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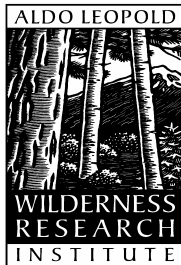
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# ANNUAL ACTIVITIES SUMMARY

## October 2004 - September 2005 (FY 2005)

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### ALDO LEOPOLD WILDERNESS RESEARCH INSTITUTE

THE MISSION OF the Aldo Leopold Wilderness Research Institute (ALWRI) is to provide scientific leadership in developing and using the knowledge needed to sustain wilderness ecosystems and values. This mission is accomplished through international leadership in research, technology transfer, education, and partnerships with governmental agencies, non-governmental organizations (NGO's), and universities.

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DANETTE PAIGE, *Program Assistant*  
SARAH PARKER, *Office Assistant*  
LAURA DOUGHTY, *Office Assistant*

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PETER LANDRES, *Research Ecologist*  
CAROL MILLER, *Research Ecologist*  
ALAN WATSON, *Research Social Scientist*  
KARI GUNDERSON, *Post-doc. Social Scientist*  
DAVID PILLIOD, *Post-doc. Aquatic Ecologist*  
ANNE BLACK, *Post-doc. Research Ecologist*  
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# Introduction

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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 similarly 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, which was created in 1967 under the Intermountain Research Station. It is now managed through the Rocky Mountain Research Station, headquartered in Fort Collins, Colorado. 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 primary goals of the Institute are: (1) to develop the scientific knowledge needed to protect and sustain wilderness and the ecological and social values derived from wilderness, and, (2) to communicate and facilitate the application of this knowledge to the wilderness management agencies and other interested groups. 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 Institute is committed to forging closer interactive ties between managers and scientists.

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. Mechanisms for this collaboration include the national level interagency Wilderness Policy Council and Wilderness Steering Committee as well as individual contacts with wilderness managers and scientists.

During 2005, the Leopold Institute coordinated a major review of its programs and priorities, resulting in the September, 2005 approval a new Program Charter. This Charter, which includes redefined "Problem" Areas ([http://leopold.wilderness.net/Program\\_CharterFY05.pdf](http://leopold.wilderness.net/Program_CharterFY05.pdf)), will provide guidance for the next 5 to 10 years.

The 2005 program of work reported on in this document was guided by the Institute's 1996 Strategic Plan. Work activities were focused 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.

This report summarizes activities and accomplishments during FY 2005 (Oct. 1, 2004 to Sept. 30, 2005). Additional details about the Leopold Institute and its programs can be found at <http://leopold.wilderness.net>.

## **LEOPOLD INSTITUTE STAFF**

Additional bibliographic information on the Leopold Institute staff can be found on our website at <http://leopold.wilderness.net/staff/staff.htm>

### **Research Scientist Staff**

- David J. Parsons – Director; Ecologist
- Anne Black – Post Doctoral Fire Ecologist
- David N. Cole – Research Geographer
- P. Stephen Corn – Research Zoologist (USGS)
- Kari Gunderson – Post Doctoral Resource Management Scientist
- Peter B. Landres – Research Ecologist
- Carol Miller – Research Fire Ecologist
- David Pilliod – Post Doctoral Research Aquatic Ecologist
- Alan E. Watson – Research Social Scientist

### **Research Support Staff**

- Neal A. Christensen – Social Science Analyst
- Brett Davis – GIS Specialist
- Blake Hossack – Zoologist, Herpetology (USGS)
- Katie Knotek – Social Science Research Associate
- Adam Liljeblad – Social Science Research Associate
- Dave Spildie –Biologist
- Janet Sproull – Research Assistant, World Wilderness Congress

### **Research Application Staff**

- Vita Wright – Research Application Program Leader
- Suzanne Schwartz – Wilderness Forestry Tech and Web Developer
- Tammy Mildenstein – Ecology Specialist

## **Program Support Staff**

- Kristy Fleshman – Support Services Specialist
- Danette Paige – Program Assistant
- Sarah Parker –Office Assistant
- Laura Doughty –Office Automation Clerk

## **GENERAL HIGHLIGHTS: FY 2005**

- ◆ In September, 2005, the Director of the Rocky Mountain Research Station and the Deputy Chief for Research of the U.S. Forest Service approved a new Program Charter for the Leopold Institute. This Charter will provide programmatic direction for the Institute for the next 5 to 10 years. It addresses the role of the Institute in providing research and science delivery and research application, as well as the importance of collaboration and partnerships. The Program Charter identifies five principle Problems around which the Institute's future program of work will be focused. These are:
  - *Inadequate understanding of recreation experiences and the impacts of recreation hamper efforts to preserve and protect wilderness resources and experiences.*
  - *Improved information is needed on how relationships between people and lands protected for their wilderness values affect and are affected by management policies and actions.*
  - *There is a need for improved information to guide the stewardship of fire as a natural process in wilderness while protecting social and ecological values inside and outside wilderness.*
  - *There is a lack of adequate understanding of how wilderness stewardship is influenced by the location of wilderness within larger ecological and social systems that extend beyond wilderness boundaries.*
  - *There is a need to improve the delivery and application of scientific knowledge and tools pertinent to wilderness stewardship.*
  
- ◆ During 2005 the Leopold Institute implemented a new "Visiting Expert and Exchange Program." Through this program, the Institute encourages and supports the hosting of scientists, managers, students and others with expertise or interest in science and/or wilderness management who wish to learn, exchange ideas and share experiences about the use of science in the support of wilderness stewardship. Visiting experts may include academic faculty, agency scientists, federal or state land managers from the United States and other countries. During 2005 the Leopold Institute hosted Dawn Magness from the U.S. Fish and Wildlife Service and the University of Alaska Fairbanks, and Jim Gladden, a political science professor at the University of Alaska, Fairbanks.
  
- ◆ Institute staff were instrumental in the successful nomination of Steve McCool, Professor at the University of Montana, for the Chief's National Wilderness Research Award. Dr. McCool's nomination was based on a lifetime of commitment to wilderness stewardship research, including many years of study on visitors and their expectations and experiences at the Bob Marshall Wilderness complex.
  
- ◆ Leopold Institute staff were actively involved in planning and organizing the 8th World Wilderness Congress which took place September 30 - October 6, 2005 in Anchorage, Alaska. Alan Watson and David Parsons served on the Executive Committee for the Congress while Alan Watson also chaired the 4 day Symposium on Science and Stewardship to Protect and Sustain Wilderness Values. Both Alan and David chaired plenary sessions during the conference. Alan, David, Peter Landres, Carol Miller, Katie Knotek, Kari Gunderson and Neal Christensen all made presentations on their research.
  
- ◆ David Parsons served as Co-Chair of the biennial George Wright Society Conference that was held in Philadelphia. In addition to organizing several sessions, he presented the Society's premier career recognition, the George Melendez Wright Award, to Jan van Wagendonk, a long time Institute collaborator and friend. David also continues to serve on the Board of Directors of the George Wright Society.

