary National Wilderness Preservation System map. Dave Spildie worked collaboratively with the USGS National Atlas, Arthur Carhart National Wilderness Training Center, and the University of Montana Wilderness Institute. Over 20,000 maps were published and distributed to wilderness managers and staff throughout the country.
- ◆ Leopold Institute staff helped organize "Wilderness Stewardship in the Rockies," a Cooperative Ecosystem Studies Unit workshop to facilitate information sharing and networking between researchers and managers and to improve wilderness science delivery to managers. Institute contributions included a half-day of presentations on fire research and application to an interagency group of wilderness managers (NPS, BLM, USFS, USGS and MT Fish Wildlife and Parks).
- ◆ Leopold Institute staff initiated planning for the 8th World Wilderness Congress Symposium on Science & Stewardship to Protect & Sustain Wilderness Values.
- ◆ Leopold Institute fire staff co-organized a special session at the International Association for Landscape Ecology Conference to address how fire history studies account for scale-dependence in fire-regimes. This topic is important because indices such as Fire Regime Condition Class (FRCC), which are scale-dependent, are being used to prioritize management activities and monitor progress toward goals. These scale dependencies are often ignored or over-simplified when using fire history data. Eight presenters from 4 universities and 2 USFS research stations examined how spatial and temporal patterns in fire regimes change across scales. Carol Miller (with Don McKenzie, PNW-FERA) is preparing a summary paper for the journal *Ecosystems*.
- ◆ Steve Corn presented an overview of his research program, emphasizing the Amphibian Research and Monitoring Initiative at the USGS Northern Rocky Mountain Science Center 5-year review.
- ◆ David Cole presented keynote presentations at a monitoring workshop and at an international conference on recreation, both convened in June, 2004 in Rovaniemi, Finland. His talks were titled, "Monitoring and management of recreation in protected areas: the contributions and

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limitations of science,” and “The Limits of Acceptable Change process: rationale and challenges to implementation.”

- ◆ Steve Corn co-chaired a symposium on the Amphibian Research and Monitoring Initiative at the annual meeting of the American Society of Ichthyologists and Herpetologists, Herpetologists' League, and Society for the Study of Amphibians and Reptiles, in Norman, Oklahoma. Selected papers from this symposium are published in the journal, *Alytes* (July 2005).

PROGRAM AREA HIGHLIGHTS: FY 2004

- ◆ *Monitoring* – The USFS Wilderness Monitoring Committee, co-chaired by the Leopold Institute's Peter Landres, completed work on "Monitoring selected conditions related to Wilderness character: a national framework." This report will be published as a General Technical Report next fiscal year [Leopold Institute Publication #544]. This document develops the conceptual foundation for monitoring trends in wilderness character within all Forest Service wildernesses. In 2004 Peter began co-leadership of the Technical Guide Development Team tasked with developing the “Technical guide for monitoring selected conditions related to Wilderness character,” which will identify the indicators and measures, and develop the detailed protocols for monitoring wilderness character. With funding received by the Chief of the Forest Service, the Technical Guide Development Team has made substantial progress identifying indicators and is on target for completing the Technical Guide by the end of Fiscal Year 2005.
- ◆ *Monitoring* – The Greater Yellowstone Inventory Network selected amphibians as one of the vital signs for long-term monitoring, and is funding Charles Peterson at Idaho State University to collaborate with the USGS at the Leopold Institute to develop amphibian monitoring on a transect of National Parks along the Continental Divide.
- ◆ *Stakeholder Relationships* – The Leopold Institute social science team received funding for several new projects to study relationships:
 - ◆ Denali National Park & Preserve and the American Alpine Club funded a study of relationships between the park and flight seers, climbers, and commercial service providers.
 - ◆ The Tongass National Forest, Alaska Department of Natural Resources and the Alaska Department of Fish & Game funded research on the relationship between the Yakutat community and the Situk River, Alaska.
 - ◆ The Bitterroot Ecosystem Management Research Project funded research on the relationship between Bitterroot Valley residents and the Bitterroot Mountains Front.
- ◆ *Visitor Experiences* – The USFS Pacific Northwest Region provided the third year of funding (\$100,000/year) for a study of visitor experiences in high use wilderness areas. David Cole is working with Troy Hall, University of Idaho, on this project. Most fieldwork has been

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completed; analysis and report-writing have begun. A new project to understand visitor conflict at high use areas in the Northeast was also funded.

- ◆ *Visitor Experiences* – The Leopold Institute’s Social Science team submitted the final report, “Understanding wilderness visitor experiences at Wrangell-St. Elias National Park and Preserve in the Alaska Regional Context” to Wrangell-St. Elias National Park & Preserve and the Alaska Region of the NPS.
- ◆ *Visitor Experiences* – Parks Canada provided additional funding to continue work on understanding visitor experiences in Canadian Parks in Nunavut.
- ◆ *Fire* – Funding (\$20,000) was received from USGS to continue David Pilliod's research on effects of prescribed and wildland fire on stream ecosystems.
- ◆ *Fire* – The Fire Effects Planning Framework (FEPF) was developed and tested as part of the JFSP project “Wildland fuels management – evaluating and planning risks and benefits.” FEPF helps users identify where and under what conditions fire may create benefits or pose threats to ecological conditions or other management targets, thus addressing the need to integrate fire management with land management planning. FEPF provided planning and tactical assistance to managers on the Bitterroot NF and assisted at least one District during the 2004 fire season. FEPF was also used in Yosemite NP to evaluate effects of management strategies on an index of firefighter safety.
- ◆ *Fire* – The Robert Fire of 2003 in Glacier National Park burned across a number of wetlands that had been surveyed for amphibians by the USGS Amphibian Research and Monitoring Initiative. USGS at the Leopold Institute is taking advantage of this to conduct a natural experiment on the effects of wildland fire on pond-breeding amphibians, extending work that began after the Moose Fire of 2001.
- ◆ *Fire* – A new Joint Fire Science Program project, “Learning from the past: retrospective analyses of fire behavior in Yosemite and Sequoia-Kings Canyon National Parks,” will use fire behavior modeling to investigate the cumulative consequences of past suppression decisions. Results from this research will allow managers to track the cumulative effects of suppression, communicate tradeoffs to the public, and improve the prioritization and planning of fuels management activities.
- ◆ *Fire and Monitoring* – A 3-year Forest Health Monitoring project “Understanding the effects of fire management practices on forest health: implications for weeds and vegetation structure in northern Idaho and western Montana” was started. This project will determine how fire management tactics (e.g., hand lines, fire retardants, burn-outs) influence short-term post-fire weed establishment and long-term post-fire patterns in vegetation structure--important information for restoring and managing post-fire landscapes.

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- ◆ *Fire and Social Science* – A GIS map of social values was produced as a result of the research project “Mapping place meanings on the Bitterroot National Forest—a landscape-level assessment of personal and community values as input to fuel hazard reduction treatments.” This project developed methods for collecting data on the meanings residents place on areas being considered for fuel treatments and then mapped this information so it can be used in landscape planning models. The map was presented to managers in the Bitterroot Valley who are using it to plan fuel treatments that simultaneously meet ecological and social objectives. A new Joint Fire Science Program project, “Integrating social values in vegetation modeling via GIS: the missing link for the Bitterroot National Forest,” will improve methods for presenting social values in GIS format, thus allowing the integration of human values into planning fire and fuels treatments.
- ◆ *Fire and Social Science* – Leopold Institute staff facilitated efforts to identify barriers to wildland fire use (WFU) in wilderness. This included a new agreement with University of Idaho to conduct a survey of USFS wilderness Fire Management Officers to determine the most significant factors influencing the WFU recommendation, and cooperating with a University of Montana graduate student who is querying USFS line officers to better understand the factors influencing their decisions. Both of these efforts will establish a foundation for mitigating barriers to restoring fire to wilderness, and for improving organizational effectiveness and the quality and consistency of fire management decisions.
- ◆ *Fire and Social Science* – The Rocky Mountain Research Station and the National Wildfire Coordinating Group’s Social Science Task Group asked Leopold Institute staff to synthesize knowledge from social science disciplines as it relates to firefighter safety. Funded by the National Fire Plan, the Institute’s Research Application Program is developing an annotated reading list on firefighter safety management that addresses decision making, organizational culture, identity, leadership, teams, uncertainty, and crisis communication. Knowledge gathered will be useful for trainings to improve organizational effectiveness related to firefighter safety.
- ◆ *Invasive Species* – A cooperative project with University of Montana “Interactions among fire, exotic plants and bio-control agents” was completed and produced results showing that the roots of exotic knapweed plants treated with a bio-control agent produced increased amounts of a natural herbicide, thus potentially inhibiting the growth of native grasses. Results from this research could dramatically change the way managers practice post-fire weed control and rehabilitation.
- ◆ *Research Application* – The Research Application Program continued exploring the utility of social science knowledge for improving research application. Funding was secured from the Joint Fire Science Program, the BLM National Science and Technology Center, the USFS Washington Office – Fire and Aviation Management, and the Pacific Northwest Research Station to investigate influences to the success of science delivery and application in the USFS, BLM, and NPS.

RESEARCH SCIENTISTS

David J. Parsons, Director. B.S., University of California, Davis. Ph.D., Stanford University. Following 21 years as a Research Biologist with the National Park Service and National Biological Survey, David transferred to the USDA Forest Service in 1994 to become Director of the Leopold Institute. His research interests include the restoration of fire to natural ecosystems, giant sequoia ecology, recreation impacts, the conduct of science in protected areas, and the application of science to policy and land management issues. Prior to moving to the Leopold Institute, he coordinated development of interdisciplinary research teams to address the effects of fire suppression on mixed conifer forests and potential impacts of air pollution, acidic deposition and climatic change on ecosystems of the southern Sierra Nevada. David has recently served as Science Team member of the Congressionally mandated Sierra Nevada Ecosystem Project and as a member of the Ecological Society of America's ad hoc Committee on Ecosystem Management. He has also served as an associate editor for *Ecological Applications*, and as a member of the Ecological Society of America's Sustainable Biosphere Initiative Committee. He is currently a member of the Board of Directors for the George Wright Society and the Ecological Society of America's National Parks Ecological Research Committee, and serves on the advisory board of the Wilderness Institute at the University of Montana. He was Chair of both the 2003 and 2005 George Wright Society Conferences. He has published more than 120 papers related to natural area ecology and management.

David N. Cole, Research Biologist. A.B., University of California, Berkeley. Ph.D., University of Oregon. From 1978 to 1988, David was a Research Ecologist with the Forest Service's Wilderness Management Research Work Unit and also with Systems for Environmental Management (a nonprofit group specializing in natural resources research). He became Project Leader of the Wilderness Management Research Work Unit in 1988. In 1993 David transferred to the Leopold Institute, where he is Research Biologist. His research interests span the entire range of wilderness management issues. Although most of his research has been in the field of recreation ecology, recent research has involved the integrated application of social and biological science to wilderness management and exploration of threats to wilderness ecosystems, other than recreation use. David is the author of more than 180 publications related to wilderness management, including two books and fourteen book chapters.

Paul Stephen Corn, Research Zoologist. B.S., University of Illinois. M.S., Ph.D., Colorado State University. Steve joined the Institute in August 1996 as its first non-Forest Service staff scientist. From 1983 to 1993, Steve was a Wildlife Biologist, Zoologist, and Research Zoologist with the U.S. Fish and Wildlife Service's National Ecology Research Center in Fort Collins, Colorado. Steve was transferred to the National Biological Service (NBS) when it was formed in 1993, and later transferred to the Biological Resources Division of the U.S. Geological Survey. Steve has studied habitat relationships of amphibians and small mammals in Douglas-fir forests in western Oregon and Washington, status of amphibian populations, effects of acid precipitation on amphibians, effects of translocation on desert tortoises, and

effects of grazing on desert tortoises. Current research projects include effects of ultraviolet radiation on mountain amphibians, population ecology of amphibian populations, effects of translocation on desert tortoises, and evaluation of sampling techniques for amphibians and desert tortoises. Steve is the author of more than 60 publications related to ecology and conservation biology of amphibians, reptiles, and small mammals. He is a member of the Species Survival Commission of the World Conservation Union (IUCN) and two endangered species recovery teams. In 1998, Steve organized a workshop on the effects of fish stocking on the biota of wilderness lakes. Papers arising from this workshop were published in the journal *Ecosystems* in 2001.

Peter B. Landres, Research Ecologist, Landscape. B.S., Lewis and Clark College. Ph.D., Utah State University. Peter taught biology, ecology, environmental issues, and conservation biology at the University of Puget Sound and the University of Colorado at Boulder for five years before coming to the Forest Service and the Leopold Institute. Peter is generally working to develop the knowledge needed to protect and preserve ecological conditions in wilderness, and to develop tools and strategies for improving the ecological-based management of wilderness. His topics of active research include (1) understanding the interactions between fire and the incursion of non-native species in large, remote wilderness ecosystems; (2) developing predictive models of development in the wildland-urban interface for strategic fuels management leading to reduced risks from wilderness fire; (3) analyzing agency policies, legislative histories, and judicial interpretation to improve interactions between state wildlife managers and federal wilderness managers, especially over the stocking of fish in wilderness lakes and establishing artificial water sources for ungulates in desert wildernesses; and (4) developing a nationwide wilderness monitoring program, concentrating on monitoring certain aspects of wilderness character and threats to wilderness character.

Carol Miller, Research Ecologist, Wilderness Fire. After a brief career as an engineer (B.S., Electrical Engineering, 1985, Penn State University), she earned a M.S. in Forest Sciences (1994) and a Ph.D. in Ecology (1998), both from Colorado State University, Fort Collins, Colorado. As a graduate student, she was supported by the USGS (originally National Park Service) Global Change Research Program in the central and southern Sierra Nevada. For this project, she developed a version of a spatially explicit forest gap model (ZELIG) that integrates climate, fire and forest pattern. Today she is leading the research program in wilderness fire at the Leopold Institute. She is currently investigating the interactions between fire and its biophysical controls at landscape scales and the consequences of changes in fire regimes for vegetation composition and distribution across landscapes. She is also using modeling approaches to determine the feasibility and consequences of restoring natural fire regimes to wilderness ecosystems. Carol was awarded the Rocky Mountain Research Station's "Early Career Scientist Publication Award" in 2003. This award recognizes publications by early career scientists who have demonstrated outstanding capability and exceptional promise for making significant contributions. Carol's award is based on her recent paper "Simulation of Effects of Climatic Change on Fire Regimes," published as a chapter in *Fire and Climatic Change in Temperate Ecosystems of the Western Americas*.

Alan E. Watson, Research Social Scientist. B.S., M.S., Ph.D., Virginia Tech. Alan's research interests focus on understanding and reporting about human aspects of wilderness use and values. Alan draws upon his education in ecological psychology, environmental psychology, social psychology, sociology, forestry, and natural resources management to study and describe human relationships with wilderness landscapes. Current topics of interest include the contribution of wilderness visitor research to understanding acceptability of natural resource management decisions, the role of wilderness in larger social and ecological systems, recreation visitor conflict, personal and social meanings attached to the wilderness resource and wilderness visits, and monitoring experiential aspects of wilderness use. Alan is the Executive Editor for Science and Research for the *International Journal of Wilderness*, a past Guest Editor for theme issues on recreation fees and pricing issues for the *Journal of Leisure Research* and the *Journal of Park and Recreation Administration*, serves on the faculty of the Department of Conservation and Society at the University of Montana, and co-chaired the science symposium at the World Wilderness Congress in Bangalore, India, (1998) and Port Elizabeth, South Africa (2001). Alan is on the Program Committee of the 8th World Wilderness Congress and Co-Chair of the Symposium on Science and Stewardship to Protect and Sustain Wilderness Values, (October 2005), Anchorage, ALASKA! In 2004, Dr. Watson was inducted into the Academy of Leisure Sciences and recognized by the *Journal of Leisure Research* for 16 years of service as Associate Editor.

POST-DOCTORAL RESEARCH AND RESEARCH SUPPORT

David Spildie, Biologist, GIS Coordinator. B.S., University of Wisconsin, Madison. M.S., University of Wyoming. Dave transferred from Wilderness Management Research Work Unit to the Leopold Institute in 1993. His interests include human impacts on wilderness ecosystems, the ecological relationships of fire, small mammals, and vegetation, and the use of Geographic Information Systems (GIS) in wilderness management. Dave implements field work, supports the research scientists, coordinates GIS projects, and is the information systems manager for the Institute. Current projects include a campsite restoration study, maintenance of the National Wilderness Preservation System digital boundary coverage, the archive of campsite monitoring and visitor survey data, and the use of Wilderness GIS data to depict the relationships between protected lands and natural resource management.

Anne Black, Post-Doctoral Research Ecologist, Wilderness Fire. B.S., University of Montana. M.S., Yale University. Ph.D., University of Idaho, Moscow. Anne's current research interests focus on both the social and ecological issues related to fire, including clarifying the institutional and organizational issues influencing fire management decisions, identifying and improving decision support systems used by fire managers, and investigating how on-the-ground fire management tactics may be influencing long-term landscape structure and ecosystem health. These interests are informed by the variety of professional roles Anne has played since leaving UM in 1984: community organizer in central and eastern Montana; employee of state, federal and tribal natural resource organizations in Washington D.C., Idaho, and the Nez Perce Tribe; landscape ecologist for the Point Reyes Bird Observatory, and the Colorado Natural Heritage Program; adjunct professor at the University of Colorado-

Denver, and conservation ecology contractor to The Trust for Public Land - Northern Rockies Program.

Neal A. Christensen, Social Science Analyst. B.S., University of Montana. M.S., Texas A&M University. Neal has worked for the Institute as a temporary and term employee since 1997. Prior to working at ALWRI, Neal worked as a staff researcher of Montana tourism and recreation for eight years at the University of Montana, School of Forestry. His research experiences include assessing the condition of social and economic systems, and the influences of recreation and tourism development on those systems. His work has been concentrated in the areas of wilderness management, outdoor recreation, and natural resource-based tourism. Neal is currently a PhD student at The University of Montana, College of Forestry and Conservation.

Brett Davis, GIS Specialist, Wilderness Fire. B.A., University of Colorado. M.S., Colorado State University. After obtaining his bachelor's degree in biology Brett worked for the City of Boulder (Colorado) Open Space Department doing battle with invasive plants. During the annual lull in the battle he was given the opportunity to perform annual strategic planning in the Geographic Information Systems (GIS) Lab. Brett continued to work in the GIS Lab for the next three fall/winters while returning to the Integrated Pest Management (IPM) frontlines each spring. Eventually, he became the assistant (and occasionally acting) IPM coordinator. During this time he was graciously given time off to take an internship with the non-profit Ecologically Sustainable Development Inc., on a project to help develop a land use plan for the Ussuri Watershed in the Russian Far East. He returned to work in Boulder with a new appreciation for the immense challenges faced by the conservation profession worldwide and a strong desire to make a positive contribution to the field. GIS and Remote Sensing continued to pique his interest and in 1999 he returned to school to learn what this technology was capable of. Two and ½ years and many interminable evenings in front of a computer later, he has a workable grasp of its capabilities and, perhaps more importantly, its limitations.

Kari Gunderson, Post-doctoral Research Scientist. B.A., University of Montana. M.S., University of Montana. Ph.D., University of Minnesota. For the past 25 years Kari has worked as a wilderness ranger, educator, and manager in the Mission Mountains Wilderness in northwestern Montana. As a graduate student, she was supported by the Leopold Institute and the Arthur Carhart National Wilderness Training Center to evaluate the "Wilderness and Land Ethic" curriculum and teacher workshops. At the Leopold Institute she works in a post-doctoral appointment to conduct research for the Bitterroot Ecosystem Management Research Project in the area of human dimensions. Kari is a faculty affiliate in the School of Forestry at the University of Montana in Missoula.

Blake Hossack, Zoologist. B.S., University of Montana. M.S., University of Idaho. Blake has coordinated surveys of amphibian populations in Glacier National Park with principal investigator Steve Corn since May 1999. He joined the Leopold Institute in September 2000. Blake is currently working with Steve Corn on the following projects: long-term monitoring of amphibian populations in Glacier National Park, effects of the 2001 Moose Fire on

amphibians and aquatic habitats in Glacier National Park, distribution of amphibians in relation to wetland UV-b dose, inventory and monitoring of amphibians in regional national wildlife refuges, and a mark-recapture study of a population of Columbia spotted frogs (*Rana luteiventris*) in the Bitterroot Mountains, Montana.

Katie Kneeshaw, Social Science Research Assistant. B.S., University of Montana. M.S., Colorado State University. After graduating from the University of Montana in May of 2001, Katie moved to Colorado to pursue her Master's degree at Colorado State University. While studying at CSU, she worked as a Research Assistant for Dr. Jerry Vaske and Dr. Alan Bright in the Human Dimensions in Natural Resources Unit. Her Master's project at CSU focused on recreationists' acceptability norms towards fire management and was funded by the USDA Pacific Southwest Forest Service Research Station. After completing her Master's degree in Recreation Resources in December of 2002, Katie accepted a position as a Research Assistant with the Leopold Institute in March of 2002. In her current position with the Leopold Institute, she works under the direction of Dr. Alan Watson and Dr. Carol Miller, incorporating her interest and experience in wilderness management, recreation management, fire management and social science research methods.

David Pilliod, Post-doctoral Research Ecologist. B.A., University of California, Santa Cruz. Ph.D., Idaho State University. After graduating from the University of California Santa Cruz, David spent five years working on forest predator projects in the West. While working for the Forest Service in 1994, David developed an interest in aquatic ecology and herpetology and entered graduate school to study the effects of non-native salmonid introductions on the ecology of high mountain lakes. In 2001, David began a post-doc research position with the USGS Amphibian Research and Monitoring Initiative (ARMI) to coordinate monitoring projects in Montana and North Dakota. Currently, he is a post-doc with the US Forest Service Aldo Leopold Wilderness Research Institute conducting research on the effects of wildland and prescribed fire on stream communities in Idaho, Montana, and Oregon. David is also investigating the effects of diseases on amphibian populations, the metapopulation dynamics of amphibians in heterogeneous landscapes, and the influence of hazardous fuel management on forest wildlife.

Janet Sproull, Research Assistant. B.S., University of Montana. Janet has worked intermittently for Alan Watson since December 1996. Her main focus has been assisting with coordination of the science & technical symposium for the World Wilderness Congress, which convenes every three to four years in select locations around the world. She is assisting with the 8th World Wilderness Congress, which is scheduled to meet in Anchorage, AK, in fall 2005. Janet also assists with compiling manuscripts from symposium presenters for publication. A native Missoulian and nature lover, Janet actively works for the preservation of Missoula's beautiful open spaces, volunteering as a member of the Missoula City Parks, Recreation & Urban Forestry Board; the Mount Jumbo Advisory Committee; and the local land trust Save Open Space.

RESEARCH APPLICATION

Vita Wright, Program Leader. B.S., M.S., University of Montana. Since joining the Leopold Institute staff in January 1998, Vita developed the Institute's Research Application Program. Her main emphasis has been to improve the transfer of scientific information between researchers and managers on a broad range of ecological and social issues. In addition to compiling and synthesizing scientific information on pressing wilderness issues, she's currently investigating ways to minimize barriers to use of science by managers and to prioritize technology transfer methods. Prior to working at the Leopold Institute, Vita obtained her M.S. degree in Organismal Biology and Ecology while conducting a multi-scale study of Flammulated Owl habitat use. Vita has also worked as a wildlife biologist on the Umatilla and Bitterroot National Forests, where she analyzed wildlife habitat for species of concern and observed the effects of past disturbances on coniferous forest ecosystems. Vita began her career by working as a Research Assistant studying habitat use and conservation of old-growth dependent bird species for the U.S. Forest Service, Pacific Northwest Forestry Sciences Lab, bald eagles in Glacier National Park, and global change and ecosystem studies conducted by the USGS field station in Glacier National Park.

Suzanne Schwartz, Website Development. B.A., Sociology, University of Montana. Suzanne has been working at the Leopold Institute since March of 2001. As a member of the Leopold Institute's Research Application Program, she designs and develops the Institute's website, as well as contributes to its continual maintenance and improvement in order to provide and deliver wilderness research information produced primarily by the Leopold Institute. In addition, Suzanne assists with the Institute's visual information including graphic design, layout for print, and image and text editing. She also provides literature searches and annotations and web-based surveys for various research projects. In 2004, she created an interactive CD for Lolo National Forest documenting information, maps, reports, and material related to the 2003 wildfires in the Southwestern Montana zone. Suzanne obtained a B.A. in Sociology with an Environmental and Rural Change Emphasis. She is interested in conservation issues and is currently interested in understanding the complex relationship between humans and the "natural" world. She has visited Malaysia where she and other students had the opportunity to evaluate environmental and social change issues such as deforestation, plantation agriculture, and ecotourism development. Prior to working at the Leopold Institute, Suzanne developed and revised websites for other organizations including Wild Rockies Field Institute, Montana Botanicals, Forest Fire In The Northern Rockies, and the Montana Chapter of the Society for Conservation Biology.

Nathan Queener, Research Aide. Originally from rural north Idaho, Nathan will graduate in May with a B.A. in Environmental Studies from the University of Montana. He first worked at the Leopold Institute for a Wilderness and Civilization class internship. He now writes Research in a Nutshell summaries for the Institute's Research Application Program. He is interested in increasing people's awareness of their connection to the natural world and in better integrating the human world and the wild. Before working at the Leopold Institute, Nathan did stream restoration and agricultural work.

PROGRAM SUPPORT

Kristy Fleshman, Support Services Specialist. B.S., Business Information Systems, University of Montana, M.B.A, University of Montana. Prior to joining the Leopold Institute as Program Assistant, Kristy worked for the School of Business Administration as a member of "Tech Team." Her duties included guiding faculty and staff with technical problems. In addition, she worked with and taught professors about their individual websites. In May of 2002, Kristy was hired by the Rocky Mountain Research Station Fire Sciences Lab. Primarily, she worked in budget administration, but also spent some of her time on the website. From there, Kristy moved to the Forestry Sciences Lab to continue her work in budget administration. Shortly after this move, she was hired by the Leopold Institute. Kristy began her college career at Montana Tech in Butte. She received an athletic scholarship and played volleyball for the Orediggers, while majoring in Business. After two years, Kristy transferred to the University of Montana where she received her undergraduate degree in Business Information Systems in May 2002, and a Masters in Business Administration in May, 2004.

Sarah Parker, Program Assistant. A.A.S Paralegal studies, University of Montana. Sarah was hired in February 2002 by the Rocky Mountain Research Station Fire Sciences Lab, where she worked with the administrative team. Sarah joined the Leopold Institute in the summer of 2003, where she assists with administrative duties. She plans to continue to work with the Leopold Institute until she completes graduate school. Sarah is also working on her B.A. in Anthropology with concentrations in Forensic Anthropology and Archaeology at the University of Montana and will graduate in December 2005. Her primary study areas include: osteology, bioarchaeology, and artifact analysis. Sarah is interested in pursuing her graduate studies in forensic anthropology at the University of Montana. Before joining the Forest Service, Sarah worked as a student intern/paralegal for the law offices of Knight, Masar & Harris, PLLP.