- ◆ David Cole, in collaboration with Troy Hall at the University of Idaho, completed fieldwork on a series of nine studies related to management of visitors in highly used wilderness in the Pacific Northwest. Reports on these projects are being developed and are being made available at [http://leopold.wilderness.net/research/fprojects/F007\\_B.htm](http://leopold.wilderness.net/research/fprojects/F007_B.htm).
- ◆ David Cole served on the steering committee for the Third International Conference on Monitoring and Management of Visitor Flows in Recreational and Protected Areas, to be held September 13-17, 2006 in Rapperswil, Switzerland.
- ◆ Alan Watson received an international science leadership award from the 8<sup>th</sup> World Wilderness Congress and the International Journal of Wilderness and collaborated with Forest Service International Programs to sponsor attendance at the Congress by native students from Canada, China, Zambia and Brazil.
- ◆ Alan Watson received a Fulbright Senior Protected Area Specialist award to visit Russia in October of 2006. Alan's participation was requested and hosted by the Russian Academy of Sciences and the Komarov Botanical Institute. He lectured on recent research completed in Alaska on the evolving relationship between native people and wilderness landscapes.
- ◆ Alan Watson coordinated a special issue of the International Journal of Wilderness, which focused on Denali National Park and Preserve. The issue also included articles written by Leopold Institute staff members Katie Knotek, Neal Christensen, Alan Watson and David Cole.
- ◆ Peter Landres chaired a Forest Service team that developed a new national framework for monitoring selected conditions related to wilderness character for application to all 406 Forest Service wildernesses. This resulted in a publication RMRS-GTR-151 entitled *Monitoring Selected Conditions Related to Wilderness Character: A National Framework*.
- ◆ Peter Landres served on the planning committee for the first International Government Seminar on Wilderness Management, held in conjunction with the 8<sup>th</sup> World Wilderness Congress in Anchorage, Alaska. Peter coordinated an afternoon of breakout sessions designed to identify future priorities for coordination between countries and individuals.
- ◆ Carol Miller received the 2004 U.S. Forest Service National Fire Plan award for Fire Research. The award was presented at the National Fire Plan meeting in New Orleans.
- ◆ Vita Wright coordinated production of seven new Research Nutshells. These were additions to a growing series of popularized overviews of recent publications produced by Leopold Institute staff.
- ◆ Katie Knotek organized and chaired a session on wilderness fire stewardship at the 8<sup>th</sup> World Wilderness Congress. She also coordinated a special issue of the International Journal of Wilderness (Volume 12, Number 1) on the same topic. Papers were included by Leopold Institute staff members Katie Knotek, Adam Liljeblad, Blake Hossack, Carol Miller and Kari Gunderson.
- ◆ Anne Black served as the lead on a National Fire Plan science delivery effort to internally publicize and make available the products of the NFP Fuels Planning: Science Synthesis and Integration project. Products to date include 8 GTRs, 37 fact sheets, 5 web-based tools and a website. Primary

activities included organizing and conducting 6 workshops and training sessions, coordinating a program evaluation, and developing additional training materials.

## **RESEARCH HIGHLIGHTS FY2005:**

The following Research Highlights were submitted for the Rocky Mountain Research Station's 2005 Research Accomplishments Report:

### **The Importance of Monitoring Wilderness Character**

**Submitted by Peter Landres**

Congress has now designated over 106 million acres of federal land as wilderness. The primary charge to the agencies that manage wilderness is that they preserve the wilderness character of this land. Agency policies also clearly state that wilderness character shall be preserved. Despite over a hundred wilderness laws and long-standing agency policies, wilderness character has never been defined in terms that allow the agencies to evaluate how wilderness character is changing over time or evaluate the impact of management actions on wilderness character. For years wilderness field and program managers have been calling for methods to track cumulative changes to wilderness character.

Scientists at the Leopold Institute are leading the effort to develop new and practical methods to monitor wilderness character. In collaboration with wilderness managers and monitoring program leaders from across the nation, this project has developed a working definition for wilderness character, identified a set of indicators and measures to be monitored, developed a cost-effective approach for gathering and reporting the data, and secured funding for this development and pilot testing. The full range of managers, from wilderness field staff to program leaders to line officers, strongly supports development of this monitoring because they believe it is of fundamental importance to the preservation of wilderness. In addition, in the course of developing this monitoring, new lines of wilderness social science research are being explored.

This monitoring will allow, for the first time, the means for tracking trends and changes in wilderness character. The benefits of this information are many: 1) improving accountability by linking performance measures and outcomes of wilderness stewardship directly to the mandates of wilderness legislation and agency policy; 2) improving decisionmaking by understanding the context for how individual decisions contribute to cumulative effects on wilderness character; 3) improving priority setting by understanding how current and proposed actions should be focused to improve wilderness character; 4) establishing legacy information on wilderness character that captures the institutional memory of wilderness managers so long-term and cumulative changes to wilderness character can be evaluated; and 5) improving public trust and confidence in agency stewardship of wilderness.

### **Lessons About Wilderness Fire Management:**

**Submitted by Carol Miller**

Since the 1970s, federal land managers have been allowing some lightning-caused fires to burn for resource management objectives. Employed primarily within federally designated wilderness or national parks, this strategy is now increasingly being used outside wilderness. Wilderness provides a valuable laboratory for learning how to use fire as a cost-effective management strategy that can benefit natural resources. Furthermore, wilderness is the best laboratory we have for understanding the range of natural variability in fire frequency, size, severity and seasonality. A cross-disciplinary team of biologists,

ecologists, social scientists and science delivery experts at the Aldo Leopold Wilderness Research Institute in Missoula, MT are uncovering wilderness's lessons about fire. These lessons are being applied across the full spectrum of lands extending from wilderness outward to the wildland urban interface.

For decades, aggressive fire suppression has been the dominant fire management strategy and in many areas has contributed to hazardous fuel accumulations, extreme wildfire behavior, and altered ecosystem structure and function. In addition, fire suppression has helped to distort human perceptions of natural systems. Although there is increasing recognition that fire management needs to include wildland fire use (WFU) and other non-aggressive management responses to fire, the orientations toward fire suppression that are held by the public and government agencies may not be quick to change. In a case study of a large prescribed fire in the Bob Marshall Wilderness Complex, scientists analyzed how the Forest Service organized public involvement and how that influenced participant attitudes toward the burn. This research will be used to develop a set of criteria for evaluating and improving the effectiveness of the agency when engaging the public in decisions to accomplish management objectives. In another study, the Leopold Institute identified the factors that influence fire management decisions and found that decisions to implement WFU are influenced by organizational culture, environmental factors, resource availability and public support. With an understanding of these factors, managers and policy makers can work to mitigate current barriers to WFU.

Wildland fire use has its richest history in large and/or remote wilderness areas like the Gila, Selway-Bitterroot, and Bob Marshall. Safe and effective use of unplanned ignitions in the adjacent front country and in smaller wilderness areas will require comprehensive planning well in advance of the ignition. This planning is being assisted with tools and methods developed by the Leopold Institute. A GIS model called BurnPro uses information on topography, historic weather, fuels, and historic ignition locations to estimate an annual probability of burning. These estimates help managers delineate fire management zones and identify where the greatest opportunities for WFU exist. ALWRI scientists are conducting a study comparing post-fire structure created by natural fires in wilderness to that created by suppressed fires in adjacent lands. The Fire Effects Planning Framework (FEPF) is a process by which land managers determine where and under what weather conditions fire is expected to create benefits or pose risks to resource targets or species of concern. FEPF is used to create map libraries of fire behavior and ecological fire effects that are used to help identify potential zones for WFU, support fire management decisions, and prioritize fuels treatments. Equally important information is the effect of fire and fuels management activities on social values. Leopold Institute scientists developed methods for mapping the meanings that people have for specific places on the landscape. These maps provide critical information about social values to managers faced with planning fire and fuel management strategies that simultaneously meet ecological and social objectives.

Wilderness areas offer the best source of information about the role that fire has historically played in the natural ecosystem. They hold a wealth of fire history data that are relatively free of the confounding effects from land use and management. Leopold Institute scientists, along with university and other RMRS collaborators, are using the repository of information in wilderness areas to reconstruct the size, frequency and location of fires. This baseline knowledge of historic fire regimes from wilderness areas is valuable for setting management targets and prescriptions in more intensively managed areas.

More information about this fire research program that integrates the social and ecological sciences can be found at <http://leopold.wilderness.net/research/fire.htm>



## **Social and institutional influences on fire stewardship in the Northern Rockies**

**Submitted by Katie Knotek**

Social science research at the Rocky Mountain Research Station is partially aimed at improving information to guide the stewardship of fire as a natural process in Northern Rockies ecosystems. This research area was developed with the knowledge that wildland fire, as a natural disturbance process, can preserve ecological conditions inside and outside wilderness ecosystems and, at the same time, influence societal values across the interface between wilderness and non-wilderness lands.