Research Projects

Research projects include in-house studies, as well as cooperative projects with scientists from other federal agencies and universities. The following provides brief descriptions of the Leopold Institute research projects active in FY 2004

ECOSYSTEM DISTURBANCE

FIRE AND FIRE RESTORATION

New! **ANALYSIS OF BARRIERS TO WILDLAND FIRE USE (WFU) IN FOREST SERVICE WILDERNESS AREAS**

WHO: Carol Miller - *Aldo Leopold Wilderness Research Institute*, Dustin Doane - *University of Idaho*

WHAT: This study will help identify the barriers to implementing WFU in FS wilderness areas. A national survey of FS wilderness fire management officers will be used to understand the factors that influence the WFU recommendation. With this information, we will be able to identify primary barriers to WFU in wilderness, thereby establishing a foundation for mitigating these barriers, and for improving organizational effectiveness and the quality and consistency of fire management decisions.

WHEN: 2004-2005

WHERE: National survey, administered from Moscow, ID.

FIRE - ECOLOGICAL RESEARCH

New! **UNDERSTANDING THE EFFECTS OF FIRE MANAGEMENT PRACTICES ON FOREST HEALTH: IMPLICATIONS FOR WEEDS AND VEGETATION STRUCTURE**

WHO: Anne Black, Peter Landres - *Aldo Leopold Wilderness Research Institute*

WHAT: This Forest Health Monitoring Project seeks to understand how fire management tactics affect forest health by determining whether these tactics (a) increase short-term post-fire weed establishment, or (b) cause long-term differences between "natural" and "suppression-caused" post-fire patterns in vegetation structure. A second objective is to assess the opportunity to use FIA data to assist in monitoring these short and long-term effects.

Research is being conducted on fires from 2003 that burned in and around four wilderness areas surrounding Missoula, MT, including assessing site-level impacts such as weeds, and patch-level impacts such as differences in edges, patch shape, and internal heterogeneity post-fire under three different fire management strategies: Wildland Fire Use, containment, and suppression.

WHEN: 2004-2006

WHERE: Rattlesnake, Welcome Creek, Anaconda-Pintlar, and the Selway-Bitterroot Wilderness areas, MT.

New! **EFFECTS OF CHARCOAL FROM DIFFERENT FUELS AND FIRE SEVERITIES ON THE DEMOGRAPHY AND PHYTOTOXIC IMPACTS OF SPOTTED KNAPWEED FOLLOWING WILDFIRE**

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WHO: Ray Callaway - *University of Montana*, Peter Landres - *Aldo Leopold Wilderness Research Institute*

WHAT: The overall purpose of this agreement is to investigate the effects of charcoal produced by different fuels and fire severities on the demography of spotted knapweed and its ability to suppress the growth of native plants in wilderness through the phytotoxic effects of (\pm)-catechin in root exudates following wildfire.

Specific objectives:

1. Conduct field and greenhouse experiments to measure differences in seed germination and establishment in spotted knapweed populations following wildfire in different fuel types (i.e., vegetation types) and fire severities.
2. Conduct field experiments in which (\pm)-catechin is applied to the rhizosphere of native grasses transplanted into forest and grassland where fire burned naturally at different intensities. The amount of catechin adsorbed by the different types of charcoal produced in these different vegetation types, and the effect of catechin on the growth of these transplanted native grasses, will be measured.
3. Measure natural amounts of (\pm)-catechin in soils from different fuel types and fire severities where spotted knapweed has invaded following wildfire.

WHEN: 2004-2008

WHERE: Areas adjacent to the Rattlesnake Wilderness, Montana.

CLIMATE DRIVERS OF FIRE AND FUEL IN THE NORTHERN ROCKIES: PAST, PRESENT AND FUTURE

WHO: Emily Heyerdahl, Matthew Rollins - *Rocky Mountain Research Station*, Penny Morgan - *University of Idaho*, Carol Miller - *Aldo Leopold Wilderness Research Institute*

WHAT: This project will identify the climate drivers of regional fire and fuel dynamics in the northern Rockies. We will identify regional fire years from multicentury tree-ring reconstructions and multidecade digital fire atlases. We will reconstruct the occurrence of regional fire years from synchrony in fire-scars dates among at least 15 widely separated sites in the region (lead PI Heyerdahl). To elucidate present, i.e., 20th century, climate forcing of fires, we will use digitized fire atlases from at least 11 National Forests (lead PIs Morgan and Rollins). To investigate the future consequences of regionally synchronous fire years, we will use a simulation model parameterized with information derived from the fire-scar and fire atlas data (lead PI Miller).

WHEN: 2003-2006

WHERE: Payette, Boise, Sawtooth, Salmon-Challis, Idaho Panhandle, Clearwater, Nez-Perce, Flathead, Kootenai, Bitterroot and Lolo National Forests.

VARIABILITY IN FIRE REGIMES ACROSS SPACE AND TIME

WHO: Carol Miller - *Aldo Leopold Wilderness Research Institute*, Penny Morgan - *University of Idaho*

WHAT: The goal of this research is to use existing data sets from the Selway-Bitterroot and Gila Wildernesses to explore and evaluate two alternative ways to characterize

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variability in fire frequency over space and through time. Variability in fire rotation will be quantified for each of the two wilderness areas. The efficacy of two alternative measures of variability will be compared based on interpretability and utility for describing fire regimes at landscape and regional scales.

WHEN: 2003-2006

WHERE: Selway-Bitterroot and Gila Wildernesses.

FIRE MANAGEMENT STRATEGIES FOR WILDERNESS AND OTHER PROTECTED WILDLANDS: THE POTENTIAL CONTRIBUTION OF LANDSCAPE-SCALE ANALYSES OF FIRE HISTORY

WHO: Carol Miller - *Aldo Leopold Wilderness Research Institute*, Lisa Graumlich, Todd Kipfer - *Montana State University*

WHAT: The purpose of this project is to understand factors that control the frequency, severity, and spread of natural fires across landscapes. Analysis of long term fire and climate patterns will be used in combination with simulation models to assess management options for fires and fuels in wildland ecosystems. Tree-ring based studies of fire history and long-term climate reconstructions will play a key role in this research.

WHEN: 2001-2005

WHERE: Various national forests and parks.

COMPARING FIRE SCAR ANALYSIS, FIRE ATLAS RECORDS, AND FIRE SIMULATIONS

WHO: Carol Miller - *Aldo Leopold Wilderness Research Institute*, Thomas Swetnam, Calvin Farris - *University of Arizona*

WHAT: The primary objective of this research is to determine how fire regime parameters derived from fire-scarred trees and historical fire atlases differ from each other, and to assess how these differences might affect our understanding of past fire regimes.

WHEN: 2001-2005

WHERE: Saguaro-Rincon Mountain Wilderness, AZ.

EFFECTS OF PRESCRIBED AND WILDLAND FIRE ON AQUATIC ECOSYSTEMS IN WESTERN FORESTS

WHO: Steve Corn, David Pilliod - *Aldo Leopold Wilderness Research Institute*, Bruce Bury, Erin Hyde, Chris Pearl - *USGS Forest and Rangeland Ecosystem Sciences Center*

WHAT: The goal of this study is to quantify and compare the ecological consequences of the following fire conditions on stream ecosystems:

1. unburned forests (fires absent for at least 70 years)
2. understory and prescribed fires
3. stand-replacement fires.

This project is supported by USFS R1/R4 National Fire Plan Adaptive Management and Monitoring funds, the Joint Fire Science Program, and the USGS.

WHEN: 2002-2005

WHERE: South Fork Salmon and Big Creek drainages, central ID; Bitterroot Mountains, MT; Rogue River area of the Siskiyou Mountains, CA, Umpqua River area, and Wallowa Mountains, OR.

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MACROINVERTEBRATE ASSEMBLAGES IN MOUNTAIN STREAMS IN BURNED (WILDLAND AND PRESCRIBED) AND UNBURNED WATERSHEDS ON THE PAYETTE NATIONAL FOREST, IDAHO

WHO: Katherine Strickler - *University of Idaho*, David Pilliod - *Aldo Leopold Wilderness Research Institute*

WHAT: This study will characterize the effects of prescribed and wildland fire on aquatic invertebrate communities. Funding is provided by the Joint Fire Sciences Program.

WHEN: 2002-2004

WHERE: Payette National Forest, ID.

FIRE - SOCIAL RESEARCH

New! **INTEGRATING SOCIAL VALUES IN VEGETATION MODELS VIA GIS: THE MISSING LINK FOR THE BITTERROOT NATIONAL FOREST**

WHO: Anne Black, Kari Gunderson, Carol Miller, Alan Watson - *Aldo Leopold Wilderness Research Institute*

WHAT: This project, funded by the Joint Fire Science Program, will advance the scientific basis for integrating social values into forest and fuel management planning while filling a locally important knowledge and data gap identified by the Bitterroot NF. The project seeks to provide managers with the means to assess potential public response to vegetation management along the Bitterroot Front (using the Bitterroot Face Fuels Treatment Project area as a focus). Our objectives are to:

- 1) provide field-verified GIS datasets representing the local public's relationship to the Bitterroot Front - their special places, meanings, uses, and landscape values - for incorporation into the SIMPPLE/MAGIS vegetation simulation model and scheduler. SIMPPLE and MAGIS are being used by the BRF to plan a hazardous fuels reduction program along the Bitterroot Face in western Montana.
- 2) seek mid-term evaluation from all users - the public, the land managers, and the model developers - then incorporate changes into final datasets;
- 3) provide to managers a usable guide for replicating methods in the future; and
- 4) provide sound scientific basis for integration of human values into vegetation simulation models.

WHEN: 2004-2006

WHERE: Bitterroot National Forest, MT

INTEGRATING SOCIAL SCIENCE RESEARCH WITH WILDLAND FIRE SCIENCE AND MANAGEMENT: PHASE I

WHO: Alan Watson - *Aldo Leopold Wilderness Research Institute*, Jim Burchfield - *University of Montana*

WHAT: The aim of this research is to consider how social science data can be applied and merged with other fire science data to provide a more holistic understanding of the factors affecting landscapes. The project calls for a literature review and assessment, the

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identification of an expert team of both social scientists and fire researchers, and a study plan to guide future research.

WHEN: 2001-2005

WHERE: Bitterroot Valley, MT

MONITORING TRUST AS AN EVALUATION OF THE SUCCESS OF COLLABORATIVE PLANNING IN A LANDSCAPE-LEVEL FUEL HAZARD REDUCTION TREATMENT PROJECT IN THE BITTERROOT VALLEY, MONTANA

WHO: Alan Watson, Kari Gunderson - *Aldo Leopold Wilderness Research Institute*, William Borrie - *University of Montana*

WHAT: Project Objectives: A. Measure public trust in the agency among residents and adjacent communities of the Bitterroot National forest in Montana and as a baseline pre-treatment selection indicators of the condition of the relationship between the public and the Forest Service B. Develop understanding of the factors that influence trust in the agency C. Monitor public trust and influencing factors throughout the stages of a landscape-level fuel hazards reduction treatment selection process as one basic indicator of success.

WHEN: 2003-2005

WHERE: Ravalli and Missoula counties in Western Montana

FIRE - RISK ASSESSMENT

SIMULATION OF WILDLAND FIRE USE (WFU) TO MEET RESTORATION OBJECTIVES IN WILDERNESS

WHO: Carol Miller - *Aldo Leopold Wilderness Research Institute*, Robert E. Keane, Russ Parsons - *Fire Sciences Lab*

WHAT: This project will apply the simulation tool LANDSUM to investigate the feasibility and consequences of implementing WFU as a fire and fuels management strategy. The project focuses on the biophysical factors that may limit or enhance the effectiveness of WFU in meeting restoration objectives. Management scenarios that follow the guidelines of a current fire management plan will be simulated to determine if restoration objectives can be met by implementing the plan. Results from the simulations will provide justification for revision or continued implementation of the fire management plan.

WHEN: 2001-2006

WHERE: Selway Bitterroot Wilderness, MT and ID

PREDICTING INDIVIDUAL RESIDENTIAL DEVELOPMENT NEAR WILDERNESS FOR STRATEGICALLY PLANNING FUEL TREATMENTS IN THE BITTERROOT NATIONAL FOREST, MONTANA

WHO: Neal Christensen, Peter Landres - *Aldo Leopold Wilderness Research Institute*

WHAT: This study statistically models and predicts the likelihood of undeveloped private land adjacent to a national forest being developed with one or more residential structures over a five-year period. The overall purpose of this project is to predict future

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rural development in the wildland-urban interface to allow fire management staff to plan fuels treatments that reduce risks to public safety and property.

WHEN: 2001-2005

WHERE: Ravalli County, MT, adjacent to the Selway-Bitterroot Wilderness

THE FIRE EFFECTS PLANNING FRAMEWORK (FEPF)

WHO: Anne Black, Carol Miller - *Aldo Leopold Wilderness Research Institute*

WHAT: The Fire Effect Planning Framework (FEPF) is a process by which land managers can map the location and fuels and weather conditions under which fire of any type - prescribed, wildland fire use or suppression - will result in positive effects for resource targets or species, and alternatively in neutral or negative effects. FEPF utilizes currently existing fire modeling and GIS software and data generally available at the district and forest level. The resulting Map Libraries of fire behavior and fire effects are useful in identifying potential WFU zones, for preparedness and fuels planning, and for the Go/No Go decision. This project was initiated to provide continued support for units desiring to use FEPF and to support additional science delivery activities. For more information on this project, visit

<http://leopold.wilderness.net/research/fprojects/F005.htm>.

WHEN: 2004-2005

WHERE: Various National Forests in Region 1; Sierra National Forest

NON-NATIVE SPECIES

FISH

DECLINING AMPHIBIANS IN THE PACIFIC NORTHWEST: DO STOCKED GAME FISH SPREAD PATHOGENIC AQUATIC FUNGI THAT CAUSE MASS MORTALITY OF AMPHIBIAN EGGS?

WHO: David Pilliod - *Aldo Leopold Wilderness Research Institute*, Jill McNeill, Vern Winston - *Idaho State University*, Bruce Bury, Chris Pearl - *USGS Forest and Rangeland Ecosystem Sciences Center*

WHAT: The aquatic water mold *Saprolegnia ferax* is thought to cause mass embryonic mortality and amphibian declines in the Pacific Northwest. Some research suggests that *S. ferax* is a nonnative pathogen that has been introduced with hatchery game fish in mountain lakes, including protected wilderness areas. The transfer of the pathogen from fish to amphibians has now been confirmed. This project will be the first broad scale field study to examine the distribution of *S. ferax* in relation to introduced fish and will test four hypotheses using a combination of field surveys and newly developed molecular techniques for identification of fungal taxa to species and subspecies levels:

1. *Saprolegnia ferax* is present in lakes with stocked fish and absent in fishless lakes.
2. *Saprolegnia ferax* is the only pathogenic fungus that could be responsible for mass mortality of amphibian eggs.
3. Mass mortality of embryos associated with pathogenic fungi occurs in conjunction with other environmental stressors (e.g., nitrification, freezing).
4. Amphibian populations are smaller in locations where embryonic mass mortality has been observed or where *S. ferax* occurs.

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This research is important for wilderness management because it examines a possible anthropogenic threat to aquatic wildlife in "protected" montane waters and provides important information for the ongoing debate over the stocking of hatchery fish in wilderness lakes.

WHEN: 2003-2006

WHERE: Western Montana (Bitterroot Valley and Bitterroot Wilderness), central Idaho (Frank Church-River of No Return Wilderness) and Oregon (Willamette Valley, Mount Rainier National Park, Cascade Mountains, Blue Mountains).

INVASIVE PLANTS

EVALUATING THE EFFECTS OF MANAGEMENT-IGNITED FIRE ON THE INFLUX OF EXOTIC PLANTS IN WILDERNESS

WHO: Peter Landres - *Aldo Leopold Wilderness Research Institute*

WHAT: This project is designed to determine whether exotic plants invade areas where management-ignited prescribed fires have been used to reduce fuels and restore a more natural fire regime.

WHEN: 2000-2003

WHERE: Frank Church-River of No Return Wilderness, ID.

RECREATION

ECOLOGICAL IMPACTS AND RESTORATION

BASELINE DATA AND TRENDS IN RECREATION IMPACTS ON WILDERNESS CAMPSITES

WHO: David Cole - *Aldo Leopold Wilderness Research Institute*

WHAT: This study will increase the number of wildernesses for which baseline data on campsite condition have been collected and to periodically repeat impact measurements in wildernesses for which baseline data exists.

WHEN: 2002-2006

WHERE: Frank Church-River of No Return Wilderness, ID; Lee Metcalf Wilderness, MT; Selway-Bitterroot Wilderness, MT and ID; Eagle Cap Wilderness, OR; San Rafael Wilderness, CA; Garden of the Gods Wilderness, IL; Caney Creek and Buffalo River Wildernesses, AR; Hercules Glades Wilderness, MO; Sequoia-Kings Canyon and Yosemite National Parks, CA.

EVALUATING THE EFFECTIVENESS OF ALTERNATIVE RESTORATION TECHNIQUES ON SUBALPINE CAMPSITES

WHO: David Cole - *Aldo Leopold Wilderness Research Institute*

WHAT: Several alternative techniques might accelerate the rate of vegetation recolonization on closed campsites around subalpine lakes. The treatments being evaluated include scarification, mulching, organic matter amendments, compost amendments, seeding, and transplanting. We are monitoring the influence of these treatments on soil properties, transplant survival and growth, seedling establishment, growth rates, survival and density, and vegetation cover.

WHEN: 1995-2005

WHERE: Eagle Cap Wilderness, OR

VISITOR EXPERIENCES

UNDERSTANDING VISITOR EXPERIENCES IN PORTIONS OF WILDERNESS THAT RECEIVE HEAVY USE, PARTICULARLY BY PEOPLE ON DAY VISITS

WHO: David Cole - *Aldo Leopold Wilderness Research Institute*, Troy Hall - *University of Idaho*

WHAT: This project will attempt to develop a deeper understanding of human experiences in wilderness, by combining qualitative and quantitative techniques and by assessing experience at various temporal scales and at various phases of the experience. It will assess how experience varies with length of trip and visitor density. Funding for this project comes from USFS Region 6.

WHEN: 2001-2006

WHERE: Forest Service wildernesses in the Pacific Northwest

New! **VISITOR CONFLICT IN HIGH-USE WILDERNESS IN THE NORTHEAST**

WHO: Rudolph Schuster - *State University of New York*, David Cole - *Aldo Leopold Wilderness Research Institute*

WHAT: Understand visitor conflict in wilderness locations that receive extremely high use.

WHEN: 2005-2008

WHERE: Wilderness in New Hampshire

DENALI NATIONAL PARK AND PRESERVE BACKCOUNTRY VISITOR USE SURVEY

WHO: Neal Christensen, Alan Watson, Katie Kneeshaw - *Aldo Leopold Wilderness Research Institute*

WHAT: A mixed-method (qualitative and quantitative methods) study of recreationists accessing the Denali backcountry by air taxi and flight-seeing aircraft, to identify influences on their experiences, describe visitor characteristics, understand the importance of experience aspects, their perceptions of impacts, reactions to encounters, and opinions about management. This information will be used to inform the park's backcountry planning process. This study is funded by the Leopold Institute and Denali National Park & Preserve.

WHEN: 2004-2005

WHERE: Ruth Amphitheater, Kahiltna Base Camp, Pika Glacier, and Eldridge Glacier, Denali National Park, Alaska.

DEVELOPING AN UNDERSTANDING OF WILDERNESS EXPERIENCES AND MEANINGS: AUYUITTUQ AND QUTTINIRPAAQ NATIONAL PARKS OF CANADA, NUNAVUT

WHO: Alan Watson - *Aldo Leopold Wilderness Research Institute*, Parks Canada, Paul Lachapelle, Stephen F. McCool - *University of Montana*

WHAT: 1) To identify and describe the range of expectations, actual wilderness-dependent experiences and related definitions and meanings associated with use of the parks for visitors and users.

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2) To identify and describe the influences on visitors' and users' expectations (e.g. past visits, stories from friends or family, tourism operators), experiences (e.g. other people, management actions, physical impacts) and related definitions and meanings associated with use of the parks.

WHEN: 2002-2005

WILDERNESS AND SOCIAL SYSTEMS

DEFINING THE ROLE OF TRUST IN COLLABORATIVE RELATIONSHIPS TO MAKE WILDERNESS STEWARDSHIP DECISIONS

WHO: William Borrie - *University of Montana*, Alan Watson - *Aldo Leopold Wilderness Research*

WHAT: To determine the appropriate measures of trust to be used in assessing the success of collaborative planning efforts to maintain or build trust while accomplishing wilderness and other public lands planning objectives.

WHEN: 2003-2005

WHERE: Ravalli County, Montana

BITTERROOT NATIONAL FOREST - HYDROLOGIC AND HUMAN CONNECTIVITY: WILDERNESS DAMS AND QUALITY OF LIFE IN THE BITTERROOT VALLEY

WHO: Kari Gunderson, Alan Watson - *Aldo Leopold Wilderness Research Institute*, Catherine Pringle - *University of Georgia*

WHAT: A mixed-method study using qualitative in-depth interviews and a quantitative community and visitor survey to develop a good understanding of the ecological, economic, social and cultural values associated with wilderness dams in the Bitterroot Valley to determine how people inside (visitors) and outside (local and distant community members) the Selway/Bitterroot Wilderness relate to or trade off these values in determining attitudes toward wilderness dams.

WHEN: 2003-2005

WHERE: Ravalli County, Montana

New! **YAKUTAT COMMUNITY STUDY**

WHO: Neal Christensen, Alan Watson - *Aldo Leopold Wilderness Research Institute*

WHAT: This study examines relationships to place between residents of Yakutat, Alaska and the Situk River. It assesses local perspectives on use, conflict, and management issues on the river. The central argument of this research is that local relationships with the Situk River are complex and varied across community members, and that types of relationships with the river influence opinions about user conflicts and management approaches. This study uses a mixed-methods approach, including in-depth interviews and structured questionnaires to address these questions. This study complements already completed research on nonresident recreation visitors to the Situk River.

WHEN: 2004-2005

WHERE: Yakutat, AK.

WILDLIFE

AMPHIBIANS AND REPTILES

AMPHIBIAN RESEARCH AND MONITORING INITIATIVE

WHO: Steve Corn, Blake Hossack, David Pilliod - *Aldo Leopold Wilderness Research Institute*, Charles R. Peterson - *Idaho State University*, Andrew Sheldon, Chris Funk, Bryce Maxell, Aimee Wyrick - *University of Montana*

WHAT: In FY 2000, the Department of the Interior (DOI) initiated a major national initiative to detect trends in amphibian populations and conduct research into causes of declines, the Amphibian Research and Monitoring Initiative (ARMI). Objectives include:

- to initiate long-term monitoring to determine trends in amphibian populations;
- to conduct research into causes of amphibian declines and malformations;
- to make use of relevant expertise within USGS and DOI; and
- to make the information available to cooperators, land managers, the scientific community, and the general public.

ARMI projects are being conducted nationally. In the northern Rocky Mountains, long-term monitoring of amphibian populations is being initiated at several national parks and wildlife refuges, and surveys are being conducted on national forests in Montana in cooperation with Region 1 of the USFS including. ARMI (USGS) funding is also being used to help fund research on amphibian population dynamics

WHEN: 2000; Ongoing

WHERE: Glacier National Park, MT; Grand Teton National Park and Yellowstone National Park, WY; Theodore Roosevelt National Park, ND; national forests in western MT; national wildlife refuges in MT and ID.

CHYTRID FUNGUS IN THE ROCKY MOUNTAINS: ESTABLISHING DISTRIBUTION & EVALUATING THREAT TO BOREAL TOADS

WHO: David Pilliod - *Aldo Leopold Wilderness Research Institute*, Erin Muths - *USGS Biological Resources Division*

WHAT: A complete understanding of disease and its role in amphibian declines is lacking. In the western U.S., chytrid fungus (*Batrachochytrium dendrobatidis*) has features of an introduced, lethal infectious disease to which amphibian populations have no resistance and which has been associated with population declines in several species. Information on the distribution of chytrid, the susceptibility of populations to chytridiomycosis, and the role of chytrid in amphibian population declines is critically needed. This project is designed to provide some of this needed information and addresses the following objectives:

1. Document the distribution of chytrid fungus in boreal toad (*Bufo boreas*) populations in the current and historic breeding locations in the Rocky Mountain region of WY and MT (data exist for CO, *L. Livo*, unpubl. data).
2. Establish 3 apex sites at robust boreal toad populations in CO, WY, and MT to:
 - a. Monitor the status of and threats (e.g. potential immunosuppression related to the presence of contaminants and risk of chytrid infection) to

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these populations and use the data to develop conservation measures to protect these unique populations on a regional scale.

- b. Use capture-recapture population data for boreal toads and data on chytrid and contaminants to develop predictive models to examine possible interactions of disease and other stressors on amphibian population dynamics and persistence.

This project will sample in wilderness and non-wilderness areas. If chytrid is spread by human use of lakes and ponds (e.g., fishing, boating), then chytrid should be less prevalent in areas with fewer human activities, such as remote lakes in national parks and wilderness areas.

WHEN: 2003-2006

WHERE: Wyoming up to the Greater Yellowstone Ecosystem (GYE) and in western Montana from the GYE to Glacier National Park; Colorado; apex sites at Denny Creek on the San Isabel National Forest in Colorado, Black Rock on the Bridger Teton National Forest in Wyoming, and Lost Trail National Wildlife Refuge in Montana.

METHODS FOR ESTIMATING DESERT TORTOISE ABUNDANCE

WHO: Steve Corn - *Aldo Leopold Wilderness Research Institute*, Philip A. Medica - *U.S. Fish and Wildlife Service*, C. Richard Tracy - *University of Nevada*, University of Nevada, Reno, Ronald W. Marlow - *University of Nevada*

WHAT: The desert tortoise is a Federally-threatened species in the Mojave Desert in the southwestern U.S. The recovery plan mandates monitoring to establish trends in abundance that would form the basis for future listing decisions, and line-transect distance sampling is now the standard technique to estimate abundance in management areas. Tortoises are slow moving relative to sampling, and the Mojave Desert is open with relatively simple vegetative structure. Tortoises may be ideally suited for distance sampling, but transect data are complicated by behavior. However, bias results from variation in amount of surface activity by tortoises from year-to-year, and failure to meet the assumption that all tortoises on the transect line are detected. This project will assist the USFWS in determining statistically valid, cost effective methods for estimating abundance of desert tortoises and with analyses of data collected.

WHEN: 1998-2003

WHERE: Southern NV.

OTHER WILDERNESS MANAGEMENT ISSUES

MONITORING

MONITORING WILDERNESS CHARACTER: DEVELOPING A CONCEPTUAL FRAMEWORK AND NATIONAL MONITORING PROTOCOLS

WHO: Peter Landres - *Aldo Leopold Wilderness Research Institute*

WHAT: This study seeks to accomplish the following objectives: 1. Develop a description of wilderness character that captures the full set of ideals, meanings, and relationships embodied by this phrase. 2. Develop a conceptual framework or model based on the Section 2(c) Definition of Wilderness from the 1964 Wilderness Act to

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describe specific national elements or "qualities" of wilderness character that managers are responsible for. 3. Develop nationally applicable indicators based on these qualities of wilderness character. These indicators will generally be from already existing corporate databases, accessed through a corporate data "warehouse." 4. Develop nationally applicable monitoring protocols that describe how the data for these indicators will be collected, stored, analyzed, and used.