Scientists at the Aldo Leopold Wilderness Research Institute, serving as social science representatives of the Bitterroot Ecosystem Management Research Project (BEMRP), are studying how social and institutional factors influence the way fire managers and the public evaluate trade-offs in the stewardship of fire as a natural process. Scientists have been working to understand the meanings local residents associate with the Bitterroot Front and how these meanings interact with public attitudes toward fire and fuels management. Scientists have also been studying how the Forest Service involves the public in fire and fuels decision making and how the public perceives the agency's ability to incorporate local values into land management. Funding for this work has come from a combination of sources, including BEMRP, the National Fire Plan (U.S. Department of Agriculture and Interior), and the Joint Fire Science Program (a partnership of six Federal wildland management and research organizations).

The Northern Rocky Mountains are a unique and valuable laboratory for investigating social issues related to fire management across landscapes that include federally protected wilderness. Recently, the planning phase of a landscape-level fuels treatment project on the Bitterroot National Forest provided the opportunity for ALWRI social scientists to conduct a baseline assessment of personal and community values attached to the Bitterroot landscape, which extends from the valley floor to the crest of the Selway-Bitterroot Wilderness. Using GIS technology, the scientists mapped the spatial distribution of these values across the landscape, providing valuable social data for modeling efforts designed to evaluate social and resource trade-offs among alternative fuels treatments. In addition, a baseline measure of trust across communities adjacent to the Bitterroot National Forest helped scientists and managers to understand the factors that influence the relationship between the public and local land managers regarding fire and fuels management. Based upon this research, BEMRP social scientists developed a simple monitoring tool to measure and monitor change in trust levels among participants in the Forest's collaborative planning process for fuels treatment. Scientists, managers, and the public are actively collaborating to incorporate results from these research efforts into management decisions.

The Bitterroot Valley has also served as a case study to provide insight into public perceptions of appropriate action to protect values at risk from wildfire. Following the Bitterroot fires of 2000, a diversity of valley residents assembled to develop a Community Wildfire Protection Plan articulating desired actions to reduce hazardous fuels and protect self-identified values at risk. BEMRP social scientists conducted research in the Bitterroot Valley to examine how the development and implementation of the Bitterroot Community Wildfire Protection Plan has addressed the interests of Bitterroot residents concerning potential wildfire risk to the Bitterroot National Forest and local rural communities.

This social science research program of BEMRP seeks to be responsive to national initiatives on fire and fuels management (e.g., the National Fire Plan and the Healthy Forests Initiative) as well as BEMRP research priorities by providing land managers with the information needed to make decisions about fire and social regimes at the interface between wilderness and non-wilderness lands.

## **Summary of Accomplishments: FY 2005**

The following CRIS progress reports were submitted documenting accomplishments for the Leopold Institute's 3 Problem Areas:

### **Recreation:**

During FY2005, Leopold Institute scientists made substantial progress in addressing the broad area of understanding the effects of recreation use and recreation management strategies on wilderness attributes and visitor experiences. David Cole's research efforts included studies of visitors to high-use wildernesses in Oregon and Washington for which field work was completed and drafts of the first two reports from the nine coordinated studies have been written. This work is setting the stage for development of a vision, including establishment of indicators and standards, for wilderness recreation management in the face of increasing wilderness use, particularly in areas close to metropolitan centers. Cole's project on recreation travel simulation modeling, which is largely funded by the National Park Service, resulted in publication of a general report on the state-of-the-art. Progress was also made in documenting trends in impact in different wildernesses and effective means of restoring damaged recreation sites.

The Leopold Institute social science staff also worked collaboratively with managers at Denali National Park & Preserve, the Forest Service's Bob Marshall Wilderness, the American Alpine Club, the Alaska Department of Fish & Game, the Alaska Department of Natural Resources, the Tongass National Forest, and Parks Canada to better understand the basic dimensions of visitor experiences to parks, wilderness and wild rivers in Alaska, Montana and the eastern arctic of Canada, how they contrast to indigenous uses of protected wildlands, and the factors that influence these experiences. This work is focused on understanding wilderness visitor experiences in low use areas and continues to advance investigation using a blend of qualitative and quantitative methods and extends across the landscape to understand the role of wilderness in larger social and ecological systems. Work on this aspect of the problem area resulted in one workshop and a site visit with managers in Canada, 3 presentations to Denali managers, one presentation to managers in Montana, one presentation at the Missoula Area Wilderness Forum, a special issue of the International Journal of Wilderness, 3 posters and 2 presentations at the World Wilderness Congress, one session containing 4 presentations at the George Wright Society, and 3 refereed journal articles during 2005.

**Impact Statement:** The growing importance of understanding the human dimension implications of natural resource management decisions has made this research more critical than ever. This research is being used to design monitoring programs, establish objectives for managing backcountry and wilderness zones, and to understand likely public response to proposed management actions.

### **Fire:**

Our fire research continues to include a mixture of in-house and cooperative projects that are jointly funded by NFP and JFSP. Carol Miller provides leadership for the program, which is conducted by a cross-disciplinary team of biologists, ecologists, social scientists, and science delivery experts. In FY05 significant accomplishments were made in better understanding the consequences of fire and fuels management strategies, fire history and fire regimes, and the social dimensions of fire and fuels management. We also were involved in substantial science delivery activities. We applied the decision-support modeling tool, BurnPro, to help plan for WFU and to quantify and model the effectiveness of WFU for meeting management objectives in several wildernesses. The Fire Effects Planning Framework was applied by the Sierra and Bitterroot National Forests and Yellowstone National Park to assist in both long-term fire planning and incident support. We launched a project to develop methods to quantify and

# Accomplishments

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track the cumulative consequences of past suppression decisions. Fire behavior models will determine where fires would have spread and what effects (including smoke production) would have resulted, had they not been suppressed. We continued work on a FHM project to use FIA plots to determine how fire management tactics influence short-term fine scale post-fire weed establishment and long-term landscape scale post-fire vegetation patterns. A draft article on cross-scale relationships in fire regimes was prepared and will be submitted to the journal *Ecosystems* in fall/winter 2005 that outlines key questions and testable hypotheses to move the study of fire as a landscape and ecosystem process into an explicitly multi-scale framework. A national survey and phone interviews of wilderness fire managers identified the incentives and disincentives for wildland fire use (WFU) facing fire managers. We investigated the causes and consequences of lack of public trust in management agencies and their ability to carry out fire and fuels management consistent with land management. A survey tool was developed and used to measure and monitor levels of public trust in the Bitterroot Valley, MT. We developed methods for collecting data on the meanings that residents of the Bitterroot Valley, MT place on areas being considered for fuel treatments and then mapped this information in a GIS so human values can be integrated into planning fire and fuels treatments. In addition to their use in planning fuels treatments, these maps have provided a framework for the public to use when expressing their needs and articulating values-at-risk at collaborative planning meetings. We commissioned a qualitative study to develop understanding of public outreach conducted by the Rocky Mountain Ranger District of the Lewis and Clark National Forest during the planning and implementation of a large scale prescribed burn in the Scapegoat Wilderness. The concept of mindfulness exhibited by high reliability organizations was applied in analysis of the agency's public outreach efforts. Cooperators interviewed residents of the Bitterroot Valley to learn their attitudes about Community Wildfire Protection Plans and to identify preferred incentives and disincentives for fuel reduction by landowners. Three new grants were awarded to initiate new projects: develop technology transfer materials to improve the use and acceptance of the Fire Effects Planning Framework (FEPF), develop a spatially explicit decision support system to integrate knowledge of aquatic species needs into FEPF, and use knowledge from social science disciplines to better understand what influences the adoption and use of scientific knowledge by fire managers.