WHEN: 2001-2005

WHERE: Missoula, MT

Completed Research Projects

PROJECTS COMPLETED DURING FY 2004

DEVELOP INDICATORS FOR MONITORING “OUTSTANDING OPPORTUNITIES” FOR WILDERNESS EXPERIENCES

WHO: Peter Landres - *Aldo Leopold Wilderness Research Institute*, Stephen F. McCool - *University of Montana*

WHAT: The purpose of this agreement was to develop indicators for monitoring "outstanding opportunities for solitude or a primitive and unconfined type of recreation." The specific objectives for this research were: 1. Organize a workshop of selected academic social scientists and agency wilderness management staff familiar with social science; 2. At this workshop, review monitoring questions (or goals) and indicators tentatively recommended by the Forest Service Wilderness Monitoring Committee; 3. Develop, as needed, new monitoring questions and indicators of "outstanding opportunities for solitude or a primitive and unconfined type of recreation;" and 4. Recommend specific measures that will be used to collect data for all monitoring indicators.

WHEN: 2004

WHERE: The University of Montana's Lubrecht Experimental Forest, MT

PRODUCTS: Landres, P. 2004. Developing Indicators to Monitor the “Outstanding Opportunities” Quality of Wilderness Character. *International Journal of Wilderness* 10(3):8-11, 20. (Leopold Publication Number 534)

EVALUATING THE RISKS AND BENEFITS OF WILDLAND FIRE AT THE LANDSCAPE SCALE

WHO: Anne Black, Peter Landres, Carol Miller - *Aldo Leopold Wilderness Research Institute*

WHAT: Through this project we developed the Fire Effects Planning Framework - a modeling protocol for evaluating the risks and benefits from wildland fire across landscapes. FEPF is designed to help design fire and fuels management plans at multiple scales and identify areas on the landscape of highest priority for fuels treatment and opportunities to restoring fire to fire-adapted ecosystems. This research involved the analysis of landscape-scale fire patterns and the factors influencing these patterns. The project was supported by the Joint Fire Science Program and the National Fire Plan. As part of this project, a comprehensive assessment of wildland fire management was conducted. This included a problem analysis based on the scientific literature, public policy and agency planning documents. For more information on this project, visit <http://leopold.wilderness.net/research/fprojects/F001.htm>.

WHEN: 2004

WHERE: Selway Bitterroot Wilderness, MT and ID; Bitterroot National Forest, MT; Yosemite National Park, CA.

PRODUCTS: Miller, Carol; Landres, Peter B.; Alaback, Paul B. 2000. Evaluating risks and benefits of wildland fire at landscape scales. *In: Neuenschwander, L.F.; Ryan, K.C., comps. Proc. Crossing the Millennium: Integrating Spatial Technologies and Ecological Principles for a New Age in Fire Management*; Moscow, ID: University of Idaho: 78-87. (Leopold Publication Number 413)

Completed Research Projects

PRODUCTS: (continued)

Miller, Carol 2003. Wildland fire use: a wilderness perspective on fuel management Fire, Fuel Treatments, and Ecological Restoration: Conference Proceedings; 2002 16-18 April; Fort Collins, CO. Proceedings RMRS U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 379-385. (Leopold Publication Number 480)

Miller, Carol. 2003. The spatial context of fire: a new approach for predicting fire occurrence. Pages 27-34 in K.E.M. Galley, R.C. Klinger, and N.G. Sugihara (eds.). Proceedings of Fire Conference 2000: The First National Congress of Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 13, Tall Timbers Research Station, Tallahassee, FL. (Leopold Publication Number 501)

Miller, Carol and Landres, Peter. 2004. Exploring information needs for wildland fire and fuels management. RMRS-GTR-127. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 36 p. (Leopold Publication Number 519)

Black, A. 2005. The Fire Effects Planning Framework. *International Journal of Wilderness*. Science and Research Perspective. 11(1):19-20. (Leopold Publication Number 540)

Other Publications:

Black, A.E., and T. Opperman. In prep. The Fire Effects Planning Framework - User's Guide. RMRS-GTR-XXX

The following products can be found at:

http://leopold.wilderness.net/research/fprojects/F001_B.htm#products

JFSP Project Highlight - Fire Effects Planning Framework: Helping to Identify the Benefits and Risks

Evaluating Wilderness Fire Risk At The Landscape Scale: A conceptual model for evaluating the risks and benefits of fire.

THE IMPACTS OF WILDLAND FIRE AND FIRE SUPPRESSION ON EXOTIC WEED INVASION

WHO: Peter Landres - *Aldo Leopold Wilderness Research Institute*, Ray Callaway - *University of Montana*

WHAT: The overall purpose of this study was to explore how wildland fire affects the establishment and growth of spotted knapweed in western Montana, how spotted knapweed subsequently affects native grasses, and whether biocontrol agents affect these interactions. Specific objectives of this research were to answer the following questions:

- A. Does wildland fire affect spotted knapweed biomass and reproduction?
- B. Does biocontrol infection reduce the biomass and reproduction of spotted knapweed?

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C. Does biocontrol infection of spotted knapweed increase the biomass and reproduction of native grasses?

D. Does wildland fire alter the relationships among biocontrol, spotted knapweed, and native grasses?

WHEN: 2004

WHERE: Bitterroot National Forest, Selway-Bitterroot Wilderness, MT.

PRODUCTS: Callaway, R.M., and W.M. Ridenour. 2004. Novel weapons: invasive success and the evolution of increased competitive ability. *Frontiers in Ecology and the Environment* 2:436-443. (Leopold Publication Number 530)

Thelen, Giles C.; Vivanco, Jorge M.; Newingham, Beth; Good, William; Bais, Harsh P.; Landres, Peter; Caesar, Anthony; Callaway, Ragan M. 2005. Insect herbivory stimulates allelopathic exudation by an invasive plant and the suppression of natives. *Ecology Letters* 8:2090217. (Leopold Publication Number 541)

Research Update: How Does Biological Control Affect Post-Fire Spotted Knapweed Invasions? - <http://leopold.wilderness.net/research/updates/U002.pdf>

THE ROLE OF ETHICS AND PUBLIC PARTICIPATION IN DEVELOPING REGIONAL PLANS FOR MANAGING FIRE AND FUELS IN WILDERNESS

WHO: Mark Hanson - *University of Montana Practical Ethics Center*, Peter Landres - *Aldo Leopold Wilderness Research Institute*

WHAT: The overall purpose of this agreement was to develop an ethical framework for public participation in regional planning of fire and fuels management in wilderness. The specific objectives of this agreement were to:

- A. Develop an ethical framework for regional planning of fire and fuels in wilderness;
- B. Develop a grant proposal that would provide the funds for testing this ethical framework;
- C. Develop a paper to be published in a peer-reviewed journal summarizing the ethical framework and its application to managing fire and fuels in wilderness in particular, and to contentious wilderness management issues in general.

WHEN: 2004

WHERE: Missoula, MT.

NATIONAL WILDLIFE REFUGE INVASIVE AND EXOTIC SPECIES SURVEY AND DATABASE

WHO: Amy Cilimburg, Doug Tempel, Vita Wright - *Aldo Leopold Wilderness Research Institute*

WHAT: In collaboration with the US Fish and Wildlife Service, the Leopold Institute conducted a survey of invasive and exotic species within National Wildlife Refuge wilderness areas. We collected information from FWS managers on the status and management of invasive plants and exotic animals and pathogens in National Wildlife Refuge wilderness areas. The primary purpose of this project was to develop a database that can function as an internet-based tool for monitoring the status of invasive species in specific wilderness areas and as a resource for information on invasive species problems and control measures in other refuges.

Completed Research Projects

WHEN: 2004

WHERE: National Wildlife Refuges with wilderness throughout the United States.

PRODUCTS: Tempel, Douglas J.; Cilimburg, Amy B.; Wright, Vita. 2004. The status and management of exotic and invasive species in National Wildlife Refuge Wilderness Areas. *Natural Areas Journal* 24:300-306. (Leopold Publication Number 528)

Research in a Nutshell: Invasive and Exotic Species in National Wildlife Refuge Wilderness Areas - <http://leopold.wilderness.net/research/nutshell/N023.pdf>

Leopold Institute Wilderness Invaders Surveys and Databases - <http://leopold.wilderness.net/research/invasives/invaders.htm>

MAPPING PLACE MEANINGS ON THE BITTERROOT NATIONAL FOREST - A LANDSCAPE-LEVEL ASSESSMENT OF PERSONAL AND COMMUNITY VALUES AS IN PUT TO FUEL HAZARD REDUCTION TREATMENTS

WHO: Kari Gunderson, Alan Watson - *Aldo Leopold Wilderness Research Institute*

WHAT: Through semi-structured and key informant qualitative interviews and focus groups with community members, this project seeks to develop an understanding of the range of personal and community values and meanings attached to the landscapes surrounding the Bitterroot Valley. The effect of Forest Service fire and fuels management actions on these values will be assessed. The project will develop qualitative descriptions of the relationships between community members and the Bitterroot landscape, and this information will help develop fuel treatment programs that reflect the social values of the local community.

WHEN: 2004

WHERE: Ravalli County, MT

PRODUCTS: BEMRP Research Project Summary: Gunderson, K. and Watson, A.E. (2004). Mapping place meanings on the Bitterroot National Forest - a landscape-level assessment of personal and community values as in put to fuel hazard reduction treatments. - <http://leopold.wilderness.net/unpublished/UNP105.pdf> (Leopold Institute Unpublished Report #105)

RAPID ASSESSMENTS OF COMMUNITY RELATIONSHIPS TO THE BITTERROOT NATIONAL FOREST

WHO: Kari Gunderson, Alan Watson - *Aldo Leopold Wilderness Research Institute*, John Titre - *Park Studies, Inc.*

WHAT: A. Provide guiding principles and a specific methodology plan for data collection and analysis for 1) low resolution/large breadth assessments, and 2) high resolution, narrow breadth assessments for a landscape level fuel treatments project coordinated by the Bitterroot Ecosystem Management Research Project. B. Provide review and feedback during implementation of the study plan, including analysis and input to applied modeling efforts. C. Develop and provide an annotated bibliography of relevant place-based planning and management articles that describe the purpose of place-based planning, methods of data collection and analysis, and applications.

WHEN: 2004

Completed Research Projects

PRODUCTS: Park Studies, Inc. will provide an annotated bibliography of relevant place-based planning and management articles that describe the purpose of place-based planning, methods of data collection and analysis, and applications.

COMMUNICATION ANALYSIS AMONG CONSERVATION EDUCATION ORGANIZATIONS IN THE BITTERROOT WATERSHED AND MISSOULA AREA - PHASE II

WHO: Kari Gunderson - *Aldo Leopold Wilderness Research Institute*

WHAT: Phase II focused on gathering information on the communication structure and education efforts within the conservation education community to improve coordination between conservation education groups and the USFS in delivering effective educational messages to the public. Recommendations will be made for improved communications and partnership opportunities between the USFS and conservation educators. This study will also provide a communication framework for national forests. Funding for this project comes from Bitterroot Ecosystem Management Research Project.

WHEN: 2004

WHERE: Bitterroot and Lolo National Forests, MT

Research Activities

In addition to conducting and coordinating research projects, Leopold Institute staff organize conferences and symposia, host visiting researchers, participate on committees and task forces, interact with University staff and graduate students as affiliate faculty, edit and review manuscripts for journals, books, and proceedings, review research proposals, and present at scientific conferences.

RESEARCH SYMPOSIA/WORKSHOPS ORGANIZED BY THE LEOPOLD INSTITUTE

Workshop	Location	Staff
“Wilderness monitoring”, special session at the National Monitoring Science and Technology Symposium	Denver, CO	Landres
Workshop to develop indicators of “outstanding opportunities for solitude or a primitive and unconfined type of recreation”	Lubrecht Forest, MT	Landres
Scaling laws in fire regimes, special session at International Association for Landscape Ecology conference	Las Vegas, NV	Miller

VISITORS HOSTED

Visitor	Title	Association
Nigel Wessels	Park Manager	Outeniqua Nature Reserve, Western Cape Province, South Africa
Eric Knapp, Carl Skinner	Research Ecologist, Geographer	USFS Pacific Southwest Research Station
Dave Thomas	Regional Fuels Specialist	USFS Region 4
Sarah McCaffrey	Research Social Scientist	USFS Northcentral Research Station
Bruce Reiman, Charlie Luce	Research Scientists	USFS Rocky Mountain Research Station, Boise Aquatic Sciences Lab
Jill Baron	Global Change Ecologist	USGS, Ft. Collins
Eric Hakanson	Research Assistant	University of Montana National Center for Landscape Fire Analysis
Steve Carver	Geographer	University of Leeds, England
Anna Sala	Professor	University of Montana, Division of Biological Sciences
Joe Scott	Research Forester	Systems for Environmental Management
Cathy Pringle	Professor	University of Georgia
Harvey Locke	Director	Yellowstone to Yukon Foundation
Tonia Opperman	Fire Ecologist	Bitterroot National Forest

Research Activities

Visitor	Title	Association
Kate Rodger	Doctoral Student	Murdoch University, Perth, Australia
Dustin Doane	M.S. Student	University of Idaho
Skip Edel	GIS Program Manager	Colorado State Forest Service
Jeff Baranyi	Staff	ESRI

SCIENTIFIC COMMITTEES, TASK FORCES, FACULTY PARTICIPATION

Role	Committee/Task Force	Staff
Board of Directors	The George Wright Society	Parsons
Executive Board Member	Society for Northwestern Vertebrate Biology	Pilliod
Co-chair	The Amphibian Research and Monitoring Initiative Symposium	Corn
Panel Member	WO level Research Grade Evaluation Panel	Parsons
Member	National Park Ecological Research Committee	Parsons
Member	National Fire Plan Research Committee	Parsons
Member	2005 Forest Service Recreation Research Conference Planning Committee	Cole
Member	The Amphibian Research and Monitoring Initiative Committee	Corn
Member	USFWS Desert Tortoise Abundance Committee	Corn
Member	PhD graduate student committee (University of Massachusetts)	Miller
Member	MS graduate student committee (University of Montana)	Miller
Member	MS graduate student committee (University of Idaho)	Miller
Member	MS graduate student committee (University of Idaho)	Watson
Member	MS graduate student committee (University of Idaho)	Watson
Member	Doctoral student committee (University of Montana)	Corn
Member	Doctoral student committee (University of Montana)	Watson
Member	Doctoral student committee (University of Montana)	Watson
Member	Doctoral student committee (University of Montana)	Watson

EDITORIAL ACTIVITIES

Journal/Publisher	Role	Staff
International Journal of Wilderness	Executive Editor	Watson
International Journal of Wilderness	Associate Editor	Cole
Environmental Management	Editorial Board	Cole

Research Activities

Herpetological Conservation/Society for the Study of Amphibians and Reptiles	Editor	Corn
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PROVIDED MANUSCRIPT REVIEWS FOR *American Midland Naturalist, Applied Herpetology Journal, Applied Vegetation Science, Australian Journal of Botany, Canadian Forest Service Information Report, Canadian Sustainable Forest Management Network Proposal, Ecological Applications, Ecological Modeling, Environmental Conservation, Frontiers in Ecology and the Environment, International Journal of Tourism Research, International Journal of Wilderness, Journal of Ecotourism, Journal of Environmental Management, Journal of Herpetology, Journal of Leisure Research, Landscape Ecology, Oikos, Canadian Forest Service Information Report, Ecological Society of America review of proposals for post-doctoral work in National Parks, Sustainable Forest Management Network Proposal, Proposal to the USGS for global change research in a network of western mountain parks, RMRS publication summarizing the “Managing the Unexpected” Workshop, and University of Montana McIntyre-Stennis Proposals.*

PRESENTATIONS AT SCIENTIFIC CONFERENCES, MEETINGS, AND SEMINARS

Talk Title	Meeting Name	Location	Staff
“Monitoring wilderness character”	Monitoring Science and Technology Symposium	Denver, CO	Landres
“Monitoring protocols and programs for protecting the character of individual wildernesses”	Monitoring Science and Technology Symposium	Denver, CO	Landres
“Identifying potential vital signs for monitoring wilderness and wildland values”	Monitoring Science and Technology Symposium	Denver, CO	Landres
“Managing for untrammeled and natural conditions in wilderness”	University of Montana Colloquium in the Philosophy of Ecology	Missoula, MT	Landres
“Ecological restoration in wilderness: the dilemma of managing for wildness and naturalness”	The University of Montana Practical Ethics Center: “Ethics, Fire, and Wilderness: Ethical issues in ecological restoration”	Missoula, MT	Landres
“The dilemma of managing for wildness and naturalness”	University of Montana class: “Wilderness management: tensions and paradoxes”	Missoula, MT	Landres
“Understanding relationships between humans and wilderness landscapes as a framework for monitoring wilderness character”	Monitoring Science and Technology Symposium	Denver, CO	Watson

Research Activities

Talk Title	Meeting Name	Location	Staff
“Mapping place meanings on the Bitterroot National Forest – a landscape-level assessment of personal and community values as input to fuel hazard reduction treatments”	Bitterroot Ecosystem Management Research Project meeting	Hamilton, MT	Watson, Gunderson
“Institutional trust in fire and fuels management”	RMRS Fire Lab Seminar Series	Missoula, MT	Watson
"Searching for wildness in South Africa"	University of Montana Graduate Student Seminar	Missoula, MT	Watson
“Identifying benefits and risks for wildland fire and fuels planning”	Risk Assessment for Decision-making Related to Uncharacteristic Wildfire	Portland, OR	Miller
“Tools and approaches to help plan for wildland fire use”	National Fire Plan Conference and Wildland Fire 2004: Surviving in the Interface Danger Zone	Reno, NV	Miller
“Scaling laws in fire regimes: moving landscape fire history into the 21 st century”	US-International Association for Landscape Ecology conference	Las Vegas, NV	Miller
“Scale dependence and constraints on a 20 th century fire regime”	US-International Association for Landscape Ecology conference	Las Vegas, NV	Miller
“Restoring wilderness fire: challenges and opportunities”	University of Montana course on Ethics, Fire, and Wilderness	Missoula, MT	Miller
“Mapping the probability of burning to help plan for wildland fire use”	Monitoring Science and Technology Symposium	Denver, CO	Miller
“Amphibians and snow: estimated changes in breeding phenology in the mountains of the western United States”	Ecological Society of America Meeting	Portland, OR	Corn
“History of the Amphibian Research and Monitoring Initiative”	Meeting of the American Society of Ichthyologists and Herpetologists, Herpetologists’ League, and Society for the Study of Amphibians and Reptiles	Norman, OK	Corn
“Status of amphibians on the Continental Divide: surveys on a transect from Montana to Colorado”	Meeting of the American Society of Ichthyologists and Herpetologists, Herpetologists’ League, and Society for the Study of Amphibians and Reptiles	Norman, OK	Corn

Research Activities

Talk Title	Meeting Name	Location	Staff
“Responses of pond-breeding amphibians to wildfire in Glacier National Park”	Fire and Hazardous Fuel Reduction Effects on Wildlife: a meeting of the Northwest Science Association and Society for Northwestern Vertebrate Biology	Ellensburg, WA	Hossack
“Wilderness and wildlife research priorities”	USFS Wildlife Scientists Meeting	Albuquerque, NM	Wright, Landres, Corn
“Monitoring and management of recreation in protected areas: the contributions and limitations of science”	International Conference on Monitoring and Management of Visitor Flows in Protected and Recreational Area	Finland	Cole
“Wilderness experiences: what should we be managing for?”	University of Montana Recreation Management Class	Missoula, MT	Cole
“Progress made in studies of wilderness experience in the Pacific Northwest”	USFS Region 6 Recreation Staff Officers Meeting	Portland, OR	Cole
“The Limits of Acceptable Change process: rationale and challenges to implementation”	The Nordic and Baltic Workshop on Visitor Information Needs and Monitoring Methods	Finland	Cole
“A state of knowledge presentation on recreation impacts”	The International Symposium on Society and Natural Resources	Colorado	Cole
“Development of recreation travel simulation models”	Visitor Use Simulation Modeling Workshop	Denver, CO	Cole
“Understanding recreational visitors’ orientations toward Alaskan wilderness”	5 th International Congress of Arctic Social Sciences (ICASS V)	Fairbanks, AK	Kneeshaw
“Situational influences of acceptable wildland fire management actions”	Second International Wildland Fire Ecology and Fire Management Congress	Orlando, FL	Kneeshaw
“Social elements influencing the use of fire in wilderness”	10 th International Symposium on Society and Resource Management	Keystone, CO	Kneeshaw
“Acceptability norms toward wildland fire management”	10 th International Symposium on Society and Resource Management	Keystone, CO	Kneeshaw
“Yakutat resident study design”	10 th International Symposium on Society and Resource Management	Keystone, CO	Christensen

Research Activities

Talk Title	Meeting Name	Location	Staff
“The use of qualitative and quantitative research in identifying experience dimensions and factors of influence at Gates of the Arctic National Park and Preserve”	Human Dimensions of Natural Resources in the Western U.S. Conference	Sun Valley, ID	Kneeshaw
“Using social science theory to facilitate the adoption of new scientific approaches by natural and recreation resource managers”	Human Dimensions of Natural Resources in the Western U.S. Conference	Sun Valley, ID	Wright
“Evaluating opportunities and risks of wildland fuels management”	2nd International Wildland Fire Ecology and Fire Management Congress and Fifth Symposium on Fire and Forest Meteorology	Orlando, FL	Black
“Identifying benefits and risks for wildland fuels and fire planning”	Wildland Fire Impacts on Watersheds: Understanding, Planning, and Response Conference	Denver, CO	Black
“Results of the Fire Effects Planning Framework for the Bitterroot National Forest and Bitterroot Front Ecosystem Management Research Project”	Bitterroot Ecosystem Management Project Meeting	Missoula, MT	Black
“What’s my scale: applying information on scaling laws to management situations”	US-International Association for Landscape Ecology conference	Las Vegas, NV	Black
“Wilderness fire management: addressing challenges and opportunities through research-practitioner partnerships”	Boise Aquatic Sciences Lab	Boise, ID	Black
“Status report: Can wildland fire use restore natural fire regimes in wilderness and other unroaded lands?”	JFSP Principal Investigators meeting	Phoenix, AZ	Davis
“Using the probability of burning to plan for wildland fire use”	2nd International Wildland Fire Ecology and Fire Management Congress	Orlando, FL	Davis, Miller
“Modeling wildfire probability using a GIS”	American Society for Photogrammetry and Remote Sensing annual meeting	Denver, CO	Davis

Research Activities

Talk Title	Meeting Name	Location	Staff
“Conflicts in managing wildlife in wilderness”	University of Montana Wildlife Management class	Missoula, MT	Landres
“Fire effects on aquatic wildlife on protected lands”	USFS Wildlife Scientist Meeting	Albuquerque, NM	Pilliod
“Preliminary results of fire and stream ecosystems project”	Joint Fire Science Program annual principal investigator meeting	Phoenix, AZ	Pilliod
“The role of nonnative fishes on amphibian distributions in the northern Rocky Mountains”	Joint Meeting of Ichthyologists and Herpetologists	Norman, OK	Pilliod
“Effects of wildland fires on stream amphibian populations in the greater Northwest”	Society for Northwestern Vertebrate Biology Annual Meeting	Ellensburg, WA	Pilliod
“Fire, water, and people”	University of Idaho Forestry class	Moscow, ID	Pilliod
“Effect of Wildland Fire on Stream Communities”	RMRS Fire Lab Seminar Series	Missoula, MT	Pilliod
“Out of the caldron and into the fire: Amphibian responses to forest fires in the northern Rockies”	Ecology Seminar Series	Missoula, MT	Pilliod
“Social science fire issues”	International Society for Human Ecology Conference	Cozumel, Mexico	Gunderson
“Communication analysis among environmental education organizations in Montana”	32nd Annual Conference of the North American Association for Environmental Education	Anchorage, AK	Gunderson
“Communication analysis among conservation education organizations in the Bitterroot Valley and Missoula area”	Montana Environmental Education Association annual conference	Bozeman, MT	Gunderson

Research Application Projects

Research application projects are intended to increase awareness, understanding, and use of existing research. This includes summarizing, synthesizing, organizing, and presenting research results so they are easily accessible. Products are available on the Leopold Institute's web site, in publications and reports, and through formal and informal presentations. The following provides brief descriptions of the Leopold Institute Research Application projects active in FY 2004.

PROJECT DESCRIPTIONS

PERSONAL AND SOCIAL INFLUENCES TO THE SUCCESS OF SCIENCE DELIVERY AND APPLICATION EFFORTS

WHO: Vita Wright - *Aldo Leopold Wilderness Research Institute*, Mike Patterson - *University of Montana*, Charisse Sydoriak - *BLM National Science and Technology Center*, John Szymoniak, Cynthia Miner - *Pacific Southwest Research Station*, James Saveland - *Rocky Mountain Research Station*, Ruth Jacobs - *USGS Forest and Rangeland Ecosystem Sciences Center*

WHAT: The project consists of three parts: (1) a literature review of social, psychology, and organizational communication theories that address the adoption of new ideas and approaches, (2) agency case studies, and (3) a national survey of wilderness managers. For each case study, we will engage in conversations with managers including local and centralized decision makers and resource (fire, fuels, wildlife) staff specialists, to meet the following objectives:

- examine the roles that science currently plays in management,
- gain a better understanding of how land managers access and use science,
- gain a better understanding of how researchers successfully disseminate scientific information and/or work with managers,
- identify specific barriers that limit managers' ability to access and use science, and
- identify potential tools and techniques for improving managers' access to and use of science.

Information gathered during the case studies will be used to develop part two of this project, a broader quantitative survey of managers responsible for managing fire, fuels, or wildlife in each wilderness management agency.

WHEN: 2004-2007

WHERE: Various locations in the western United States.

THE LEOPOLD INSTITUTE WEB SITE

WHO: Suzanne Schwartz, Vita Wright, Amy Cilimburg - *Aldo Leopold Wilderness Research Institute*, Lisa Eidson - *University of Montana Wilderness Institute*

WHAT: We are continually maintaining and improving our website in order to provide readily accessible information about the Leopold Institute, its research and research application programs, staff, and recent activities, as well as to allow easy access to Institute publications. This project is also designed to make sure wilderness research

Research Application Projects

information, especially that produced by the Leopold Institute, is accurately and efficiently represented by the Wilderness Information Network.

WHEN: 2001-2010; Ongoing

LEOPOLD INSTITUTE RESEARCH IN A NUTSHELL - RESULTS AND MANAGEMENT IMPLICATIONS

WHO: Vita Wright, Amy Cilimburg, Janet Doherty, Alison Perkins, Nathan Queener - *Aldo Leopold Wilderness Research Institute*

WHAT: This project was developed to provide brief overviews of selected research projects in order to highlight research results and management implications and to provide a list of associated publications or products that contain more detailed information. These are available in hard copy and on our web site, through the Research Application Program web page.