Impact Statement: This research will help improve understanding of the social and biophysical constraints to restoring fire as a natural ecological process and at understanding the options available for the stewardship of the process of fire in wilderness that includes natural and prescribed fire. It will help managers make decisions about fire use across boundaries and over large landscapes as well as understand the social context within which they make and implement decisions.

## **Invasives:**

Field work continued for several different projects studying the factors related to the influx of nonnative invasive plants. During the 2005 field season, Peter Landres completed data collection on research funded by the Forest Health Monitoring Program to see if fire management activities such as handline, explosive line, helispots, and spike camps influence the introduction and establishment of non-native plants in remote backcountry locations inside wilderness. Field work was also completed by Landres investigating the feasibility of using already established FIA plots for detecting the influx of non-native plants in areas burned by fire. Field research conducted by Landres and Ray Callaway at the University of Montana documenting the novel effects of a biocontrol agent increasing the allelopathic effect of an exotic invasive plant was published in the journal *Ecology Letters*. This latter field research has been presented at over 7 invited university seminars and was acknowledged when Callaway received an international award for his work on allelopathy. Field work continued during 2005 on the RJVA with the University of Montana to study the effects of fire-produced charcoal on the germination and establishment of spotted knapweed seeds, and the effects of this charcoal on mediating the effect of

## Accomplishments

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knapweed-produced allelopathic herbicide on the establishment and growth of native bunchgrasses following wildfire.

A study in 2004 conducted by Steve Corn with funding from the USGS Amphibian Research and Monitoring Initiative and a Cooperative Ecosystem Studies Unit grant to Grand Teton National Park (GRTE) confirmed the presence of a pathogenic chytrid fungus, which may represent an emerging infectious disease, in amphibian populations in GRTE. These results stimulated a proposal for further research to the USGS Park Oriented Biological Support program from Corn and Sophie St. Hilaire, veterinary pathologist at Idaho State University. This study, which will compare pathogenicity of chytrid strains in GRTE to strains from Colorado, has been funded for work in 2006-07.

David Pilliod left the Institute to take a faculty position at California Polytechnic University, San Luis Obispo. He continues to study the role of hatchery fish in the spread of pathogens to native amphibians, and to lead a multi-investigator meta-analysis of the effects of introduced trout on amphibian occurrence in the northern Rocky Mountains. A manuscript from this analysis is nearing completion

### Impact Statement:

The spread of alien species in wilderness and other protected areas has become one of the greatest threats to natural ecosystems. The studies reported here will provide guidance on better understanding both the occurrence and management of such species and provide a portion of the basis needed to control their further spread.

Leopold Institute projects include in-house research and research application studies, as well as cooperative projects with scientists from other federal agencies and universities. This section provides brief descriptions of projects that were either initiated or completed in FY 2005.

On-going projects are listed by title and Principal Investigator. Additional details are available on the Institute's website: <http://leopold.wilderness.net/research.cfm>

## **PROJECTS INITIATED IN FY 2005:**

**TRENDS IN CAMPSITE IMPACTS IN THE SOUTHWEST.** David Cole - Aldo Leopold Wilderness Research Institute; Pam Foti, Northern Arizona University

**PROJECT DESCRIPTION:** Collect data on campsite conditions in several wilderness areas in Arizona for comparison with earlier data. The goal is to better understand trends in ecological impacts on wilderness campsites in the southwest.

**WHERE:** Selected wildernesses in Arizona

**INTEGRATING SOCIAL VALUES IN VEGETATION MODELS VIA GIS: THE MISSING LINK FOR THE BITTERROOT NATIONAL FOREST.** Anne Black, Alan Watson, Carol Miller - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** This project aims to improve methods for presentation of data on social values in a GIS format. Such methods are needed to further increase effectiveness of integration of human values into planning fire and fuels treatments. Information on social effects of alternatives is necessary for NEPA documentation, and while there are several possible techniques to accomplish this objective, none that are GIS-based have been tested sufficiently or peer-reviewed, nor are any theoretically based.

**WHERE:** Bitterroot National Forest, Montana. This study is a collaborative effort with the Bitterroot Ecosystem Management Project.

**HIGH RELIABILITY ORGANIZATION OF PUBLIC INVOLVEMENT IN AGENCY DECISION TO ACCOMPLISH WILDERNESS FIRE MANAGEMENT OBJECTIVES.** Katie Knotek, Alan Watson, Carol Miller - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** This project uses the South Fork Sun River Prescribed Fire on the Rocky Mountain District of the Lewis and Clark National Forest as a case study to develop an understanding of public involvement in agency decisions regarding the planning and implementation of a fire and fuels management project in a wilderness adjacent to other land uses. Emphasis is on identifying specific public involvement processes conducted before, during and following implementation of the prescribed burn. It will analyze the perceptions of both agency personnel and public participants concerning the agency's organization of public involvement in management decisions regarding the planning and implementation of the prescribed burn. Analysis will emphasize identification of Highly Reliable Organization (HRO) characteristics exhibited by the agency in public involvement efforts and its influence on participant attitudes towards the burn.

**WHERE:** Lewis and Clark National Forest, Montana

**LEARNING FROM THE PAST: RETROSPECTIVE ANALYSES OF THE FIRE BEHAVIOR IN YOSEMITE AND SEQUOIA-KINGS CANYON NATIONAL PARKS.** Carol Miller, Anne Black, Brett Davis - Aldo Leopold Wilderness Research Institute; Mike Beasley and Tony Caprio, National Park Service

**PROJECT DESCRIPTION:** Retrospective fire behavior modeling and risk-benefit assessments will be used to better understand the consequences of fire suppression decisions for suppressed lightning ignitions that have occurred since 1991 in Yosemite and Sequoia-Kings Canyon National Parks. We will determine where lightning ignitions would have spread had they not have been suppressed and will assess the effects that would have resulted from these fires. Methods we develop will allow managers to quantify and track the consequences of suppression activities.

**WHERE:** Yosemite and Sequoia-Kings Canyon National Parks, California

**MONITORING EFFECTS OF TRUST IN COLLABORATIVE PLANNING FOR A LANDSCAPE-LEVEL FUELS TREATMENT PROJECT ON THE BITTERROOT NATIONAL FOREST, MONTANA.** Alan Watson, Katie Knotek - Aldo Leopold Wilderness Research Institute;

William Borrie, University of Montana

**PROJECT DESCRIPTION:** This project, carried out over two years, will evaluate the application of recent research on trust in collaborative planning for a fuels treatment project on the Bitterroot National Forest. It will use knowledge gained from a recently completed Joint Fire Sciences project as an evaluation of the success of collaborative planning in a landscape-level fuel hazard reduction treatment project. This project is part of a larger Bitterroot Ecosystem Management Project effort.

**WHERE:** Bitterroot National Forest, Montana. This study is a collaborative effort with the Bitterroot Ecosystem Management Project.

## **PROJECTS ON-GOING IN FY 2005:**

(See the Institute's web site for additional details: <http://leopold.wilderness.net/research.cfm>)

**BASELINE DATA AND TRENDS IN RECREATION IMPACTS ON WILDERNESS CAMPSITES.** David Cole - Aldo Leopold Wilderness Research Institute

**UNDERSTANDING VISITOR EXPERIENCES IN PORTIONS OF WILDERNESS THAT RECEIVE HEAVY USE, PARTICULARLY BY PEOPLE ON DAY VISITS.** David Cole - Aldo Leopold Wilderness Research Institute, Troy Hall - University of Idaho

**VISITOR CONFLICT IN HIGH-USE WILDERNESS IN THE NORTHEAST.** Rudolph Schuster - State University of New York, David Cole - Aldo Leopold Wilderness Research Institute

**EFFECTIVENESS OF SOIL AMENDMENTS, TRANSPLANTING, AND SEEDING IN ACCELERATING THE REVEGETATION OF DISTURBED SUBALPINE CAMPSITES, EAGLE CAP WILDERNESS, OREGON.** David Cole - Aldo Leopold Wilderness Research Institute

**DEFINING THE ROLE OF TRUST IN COLLABORATIVE RELATIONSHIPS TO MAKE WILDERNESS STEWARDSHIP DECISIONS.** William Borrie - University of Montana, Alan Watson - Aldo Leopold Wilderness Research Institute

**DEVELOPING AN UNDERSTANDING OF WILDERNESS EXPERIENCES AND MEANINGS: AUYUITTUQ AND QUTTINIRPAAQ NATIONAL PARKS OF CANADA, NUNAVUT.** Alan Watson - Aldo Leopold Wilderness Research Institute, Parks Canada, Paul Lachapelle, Stephen F. McCool - University of Montana

**BITTERROOT NATIONAL FOREST - HYDROLOGIC AND HUMAN CONNECTIVITY: WILDERNESS DAMS AND QUALITY OF LIFE IN THE BITTERROOT VALLEY.** Kari Gunderson, Alan Watson - Aldo Leopold Wilderness Research Institute, Catherine Pringle - University of Georgia

**YAKUTAT COMMUNITY STUDY.** Neal Christensen, Alan Watson - Aldo Leopold Wilderness Research Institute

**LEARNING FROM THE PAST: RETROSPECTIVE ANALYSES OF FIRE BEHAVIOR IN YOSEMITE AND SEQUOIA-KINGS CANYON NATIONAL PARKS.** Carol Miller, Anne Black, Brett Davis - Aldo Leopold Wilderness Research Institute, Tony Caprio - Sequoia-Kings Canyon National Park, Michael Beasley - Yosemite National Park

**CLIMATE DRIVERS OF FIRE AND FUEL IN THE NORTHERN ROCKIES: PAST, PRESENT AND FUTURE.** Emily Heyerdahl, Matthew Rollins - RMRS Fire Lab, Penny Morgan - University of Idaho, Carol Miller - Aldo Leopold Wilderness Research Institute

**FIRE MANAGEMENT STRATEGIES FOR WILDERNESS AND OTHER PROTECTED WILDLANDS: THE POTENTIAL CONTRIBUTION OF LANDSCAPE-SCALE ANALYSES OF FIRE HISTORY.** Carol Miller - Aldo Leopold Wilderness Research Institute, Lisa Graumlich, Todd Kipfer - Montana State University

**COMPARING FIRE SCAR ANALYSIS, FIRE ATLAS RECORDS, AND FIRE SIMULATIONS.** Carol Miller - Aldo Leopold Wilderness Research Institute, Thomas Swetnam, Calvin Farris - University of Arizona

**SIMULATION OF WILDLAND FIRE USE (WFU) TO MEET RESTORATION OBJECTIVES IN WILDERNESS.** Carol Miller - Aldo Leopold Wilderness Research Institute, Robert E. Keane, Russ Parsons - Fire Sciences Lab

**VARIABILITY IN FIRE REGIMES ACROSS SPACE AND TIME.** Carol Miller - Aldo Leopold Wilderness Research Institute, Penny Morgan - University of Idaho

**WILDERNESS FIRE REPORTING.** David Parsons, Peter Landres, Vita Wright, Carol Miller, Doug Tempel - Aldo Leopold Wilderness Research Institute, Susan Sater - U.S. Forest Service Pacific Northwest Region (R6), Chris Ryan - U.S. Forest Service Northern Region (R1), Steve Boutcher - U.S. Forest Service Washington Office

**EVALUATING THE EFFECTS OF MANAGEMENT-IGNITED FIRE ON THE INFLUX OF EXOTIC PLANTS IN WILDERNESS.** Peter Landres - Aldo Leopold Wilderness Research Institute

**EFFECTS OF CHARCOAL FROM DIFFERENT FUELS AND FIRE SEVERITIES ON THE DEMOGRAPHY AND PHYTOTOXIC IMPACTS OF SPOTTED KNAPWEED FOLLOWING WILDFIRE.** Ray Callaway - University of Montana, Peter Landres - Aldo Leopold Wilderness Research Institute

**MONITORING EFFECTS ON TRUST IN COLLABORATIVE PLANNING FOR A LANDSCAPE-LEVEL FUELS TREATMENT PROJECT ON THE BITTERROOT NATIONAL FOREST.** Katie Knotek, Alan Watson - Aldo Leopold Wilderness Research Institute, William Borrie - University of Montana

**HIGH RELIABILITY ORGANIZATION OF PUBLIC INVOLVEMENT IN AGENCY DECISIONS TO ACCOMPLISH WILDERNESS FIRE MANAGEMENT OBJECTIVES.** Katie Knotek, Alan Watson, Carol Miller - Aldo Leopold Wilderness Research Institute

**INTEGRATING SOCIAL VALUES IN VEGETATION MODELS VIA GIS: THE MISSING LINK FOR THE BITTERROOT NATIONAL FOREST.** Anne Black, Alan Watson, Carol Miller - Aldo Leopold Wilderness Research Institute

**INTEGRATING SOCIAL SCIENCE RESEARCH WITH WILDLAND FIRE SCIENCE AND MANAGEMENT: PHASE I.** Alan Watson - Aldo Leopold Wilderness Research Institute, Jim Burchfield - University of Montana

**PREDICTING INDIVIDUAL RESIDENTIAL DEVELOPMENT NEAR WILDERNESS FOR STRATEGICALLY PLANNING FUEL TREATMENTS IN THE BITTERROOT NATIONAL FOREST, MONTANA.** Neal Christensen, Peter Landres - Aldo Leopold Wilderness Research Institute

**ORGANIZATIONAL MANAGEMENT TOOLS FOR WILDLAND FIRE MANAGERS: AN ANNOTATED READING LIST.** Greg Larson - University of Montana, Vita Wright - Aldo Leopold Wilderness Research Institute



**UNDERSTANDING THE EFFECTS OF FIRE MANAGEMENT PRACTICES ON FOREST HEALTH: IMPLICATIONS FOR WEEDS AND VEGETATION STRUCTURE.** Anne Black, Peter Landres - Aldo Leopold Wilderness Research Institute

**THE FIRE EFFECTS PLANNING FRAMEWORK (FEPP).** Anne Black, Carol Miller - Aldo Leopold Wilderness Research Institute

**DEVELOPMENT AND DELIVERY OF SCIENCE SYNTHESIS:FUELSTOOLS AND TRAINING MATERIALS.** Anne Black - Aldo Leopold Wilderness Research Institute

**METHODS FOR ESTIMATING DESERT TORTOISE ABUNDANCE.** 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

**AMPHIBIAN RESEARCH AND MONITORING INITIATIVE.** 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

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

**CHYTRID FUNGUS IN THE ROCKY MOUNTAINS: ESTABLISHING DISTRIBUTION & EVALUATING THREAT TO BOREAL TOADS.** David Pilliod - Aldo Leopold Wilderness Research Institute, Erin Muths - USGS Biological Resources Division

**EFFECTS OF PRESCRIBED AND WILDLAND FIRE ON AQUATIC ECOSYSTEMS IN WESTERN FORESTS.** Steve Corn, David Pilliod - Aldo Leopold Wilderness Research Institute, Bruce Bury, Erin Hyde, Chris Pearl - USGS Forest and Rangeland Ecosystem Sciences Center

**MACROINVERTEBRATE ASSEMBLAGES IN MOUNTAIN STREAMS IN BURNED (WILDLAND AND PRESCRIBED) AND UNBURNED WATERSHEDS ON THE PAYETTE NATIONAL FOREST, IDAHO.** Katherine Strickler - University of Idaho, David Pilliod - Aldo Leopold Wilderness Research Institute

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

**LEOPOLD INSTITUTE WEB SITE.** Suzanne Schwartz, Vita Wright - Aldo Leopold Wilderness Research Institute, Lisa Eidson - University of Montana Wilderness Institute

## **PROJECTS COMPLETED IN FY 2005:**

### **MONITORING WILDERNESS CHARACTER: DEVELOPING A CONCEPTUAL FRAMEWORK AND NATIONAL MONITORING PROTOCOLS.** Peter Landres - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** This study sought to accomplish the following objectives: 1) Develop a description of wilderness character that can be used for developing monitoring direction, and 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 describe specific national elements or “qualities” of wilderness character that managers are responsible for and that could be monitored. 3) Develop nationally applicable indicators based on these qualities of wilderness character; These indicators will generally be from already existing Forest Service and other national 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.