WHEN: 2000-2005; Ongoing

THE LINKING WILDERNESS RESEARCH AND MANAGEMENT SERIES OF ANNOTATED READING LISTS

WHO: Vita Wright, Marion Hourdequin, Amy Cilimburg, Brian Glaspell, Sophie Osborn, Alison Perkins, Annette Puttkammer, Doug Tempel, Brett Walker - *Aldo Leopold Wilderness Research Institute*

WHAT: This series of annotated reading lists was developed to help land managers and others access scientific information relevant to protecting and restoring wilderness and similarly managed lands, as well as the myriad of values associated with such lands. References in these reading lists are categorized to provide context for each publication, and then organized to provide a logical framework for addressing the issue. Each volume begins with references necessary to understand the overall issue, and then provides references useful for identifying management goals, understanding influences on those goals, and finally, for selecting and implementing management approaches. Within each section, articles are annotated to clarify their relevance to that section and to highlight their importance for wilderness management. To date we have completed the first four in the series and a draft of the fifth volume:

- Volume 1-Wilderness Fire Restoration and Management
- Volume 2-Defining, Managing, and Monitoring Wilderness Visitor Experiences
- Volume 3-Recreation Fees in Wilderness and other Public Lands
- Volume 4-Understanding and Managing Invasive Plants In Wilderness
- Volume 5-Backcountry Recreation Impacts to Wildlife (Draft).

These volumes can be downloaded or ordered from our web site, through the Research Application Program web page. The references in these volumes are also available in an issue-driven searchable database, as part of the Wilderness Stewardship Reference System.

WHEN: 2001-2005; Ongoing

New! **FUELS PLANNING: SCIENCE SYNTHESIS AND INTEGRATION - ENVIRONMENTAL CONSEQUENCES**

Research Application Projects

WHO: Elaine Sutherland- *RMRS*, Anne Black - *Aldo Leopold Wilderness Research Institute*

WHAT: The mission of the Environmental Consequences team is to provide fuel treatment planners with the means to estimate the environmental consequences of proposed fuel treatment activities in the dry, interior forests (Ponderosa Pine, interior Douglas-fir, and Lodgepole Pine) of the western U.S. on air, soil and water resources, flora, terrestrial and aquatic fauna, and Armillaria root disease occurrence.

This is a subteam of the National Fuels Synthesis: Science Synthesis and Integration Team led by Russ Graham (*RMRS*) and Sarah McCaffrey (*NCS*). Other teams include: fire behavior (D. Peterson, *PNW*), economics (J. Barbour, *PNW*), and social (P. Jakes, *NCS*).

For more information on this project, go to the Environmental Consequences Team webpage - <http://forest.moscowfsl.wsu.edu/fuels/>

WHEN: 2004-2005

WHERE: Interior West dry-forest habitats, USA

New! **USING SOCIAL SCIENCE TO IMPROVE WILDLAND FIRE MANAGEMENT: FIREFIGHTER SAFETY**

WHO: Greg Larson - *University of Montana*, Vita Wright - *Aldo Leopold Wilderness Research Institute*

WHAT: This project will compile and organize organizational communication and management literature, such as that on organizational culture, identity, leadership, group dynamics, and decision making, that can be used to understand and manage individual and group behavior within the context of firefighting and fire management. An annotated reading list will be produced that can be used to help improve organizational culture and practices related to firefighter safety, to assess the effectiveness of firefighter safety campaigns, and to improve firefighter safety trainings.

WHEN: 2004-2005

WILDERNESS FIRE REPORTING

WHO: David Parsons, Peter Landres, Vita Wright, Carol Miller, Doug Tempel - *Aldo Leopold Wilderness Research Institute*, Susan Sater, Chris Ryan, Steve Boutcher - *U.S. Forest Service*

WHAT: Staff at the Leopold Institute have attempted to compile the number of acres burned in Wilderness annually by contacting Regional Fire or Wilderness managers in the USFS and NPS. Owing to the lack of formal tracking, the numbers in the Leopold Institute database are only as accurate as the estimates provided by various regional staff at the time of inquiry. We are working with these agencies in an attempt to figure out how best to track the Wilderness acres burned under wildland fire use, prescribed fire, and suppression strategies for each fire.

WHEN: 1997-2004

ANNOTATED BIBLIOGRAPHY AND SEARCHABLE DATABASE ON WILDERNESS RECREATION

WHO: Yu-Fai Leung - *North Carolina State University*

Research Application Projects

WHAT: This project will develop an internet-served bibliography of recreation ecology research and will emphasize items published since the Cole and Schreiner bibliography (1981).

WHEN: Closed 2004

WHY: A great deal of recreational impacts research has occurred in the last 20 years. This published bibliography will provide an update of references, superceding the publication by David Cole and Edward Schreiner, Impacts of backcountry recreation: site management and rehabilitation--an annotated bibliography (Leopold Institute publication #84). Additionally, with the advent of easily accessible information served on the web, this bibliography will be made available as a searchable database.

Research Application Activities

In addition to conducting and coordinating research application projects, staff activities include organizing workshops, making site visits and consultations, participating on committees and task forces, interacting with university staff and graduate students as affiliate faculty, and presenting at conferences and meetings for management audiences.

WORKSHOPS AND SYMPOSIA ORGANIZED BY THE LEOPOLD INSTITUTE

Workshop/Symposium	Location	Staff
Meeting of USFWS Regional Wilderness Coordinators and Leopold Institute staff	Missoula, MT	Wright
Fuels Synthesis Project, Missoula Beta-test	Missoula, MT	Black

SITE VISITS AND CONSULTATIONS

Program/Site/Topic	State	Agency / Org.	Staff
Worked with scientists at Glacier Bay to review and consult on proposal to establish long term ecological research proposal modeled after the NSF LTER program	AK	NPS	Parsons
Interagency Wilderness Steering Committee discussion of an interagency, NWPS-wide monitoring program on conditions related to wilderness character	DC	Interagency	Landres
Provided review and input to wilderness management and research plan for Kruger National Park, South Africa	South Africa	Kruger National Park	Watson
Task Force developing standards and guidelines for incorporating carrying capacity and visitor management more adequately within general management plans	USA	NPS	Cole
Amphibian monitoring in Yellowstone and Grand Teton National Parks	MT	NPS	Corn
Assessment of desert tortoise populations	NV	USFWS	Corn
Meeting with Fire Management Officer on Gila NF	FL	USFS	Davis, Miller
Briefed Region 1 National Fire Plan Coordinator on fire research	MT	USFS	Miller
Meeting with Region 1 GIS Fire Planner to describe the model BurnPro	MT	USFS	Miller
Meeting with Great Smoky Mountains NP personnel to describe the model BurnPro	TN	NPS	Miller
Meeting with Bitterroot NF fuels specialist and fire ecologist to discuss results of fire effects modeling	MT	USFS	Miller

Research Application Activities

Program/Site/Topic	State	Agency / Org.	Staff
Consultation with Valhalla Wilderness Society (VWS) regarding fire management issues in Canada's provincial parks	British Columbia, Canada	VWS	Miller
Region 1 Fire Planning Workshop	MT	USFS	Miller
Led discussion on wilderness fire reporting with National and Regional Wilderness Specialists	OR	USFS	Wright
Consulted with Landbird Monitoring Program on technology transfer ideas	MT	USFS / UM	Wright
Information Systems/Project Leader Meeting	MT	USFS	Spildie
Region 1 Winter Wilderness Meeting	MT	USFS	Spildie, Davis
ARC Training for Bitterroot National Forest Fire Ecologist	MT	USFS	Black
Custer National Forest- Beartooth Ranger District: Met with FMO and AFMO about local fire planning efforts and needs, and to discuss opportunity to use FEPP for management of the Pryor Mountains.	MT	USFS	Black
Provided update of the Fire Effects Planning Module to the BNF's Fire Ecologist	MT	USFS	Black

MANAGEMENT COMMITTEES, TASK FORCES

Role	Committee/Task Force	Staff
Co-chair	USFS Wilderness Monitoring Committee	Landres
Co-chair	Forest Service Wilderness Character Technical Guide Development Team	Landres
Member	The Chief's Wilderness Advisory Group	Cole
Member	PNW Regional Technology Transfer group	Wright
Member	JFSP Fire Technology Transfer Group	Wright, Black
Member	Wilderness.net Working Group	Spildie, Wright, Landres
Member	Partners in Amphibian and Reptile Conservation Habitat Management Guidelines Committee	Pilliod
Member	Partners in Amphibian and Reptile Conservation National Steering Committee	Pilliod
Member	Wilderness Internet Map Service Group	Spildie
Member	2005 Wilderness Stewardship in the Rockies planning team	Landres
Member	NPS National Wilderness Steering Committee	Parsons

Research Application Activities

Role	Committee/Task Force	Staff
Panelist	Expert panel providing input to the planning team for the Colorado River Management Plan	Watson

PRESENTATIONS TO MANAGEMENT AUDIENCES

Talk Title	Meeting Name	Location	Staff
“Research activities in wilderness”	CESU workshop: Wilderness Stewardship in the Rockies: Let’s Talk!	West Glacier, MT	Parsons
“International conservation issues and the World Parks Congress”	Missoula Area Wilderness Forum	Missoula, MT	Parsons
“The World Parks Congress, South Africa”	Leopold Institute Brown Bag Seminar	Missoula, MT	Parsons
“The restoration of fire to wilderness”	UM Wilderness Institute Lecture Series	Missoula, MT	Parsons, Black
“Application of climate change science to management of natural ecosystems”	Mountain Climate Change Workshop	Kings Beach, CA	Parsons
“Implications for protected area management and the need for more effective science delivery”	The Mountain Climate Sciences Symposium	Kings Beach, CA	Parsons
“ALWRI science delivery and application approaches”	RMRS Management Team Meeting	Albuquerque, NM	Wright
“Wildlife and wilderness research priorities”	USFWS Regional Wilderness Coordinators	Missoula, MT	Wright
“Leopold Institute Research Application Program Overview”	USFWS Regional Wilderness Coordinators	Missoula, MT	Wright
“Local community values attached to wilderness”	USFS Northern Region Wilderness Ranger Rendezvous	Choteau, MT	Watson
“Partnerships in Alaska to define wilderness values”	Alaska Wilderness, Recreation, and Tourism Association annual conference	Sitka, AK	Watson
“Results of a recreation use study on the Tongass NF, Yakutat Ranger District”	Situk River Partners Meeting	Yakutat, AK	Watson
“Research on visitors (recreation) and users (Inuit and scientists) of two remote National Parks in the Eastern Arctic of Canada”	Parks Canada	Ottawa, Ontario	Watson

Research Application Activities

Talk Title	Meeting Name	Location	Staff
“Results of a recreation use study on the Tongass NF, Yakutat Ranger District”	Situk River Partners Meeting	Alaska	Christensen
“Monitoring recreation impacts in wilderness”	Carhart Visitor Use Management Workshop	Palm Springs, CA	Cole
“Recreation impacts in wilderness”	Carhart Visitor Use Management Workshop	Palm Springs, CA	Cole
“Management strategies for recreation impacts in wilderness”	Carhart Visitor Use Management Workshop	Palm Springs, CA	Cole
“Reinvigorating visitor use data collection efforts”	USFS regional wilderness specialists’ meeting	San Diego, CA	Cole
“Wilderness recreation management strategies”	USFS regional wilderness specialists’ meeting	San Diego, CA	Cole
“Input into ALWRI rechartering”	USFS regional wilderness specialists’ meeting	San Diego, CA	Cole
“Wilderness recreation research and the US Fish and Wildlife Service”	USFWS Regional Wilderness Coordinators Meeting	Missoula, MT	Cole
“Recreation-related wilderness monitoring”	USFS Northern Region Wilderness Workshop	Missoula, MT	Cole
“Restoration in wilderness: the importance of symbolic values”	CESU workshop: Wilderness Stewardship in the Rockies: Let’s Talk!	West Glacier, MT	Cole
“The social science of fire”	CESU workshop: “Wilderness Stewardship in the Rockies: Let’s Talk!”	West Glacier, MT	Kneeshaw
“Managing fire in wilderness”	USFWS Regional Wilderness Coordinators Meeting	Missoula, MT	Miller
“Wilderness fire research”	CESU workshop: Wilderness Stewardship in the Rockies: Let’s Talk!	West Glacier, MT	Miller
“Can wildland fire use restore natural fire regimes in wilderness and other unroaded lands?”	Grand Canyon NP fire and resource management staff	Flagstaff, AZ	Miller
“Wildland Fuels Management: evaluating and planning risks and benefits?”	CESU workshop: Wilderness Stewardship in the Rockies: Let’s Talk!	West Glacier, MT	Black
“Monitoring wilderness character”	CESU workshop: Wilderness Stewardship in the Rockies: Let’s Talk!	West Glacier, MT	Landres