**WHERE:** Missoula, MT

#### **PRODUCTS:**

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

[Leopold Publication Number 532](#)

Landres, Peter. 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](#)

Landres, Peter; Boutcher, Steve; Merigliano, Linda; Barns, Chris; Davis, Denis; Hall, Troy; Henry, Steve; Hunter, Brad; Janiga, Patrice; Laker, Mark; McPherson, Al; Powell, Douglas S.; Rowan, Mike; Sater, Susan. 2005. Monitoring selected conditions related to Wilderness character: a national framework. USDA Forest Service Rocky Mountain Research Station General Technical Report RMRS-GTR-151, Fort Collins, CO.

[Leopold Publication Number 544](#)

Watson, Alan E. 2004. Human relationships with wilderness: The fundamental definition of wilderness character. *International Journal of Wilderness* 10(3):4-7.

Leopold Publication Number 553.

### **ANALYSIS OF BARRIERS TO WILDLAND FIRE USE (WFU) IN FOREST SERVICE WILDERNESS AREAS.** Carol Miller - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** This study helped to identify the barriers to implementing WFU in FS wilderness areas. A national internet survey of FS wilderness fire management officers was used to understand the factors that influence the WFU recommendation. Although we encountered problems with the administration of the survey and had a low response rate, we were 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. This study documented that decisions to implement WFU are influenced by organizational culture, environmental factors, resource availability and public support.

**WHERE:** National survey, administered from Moscow, ID.

## **PRODUCTS:**

Doane, D. 2005. Barriers to Wildland Fire Use in USDA Forest service Wilderness Areas as perceived by wilderness fire managers. Master's Thesis. The University of Idaho, Moscow.

Doane, D.; O'Laughlin, J.; Morgan, P.; Miller, C. 2005. Barriers to Wildland Fire Use in USDA Forest Service Wilderness Areas as Perceived by Wilderness Fire Managers. Contribution No. 1006, College of Natural Resources Experiment Station, University of Idaho Moscow, Idaho

Doane, D.; O'Laughlin, J.; Morgan, P.; Miller, C. 2006. Barriers to wildland fire use: a preliminary problem analysis. *International Journal of Wilderness* 12: 36-38.

## **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.** Adam Liljeblad - Aldo Leopold Wilderness Research Institute, William Borrie - University of Montana, Alan Watson - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** 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.

**WHERE:** Ravalli and Missoula counties in Western Montana

### **PRODUCTS:**

Liljeblad, Adam. 2005. Towards a comprehensive definition of trust: Understanding the public's trust in natural resource management. Master's Thesis. The University of Montana, Missoula.

[Leopold Publication Number 558](#)

Knotek, Katie. 2005. Social and institutional influences on wilderness fire stewardship. *International Journal of Wilderness*. 11(3): 30 & 12.

[Leopold Publication Number 563](#)

Liljeblad, Adam; Borrie, William; Watson, Alan. 2005. 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. Final report on file at: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Aldo Leopold Wilderness Research Institute, Missoula, MT. 91 p.

Liljeblad, Adam; Borrie, William T. In press. Trust in wildland fire and fuel management decisions. *International Journal of Wilderness*. 12(1).

## **FUELS PLANNING: SCIENCE SYNTHESIS AND INTEGRATION - ENVIRONMENTAL CONSEQUENCES.** Elaine Sutherland - Rocky Mountain Research Station, *Anne Black* - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** 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). Anne's role was as assistant to the Environmental Consequences team leader (Elaine Sutherland). She was responsible for overseeing development of the project website, team logistics and share compilation and editorial review of the team's GTR.

**WHERE:** Interior West dry-forest habitats, USA

**PRODUCTS:**

Black, Anne. 2004. Wildland Fire Use: the 'other' treatment option. Environmental Consequences Fact Sheet 6; Fuels planning: science synthesis and integration. Res. Note RMRS-RN-23-6-WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

[Leopold Publication Number 535](#)

[Environmental Consequences Team webpage](#) - This website connects agency employees, scientists, educators, and the public to a toolkit and other resources to assist in determining effects from various fuels treatment activities on dry-Interior West cover types. Through the 'home' page, this will also connect users with the national Fuels Synthesis website.

**RAPID ASSESSMENT OF COMMUNITY RELATIONSHIPS TO THE BITTERROOT NATIONAL FOREST.**

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

**PROJECT DESCRIPTION:** Cooperative with the Bitterroot Ecosystem Management Research Project, this study tested the application of rapid appraisal principles and methodologies to understand the relationships Bitterroot Valley residents have with the Bitterroot National Forest landscape. The cooperator also produced 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.

**WHERE:** Communities around the Bitterroot National Forest.

**PRODUCTS:**

Annotated bibliography, on file, Leopold Institute

**MAPPING MEANINGS TO SUPPORT FUEL TREATMENT DECISIONS ON THE BITTERROOT NATIONAL FOREST.**

Kari Gunderson, Alan Watson - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** This post doctoral project, conducted cooperatively with the Bitterroot Ecosystem Management Research Project, was conducted at two levels. First, using rapid appraisal methodologies, interviews with individuals and groups were conducted to obtain understanding of the meanings people attach to the Bitterroot wilderness and non-wilderness lands. Second, these meanings were mapped using GIS methods to graphically depict areas of intense relationships and the scale of meanings people attach to this landscape. Third, community members were asked to describe how they believed proposed fuel treatment types and intensities would interact with the relationship they had with this landscape. This information was used in discussions with managers and other scientists to select the more specific location of proposed research and fuel treatments. Phase II of this research (funded by Joint Fire Science Program) is

ongoing and aimed at providing more specific meaning information on the sites selected for fuel treatment.

**WHERE:** Bitterroot National Forest communities

**PRODUCTS:**

Gunderson, Kari. In press. Understanding place meanings for wilderness: personal and community values at risk. *International Journal of Wilderness*. Volume 12(1).

**INTEGRATING SOCIAL SCIENCE RESEARCH WITH WILDLAND FIRE SCIENCE: ASSESSING VALUES AT RISK FROM THE BITTERROOT COMMUNITY WILDFIRE PROTECTION PLAN.**

Alan Watson - Aldo Leopold Wilderness Research Institute; Jim Burchfield, Paul Lachapelle and Tam Ubben, The University of Montana

**PROJECT DESCRIPTION:** To understand how Bitterroot residents regard the efficacy of the actions recommended and carried out under the Community Wildfire Protection Plan, 23 individuals representing a diversity of interests were interviewed in 2004 and 2005. People were asked to describe how recommended fuel treatments conformed to people's attitudes, values, and community norms regarding forest lands in the Bitterroot, and whether the treatments were addressing priority values at risk. Results seem to indicate that the management of wildland fire use fires in wilderness will be guided more by physiographic, weather, and demographic conditions than the intensity of treatments in the wildland-urban interface.

**WHERE:** Bitterroot Valley, Montana

**PRODUCTS:**

**Burchfield, James; Lachapelle, Paul; Ubben, Tam. 2005.** Integrating social science research with wildland fire science: assessing values at risk from the Bitterroot Community Wildfire Protection Plan. University of Montana, College of Forestry and Conservation. Final report to the Leopold Institute.

**AUYUITTUQ AND QUTTINIRPAAQ NATIONAL PARKS SUMMER 2004 VISITOR EXPERIENCE STUDY.**

Alan Watson - Aldo Leopold Wilderness Research Institute; Steve McCool & Paul Lachapelle - The University of Montana; Frances Gertsch & Vicky Sahanatien - Parks Canada

**PROJECT DESCRIPTION:** This research was designed to assist Parks Canada Agency managers to better understand the experiences of visitors to Auyuittuq and Quttinirpaaq National Parks in Nunavut Territory, Canada. Such an understanding is an important component of designing management programs that will protect the values and resources in national parks, yet provide opportunities for enjoyment of them. The study is part of a multi-phase research project aimed at developing indicators for sustaining visitor experiences and supporting both present and future management actions.

**WHERE:** Auyuittuq and Quttinirpaaq National Parks, Nunavut Territory, Canada

**PRODUCTS:**

Lachapelle, Paul R.; McCool, Stephen F.; Watson, Alan E. 2005. Auyuittuq and Quttinirpaaq National Parks Summer 2004 Visitor Experience Study. Technical completion report. The University of Montana, on file at the Leopold Institute.

Workshop (July 2005) proceedings in preparation.

**BOB MARSHALL WILDERNESS COMPLEX 2004 VISITOR STUDY.** Alan Watson & Katie Knotek - Aldo Leopold Wilderness Research Institute; Joshua G. Whitmore, William T. Borrie, Steve McCool - University of Montana

**PROJECT DESCRIPTION:** The purpose of this study was to provide information on the characteristics of Bob Marshall Wilderness Complex (BMWC) use, users, and user attitudes about the wilderness and its management. Originally, this project began in 2003 with a full survey conducted in that year. However, the summer of 2003 was not a typical year for the BMWC. Fires and firefighting activity led to direct closures of popular recreation areas, destinations, and trailheads. Smoke, access limitations, and safety concerns undoubtedly discouraged visitation in areas directly affected as well as across the whole complex. A decision was made to repeat the survey in 2004 in hopes of better understanding the impacts of fires and fire closures. Data from 2004 allows comparisons to previous studies conducted in 1970 and 1982 and an understanding of how visitation was affected while the fires were burning in 2003.

**WHERE:** Bob Marshall Wilderness, Montana

**PRODUCTS:**

Whitmore, Joshua G.; Borrie, William T.; Watson, Alan E. 2005. Bob Marshall Wilderness Complex 2004 Visitor Study. The University of Montana, Final report to the Leopold Institute and the Lolo National Forest.

Borrie, William T.; McCool, Stephen F.; Whitmore, Joshua G. In press. Wildland fire effects on visits and visitors to the Bob Marshall Wilderness Complex. *International Journal of Wilderness* Volume 12(1).

**DENALI NATIONAL PARK AND PRESERVE FLY-IN RECREATION VISITOR STUDY.** Neal Christensen, Alan Watson, Katie Knotek - Aldo Leopold Wilderness Research Institute

**PROJECT DESCRIPTION:** This study provides information to assist park managers in understanding the factors influencing visitor experiences, and support selection of management actions that reduce user conflicts and improve visitor experiences in Denali National Park & Preserve high use backcountry glacier areas. This research focused on two subpopulations of visitors to the study area: multi-day backcountry users on trips by air taxi from Talkeetna and day-use sightseers (flightseers) out of Talkeetna on air tours of the glacier backcountry. The study used both qualitative and quantitative research methods to address six objectives.

**WHERE:** Denali National Park & Preserve, Talkeetna, Alaska

**PRODUCTS:**

Christensen, Neal; Watson, Alan; Kneeshaw (Knotek), Katie. 2005. Denali National Park & Preserve fly in recreation visitor study: Ruth Amphitheater, Kahiltna Base Camp, Pika Glacier, Buckskin Glacier, Eldridge Glacier, and other glaciers south of Mt. McKinley. Final report to the National Park Service. August 2005. On file at the Leopold Institute.

Watson, Alan E.; Knotek, Katie; Christensen, Neal. 2005. Voices from Denali: "It's bigger than wilderness." *International Journal of Wilderness* 11(2):4-7.

In addition to conducting and coordinating research and research application projects, Leopold Institute staff organize and participate in conferences and symposia, host visiting scientists and managers, participate on committees and task forces, work collaboratively with University staff and graduate students, edit and review manuscripts for journals, books, and proceedings, review research proposals, and make presentations at scientific and management conferences and training sessions. A sampling of those activities are listed below.

## PRESENTATIONS TO SCIENTIFIC/PROFESSIONAL ORGANIZATIONS:

Presentation Title	Meeting Name and Location	Staff
“Wilderness zoning: should we purposely manage to different standards”	George Wright Society Conference, Philadelphia, PA	D. Cole
“Barriers to addressing user capacity in National Park Service planning”	George Wright Society Conference, Philadelphia, PA	D. Cole
“Recreation impact monitoring: lost in the gulf between science and management”	George Wright Society Conference, Philadelphia, PA	D. Cole
“Ecological restoration in wilderness—What do we gain? What do we lose?”	George Wright Society Conference, Philadelphia, PA	P. Landres
“Wild Nature: key issues in preserving ecological systems and wilderness character”	George Wright Society Conference, Philadelphia, PA	P. Landres
“The challenge of understanding and preserving wilderness character”	George Wright Society Conference, Philadelphia, PA	P. Landres
“Probability of burning model improves wildland fire planning”	Resource Management Tools and Geospatial Conference, Phoenix, AZ	B. Davis and C. Miller
“Visitor experiences enable relationships in the Gates of the Arctic National Park and preserve and Wrangell-St. Elias National Park and preserve”	George Wright Society Conference, Philadelphia, PA	K. Knotek and A. Watson
“A model for understanding social elements of change in wilderness fire stewardship”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	K. Knotek
“Planning for the 8 <sup>th</sup> World Wilderness Congress”	George Wright Society Conference, Philadelphia, PA	A. Watson
“Human Relationships as Wilderness Character”	George Wright Society Conference, Philadelphia, PA	A. Watson
“Human relationships with the Situk River”	George Wright Society Conference, Philadelphia, PA	A. Watson
Panel presentation on considerations for the management of fire	George Wright Society Conference, Philadelphia, PA.	C. Miller
“Achieving wildland fire stewardship: tools and approaches” (poster)	National Fire Plan Conference, Albuquerque, NM	C. Miller
Fire Effects Planning Framework	Saskatchewan, Canada	A. Black
Fire Effects Planning Framework (Poster)	Albuquerque, NM	A. Black
“International cooperation at the	8 <sup>th</sup> World Wilderness Congress, Anchorage,	A. Watson, D.

## Activities

Leopold Institute to protect wilderness values”	AK	Parsons
“Research on the relationship between people and wilderness landscapes”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	A. Watson, B. Glaspell, K. Knotek, N. Christensen
“An extended case study approach to studying wilderness experiences and meanings in Alaska”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	B. Glaspell, A. Watson, K. Knotek, N. Christensen
“10 years of the International Journal of Wilderness: science, education, stewardship and international issues”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	J. Sproull, A. Watson
“Defining relationships with the Situk River, Alaska”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	N.Christensen, A. Watson
“Mapping human meanings in forest landscapes”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	S. Carver, A. Watson
“Wilderness watershed: off-site contributions to quality of life and ecosystems”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	K. Gunderson, C. Cook
“A manager’s toolkit to address trust in public lands planning”	8 <sup>th</sup> World Wilderness Congress, Anchorage, AK	A. Liljeblad, B. Borrie
“Selecting indicators for visitor experiences”	Visitor experience workshop, Iqaluit, Canada	A. Watson, B. Glaspell
“Designing monitoring systems for visitor experience indicators”	Visitor experience workshop, Iqaluit, Canada	A. Watson