Research Application Activities

Talk Title	Meeting Name	Location	Staff
“A framework for evaluating proposals for scientific activities in wilderness”	CESU workshop: Wilderness Stewardship in the Rockies: Let’s Talk!	West Glacier, MT	Landres
“Natural resource monitoring in wilderness: an overview”	Carhart Center course: “Monitoring natural resources in wilderness”	Tuscon, AZ	Landres
“Monitoring national indicators of wilderness character”	Wildland Values Workshop: NPS Southern Colorado Plateau Inventory and Monitoring Network	Flagstaff, AZ	Landres
“Monitoring selected conditions related to wilderness character: a national framework”	Carhart Center Regional Wilderness Stewardship Training	Crane Lake, MN	Landres
“Guidelines for evaluating proposals for scientific activities in wilderness”	Carhart Center Regional Wilderness Stewardship Training	Crane Lake, MN	Landres
“The challenge of monitoring wilderness character”	Carhart Center Regional Wilderness Stewardship Training	Lake Mead, NV	Landres
“Monitoring wilderness character”	USFS Wilderness Monitoring Committee	Salt Lake City, UT	Landres
“The challenge of monitoring wilderness character”	USFWS Regional Wilderness Coordinators	Missoula, MT	Landres
“Guidelines for evaluating proposals for scientific activities in wilderness”	USFWS Regional Wilderness Coordinators	Missoula, MT	Landres
“Conflicts over wildlife management in wilderness”	USFWS Regional Wilderness Coordinators	Missoula, MT	Landres
“Fire and amphibians”	USFS Northern Region Wildlife staff meeting	Missoula, MT	Pilliod
“Restoring wilderness fire: Challenges and Opportunities”	Greater Yellowstone Area spring inter-agency fire meeting	Bozeman, MT	Black
“Restoring wilderness fire: the Fire Effects Planning Framework”	Selway-Bitterroot Wilderness spring fire meeting	Hamilton, MT	Black
“Leopold Institute Fire Program: BurnPro and FEPF”	RMRS – Boise Aquatic Sciences Lab meeting	Boise, ID	Black
“Tools for restoring and maintaining fire – BurnPro and FEPF”	Fire Program Analysis team meeting	Boise, ID	Black

Research Application Activities

Talk Title	Meeting Name	Location	Staff
“Overview of FEPF (Fire Effects Planning Framework)”	Arthur Carhart Wilderness Training Center Monthly meeting	Missoula, MT	Black
“Tools for restoring and maintaining fire – BurnPro and FEPF”	National Fire Program Analysis Phase II meeting	Boise, ID	Black
“40 th Anniversary NWPS map”	Committee to Develop and Publish the 40 th Anniversary National Wilderness Preservation System Map	Missoula, MT	Spildie
“Can wildland fire use restore natural fire regimes in wilderness and other unroaded lands?: Results for the Selway-Bitterroot Wilderness Area”	Selway-Bitterroot Wilderness Area Spring Fire Use meeting	Hamilton, MT	Davis
“Can wildland fire use restore natural fire regimes in wilderness and other unroaded lands? Results for Yosemite NP”	Yosemite National Park fire and resource management staff	El Portal, CA	Davis
“Can wildland fire use restore natural fire regimes in wilderness and other unroaded lands? Results for the Kern and Kaweah watersheds”	Sequoia-Kings Canyon National Park fire and resource management staff	Sequoia-Kings Canyon NP	Davis
“Amphibian research in Glacier National Park”	Glacier-Waterton Lakes International Peace Park Science Conference	West Glacier, MT	Corn
“Leopold Institute amphibian and fire research in Glacier National Park”	Glacier NP staff	Glacier NP, MT	Corn

New Publications

In 2004, Leopold Institute staff and its collaborators published the following papers. Publications can be ordered from the Leopold Institute's web site: <http://leopold.wilderness.net/pubs.cfm>.

Boone MD, Corn PS, Donnelly MA, Little EE, Niewiarowski PH. 2003. Physical stressors. *In*: Linder G, Bishop CA, Sparling DA, editors. Global decline of amphibian populations: an integrated analysis of multiple stressor effects. Pensacola, FL: Society of Environmental Toxicology and Chemistry. p 129–151.

Campbell DH, Muths E, Turk JT, Corn PS. 2004. Sensitivity to acidification of subalpine ponds and lakes in northwestern Colorado. *Hydrological Processes* 18:2817–2834.

Cole, David N. 2004. Impacts of hiking and camping on soils and vegetation. *In*: Buckley, Ralf (ed). Environmental impacts of ecotourism. CABI Publishing: Wallingford, UK: 41-60.

Cole, David N.; Monz, Christopher A. 2004. Spatial patterns of recreational impact on experimental campsites. *Journal of Environmental Management* 70: 73-84.

Cole, David N. 2004. Wilderness experiences: what should we be managing for? *International Journal of Wilderness* 10(3): 25-27.

Cole, David N. 2004. Travel simulation modeling: an emerging tool for visitor management in wilderness. *International Journal of Wilderness* 10(3): 40,44.

Cole, David N. 2003. Degradation. *In*: Jenkins, John and Pirgam, John (eds.) *Encyclopedia of leisure and outdoor recreation*. Routledge: London: 103-105.

Cole, David N. 2004. Monitoring and management of recreation in protected areas: the contributions and limitations of science. *In*: Sievanen, T.; Erkkonen, J.; Jokimaki, J.; Saarinen, J.; Tuulentie, S.; Virtanen, E. (eds.). *Policies, methods and tools for visitor management: proceedings of the second international conference on monitoring and management of visitor flows in recreational and protected areas; 2004 June 16-20; Rovaniemi, Finland*. Working Papers of the Finnish Forest Research Institute: 9-16.

Cole, David N. 2004. Environmental impacts of outdoor recreation in wildlands. *In*: Manfredo, Michael J.; Vaske, Jerry J.; Bruyere, Brett L.; Field, Donald R.; Brown, Perry J. (eds.). *Society and natural resources: a summary of knowledge*. Modern Litho: Jefferson, MO: 107-116.

Cole, David N.; Wright, Vita. 2004. Information about wilderness visitors and recreation impacts: is it adequate? *International Journal of Wilderness* 10(1): 27-31.

Cole, David N.; Daniel, Terry C. 2004. The science of visitor management in parks and protected areas: from verbal reports to simulation models. *Journal for Nature Conservation* 11: 269-277.

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- Cole, David N., van Wagendonk, Jan W., McClaran, Mitchel P., Moore, Peggy E., McDougald, Neil K. 2004. Response of mountain meadows to grazing by recreation pack stock. *Journal of Range Management* 57(2): 153-160.
- Cole, David N.; Monz, Christopher A. 2003. Impacts of camping on vegetation: response and recovery following acute and chronic disturbance. *Environmental Management* 32(6): 693-705.
- Cole, David N. 2004. Carrying capacity and visitor management: facts, values and the role of science. In: Harmon, David; Kilgore, Bruce M.; Vietzke, Gay E., eds. *Protecting our diverse heritage: the role of parks, protected areas, and cultural sites*. George Wright Society, Hancock, MI: 43-46.
- Corn PS. 2003. Deteriorating status of western amphibians: can we generalize about causes? *In*: Linder G, Bishop CA, Sparling DA, editors. *Global decline of amphibian populations: an integrated analysis of multiple stressor effects*. Pensacola, FL: Society of Environmental Toxicology and Chemistry. p 249–255.
- Corn PS, Muths E. 2004. Variable breeding phenology affects the exposure of amphibian embryos to ultraviolet radiation: reply. *Ecology* 85:1759–1763
- Davis, Brett, Carol Miller. 2004. Modeling Wildfire Probability Using a GIS. *In*: Proceedings of the ASPRS 2004 Annual Conference, Denver, USA. May 23-28. American Society for Photogrammetry and Remote Sensing, 2004. Available on CD only.
- Dunham, Jason B., Pilliod, David S., Young, Michael K. 2004. Assessing the Consequences of Nonnative Trout in Headwater Ecosystems in Western North America. *Fisheries*. 29(6): 18-26.
- Jain, Theresa, B.; Pilliod, David, S.; Graham, Russell, T. 2004. Tongue-tied: Understanding intensity and severity within the fire disturbance continuum. *Wildfire Magazine*. July/August Issue: 22-26.
- Johnson, Andrew K.; Dawson, Chad P. 2004. An exploratory study of the complexities of coping behavior in Adirondack Wilderness. *Leisure Sciences*. 26:281-293.
- Kluwe, Joan; Krumpel, Edwin E. 2003. Interpersonal and Societal Aspects of Use Conflicts: A Case Study of Wilderness in Alaska and Finland. *International Journal of Wilderness*. 9(3): 28-33.
- Landres, Peter. 2004. The Wilderness Stewardship Reference System. *International Journal of Wilderness* 10(2):34, 22.

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- Landres, Peter., Judy Alderson, and David J. Parsons. 2003. The challenge of doing science in wilderness: historical, legal, and policy context. *George Wright FORUM* 20(3):42-49.
- Miller, Carol; Landres, Peter. 2004. Exploring information needs for wildland fire and fuels management. RMRS-GTR-127. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 36 p.
- Newsome, David; Cole, David; Marion, Jeff. 2004. Environmental impacts associated with recreational horse riding. In: Buckley, Ralf (ed). Environmental impacts of ecotourism. CABI Publishing: Wallingford, UK: 61-82.
- Parsons, David J. 2004. Science and the management of protected areas. In: Harmon, D. and G.L. Worboys (eds.), Managing Mountain Protected Areas: Challenges and Responses for the 21st Century. Proceedings of the Mountain Protected Areas Workshop, 5th World Parks Congress, Durban, South Africa, September 2003. Colledara, Italy: Andromeda Editrice. 36-40.
- Parsons, David J. 2004. Supporting basic ecological research in U.S. national parks: challenges and opportunities. *Ecological Applications* 14(1):5-13.
- Shroyer, Maretha; Watson, Alan; Muir, Andrew. 2003. Wilderness research in South Africa: Defining priorities at the intersection of qualities, threats, values and stakeholders. *International Journal of Wilderness*. 9(1): 41-45.
- Spildie, David R.; Allan, Harold A.; Quesenberry, Carol, A. 2004. National Wilderness Preservation System. [Two-sided color poster with map, descriptive text, summary tables, and photographs.] Reston, Virginia: U.S. Geological Survey, (scale 1:5,000,000). ISBN 0-607-97154-1. Available from the U.S. Geological Survey Distribution Center. Denver, Colorado.
- Spildie, Dave. 2004. Mapping the United States National Wilderness Preservation System. *International Journal of Wilderness*. 10(1): 32.
- Tempel, Douglas J.; Cilimburg, Amy B.; Wright, Vita. 2004. The status and management of exotic and invasive species in National Wildlife Refuge Wilderness Areas. *Natural Areas Journal*. 24:300-306.
- Watson, Alan E.; Kneeshaw, Katie; Glaspell, Brian (compilers). 2004. A taste of the north: voices from the wilderness about the wilderness character of Alaska. *International Journal of Wilderness* 10(2): 4-7.
- Watson, Alan E., Patterson, Michael, Christensen, Neal; Puttkammer, Annette; Meyer, Shannon. 2004. Legislative intent, science, and special provisions in wilderness: A process for navigating statutory compromises. *International Journal of Wilderness*. 10(1): 22-26.

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- Whiting, Alex. 2004. The relationship between Qikiktagrugmiut (Kotzebue Tribal members) and the Western Arctic Parklands, Alaska, United States. *International Journal of Wilderness* 10(2): 28-31,8.
- Wright, V. 2004. How do land managers adopt scientific knowledge and technology? Contributions of the Diffusion of Innovations theory. *In*: Munro Neil, Dearden, Phil, Herman, Tom B., Beazley, Karen, Sorun Bondrup-Nielson, eds. Making Ecosystem-based management work. Proceedings of the Fifth International Conference on Science and Management of Protected Areas, Victoria, BC, 11-16 May 2003. [CD-ROM]. SAMPAA: Wolfville, Nova Scotia, Canada. Available: <http://www.sampaa.org/> ISBN: 0-9699338-6-X. Chapter 8(3).
- Wright, Vita. 2003. New tools to access wilderness research information. *Park Science* 22(1):7-8.
- Wright, Vita. 2004. Barriers to science-based management: What are they and what can we do about them? (Session summary). *In*: David Harmon, Bruce M. Kilgore, and Gay Vietzke, eds. Protecting Our Diverse Heritage: the role of parks, protected areas, and cultural sites. George Wright Society, Hancock, MI: 34-37.

Outside Funds

Outside funds generated to support programs and activities conducted by the Leopold Institute and its collaborators:

Source	Amount	Project	Staff
Joint Fire Science Program	\$188,029	Learning from the past: Retrospective analysis of fire behavior in Yosemite and Sequoia-Kings Canyon National Park	Miller, Black
USFWS	\$66,850	Technical guide for wilderness character monitoring	Landres
Joint Fire Science Program	\$68,832	Integrating social values in vegetation models via GIS: The missing link for the Bitterroot National Forest	Watson
BLM	\$60,000	Institute support	Parsons
USFWS	\$30,000	Institute support	Parsons
Forest Health Monitoring Program	\$54,000	Evaluation monitoring	Black, Landres
Denali National Park and Preserve	\$30,739	Denali National Park and Preserve	Watson
University of Nevada	\$29,217	Provide technical assistance to USFWS in monitoring desert tortoise populations	Corn
USFS - WO	\$20,000	Wilderness character monitoring	Cole
US Geological Survey	\$20,000	Effects of prescribed fire on stream ecosystems	Pilliod
BLM - NSTC	\$20,000	Barriers to integrating science in the BLM	Wright
USFS - WO – Fire & Aviation Management	\$11,500	Influences to the use of scientific knowledge by public land managers	Wright
PNW Research Station	\$8,000	Influences to the success of science delivery	Wright
Alaska Department of Fish and Game	\$5,000	Yakutat River Community Study	Watson
Alaska Department of Natural Resources	\$5,000	Study of community users on the Situk River	Watson
Metla, Finland	\$3,000	Keynote presentations - travel	Cole
Carhart Training Center	\$1,500	Visitor Use Management Workshops - travel	Cole
American Alpine Club	\$1,000	Denali National Park and Preserve - travel	Watson
National Parks Foundation	\$886	National Park Research Program meeting - travel	Parsons
George Wright Society	\$750	Annual board meeting - travel	Parsons
Fire Program Analysis (FPA)	\$555	FPA meeting in Boise - travel	Black