### SHORT COURSES/TRAINING PRESENTED:

Course/Training	Location	Staff
Wilderness visitor management; Carhart Center	Missoula, MT	D. Cole
The challenge and importance of monitoring wilderness character; Carhart Regional Wilderness Stewardship Training.	Grand Junction, CO	P. Landres
Ecological restoration in wilderness – What do we gain? What do we lose?; Carhart National Wilderness Stewardship Training.	Seeley Lake, MT	P. Landres
8 <sup>th</sup> World Wilderness Congress international wilderness managers training.	Anchorage, AK	A. Watson
Stewardship and maintenance of the NWPS Boundary Stewardship Program; USGS Northern Rocky Mountain Science Center Staff	Bozeman, MT	D. Spildie
BurnPro; Technical Fire Management course	Bothell, WA	C. Miller
Restoring wilderness fire: challenges and opportunities”; University of Montana	Missoula, MT	C. Miller
Fire Effects Planning Framework	Missoula, MT	C. Miller
Fire Effects Planning Framework and BurnPro	Missoula, MT	A. Black
Fire Science Synthesis	Beaverhead-Deerlodge, Mendocino, Gila NF’s and	A. Black



## Activities

	R-1 Regional Training Academy, Missoula	
“Managing for Wildland Fire Use: social and organizational issues”	Northern Rockies S580 Missoula, MT	A. Black
“Barriers to effective science delivery and application”	Transfer of Forest Science Knowledge & Technology Conference, Portland, OR	V. Wright
“Social influences to the adoption of science”	Science & Technology Application Workshop, Athens, GA	V. Wright
“Monitoring relationships between people and wilderness landscapes” Pennsylvania State University	State College, PA	A. Watson

### PRESENTATIONS TO LAY ORGANIZATIONS:

Presentation	Meeting Name and Location	Staff
“Fire Effects Planning Framework: mapping benefits and risks of fire to support wildland management”	Greater Yellowstone Coordinating Committee’s Whitebark Pine Committee, Bozeman, MT	A. Black
Ecological restoration in wilderness: science and values	Northern Rockies Wilderness Workshop, Lubrecht Forest, MT	D. Cole
Wilderness recreation research: special areas and specialized research	Forest Service Recreation and Management Workshop, Portland, OR	D. Cole
The 10 year wilderness stewardship challenge: conducting site inventories	R-1 Wilderness Ranger Rendezvous, Red Lodge, MT	D. Cole
Large Scale strategic planning for Colorado Wilderness	R-4, Golden, CO	D. Cole
State of the institute address	Region 1 Winter Wilderness Meeting, Great Falls, MT	K. Knotek
Visitor and community response to fire restoration in wilderness	Northern Rockies Wilderness Workshop, Lubrecht Forest, MT	K. Knotek
The role of social scientists in the Trapper-Bunkhouse project	BEMRP, Missoula, MT	K. Knotek
Summary of priorities for international wilderness stewardship	Global Wilderness Managers Seminar, Anchorage, AK	P. Landres
Monitoring wilderness character	National Forest System Directors, Washington, D.C	P. Landres
Why wilderness research?	Forest Service National Leadership Team, Washington, D.C	P. Landres
Monitoring wilderness character	Forest Service Brown Bag, Washington, D.C	P. Landres
Evaluating proposals for scientific activities in wilderness	Glacier Bay National Park, Gustavus, AK	P. Landres
The challenge of monitoring wilderness character	R-10 Wilderness Rendezvous, Juneau, AK	P. Landres
Tools and approaches to help plan for wildland fire.	Region 2, Grand Junction, CO	C. Miller
Fire Effects Planning Framework and BurnPro.	R-1 Fire Management Officers meeting, Coeur d’Alene, ID	C. Miller

## Activities

Addressing wilderness fire management challenges through research.	Flathead NF, Spotted Bear, MT	C. Miller
Recreation conflict: research progress and issues	Forest Service Recreation and Management Workshop, Portland, OR	A. Watson
Public purpose marketing: a public lands approach to sustainable relationships	Forest Service Recreation and Management Workshop, Portland, OR	A. Watson
Science to understand the role of public lands managers in stewardship of the relationship between the public and public lands	Joint Northern Region, Intermountain Region, Rocky Mountain Research Station Leadership Meeting	A. Watson
Mapping meanings for fuel management projects	Regional Training Academy, Missoula, MT	A. Watson
Fire Effects Planning Framework	Sierra, Mendocino, Beaverhead-Deerlodge, Bitterroot, Gila National Forests and R-1 Spring FMO meeting	A. Black
Science Synthesis: Fuels Tools	R-6/BLM - Portland, OR	A. Black
Incorporating high reliability concepts into fire stewardship: introduction to concepts and an invitation	Bitterroot National Forest	A. Black
Making decisions about fire: a structure for inquiry and preliminary results	Moscow, ID	A. Black
High reliability in fire organizations	Gila National Forest	A. Black
Understanding the effects of fire management practices on forest health: implications for vegetation structure and weeds (poster)	Forest Health Monitoring Meeting, Miami, FL	A. Black

### SELECTED TECHNOLOGY TRANSFER ACTIVITIES:

Activity	Staff
Developed campsite monitoring protocols for use with the Chief's Wilderness Challenge.	D. Cole
Consulted with the National Park Service's national task group on carrying capacity.	D. Cole
Served on Protocol Evaluation Panel for the Grand Canyon Monitoring and Research Center.	D. Cole
Worked with Carhart Training Center to develop methodology for capturing experiential knowledge regarding recreation management practices.	D. Cole
Presented the results of the project 'Can Wildland Fire Use Restore Natural Fire Regimes to Wilderness and Other Unroaded lands?' to Great Smoky Mountains National Park staff	B. Davis
Presented the results of the project 'Can Wildland Fire Use Restore Natural Fire Regimes to Wilderness and Other Unroaded lands?' to Gila National Forest Staff.	B. Davis
Met with scientists and park managers from the USGS, Yosemite NP and Sequoia-Kings Canyon NP to discuss the development of new fuel models for the two parks.	B. Davis
Provided support to Colorado State University researchers on the use of BurnPro, a probability of burning model	B. Davis
Developed and implemented monitoring instrument to measure trust among public	K. Knotek, A.

## Activities

in collaborative planning on Trapper-Bunkhouse fuel treatment project on the Bitterroot National Forest.	Watson, A. Liljebblad
Presented preliminary findings from the Bob Marshall Wilderness Complex 2004 Visitor Study to the Bob Marshall Wilderness Complex managers.	K. Knotek
Participated in the presentation of final results from the Trust (JFSP & BEMRP) study to Bitterroot National Forest Employees.	K. Knotek
Developed ALWRI research updates on the project “High reliability organization of public involvement in agency decisions to accomplish wilderness fire management objectives” and “Monitoring trust as an evaluation of the success of collaborative planning in a landscape-level fuel hazard reduction treatment project in the Bitterroot Valley, MT.”	K. Knotek
Presentation and discussion on “The challenge and importance of monitoring wilderness character”, 40 <sup>th</sup> Anniversary National Wilderness Conference, Lake George, NY.	P. Landres
Presentation and discussion on “Special provisions in wilderness legislation”, 40 <sup>th</sup> Anniversary National Wilderness Conference, Lake George, NY.	P. Landres
Presentation and discussion on “The dilemma of managing for wildness and naturalness in wilderness”, 40 <sup>th</sup> Anniversary National Wilderness Conference, Lake George, NY.	P. Landres
Presentation and discussion on “The dilemma of managing for wildness and naturalness in wilderness”, University of Montana	P. Landres
“To burn or not to burn? The dilemma of managing for wildness and naturalness in wilderness”, Fire Sciences Lab, Missoula, MT.	P. Landres
“Managing fish and wildlife in wilderness”, University of Montana Missoula, MT.	P. Landres
Research report to Denali National Park & Preserve, NPS Regional Office, Anchorage, Alaska.	A. Watson
Research report to Denali National Park & Preserve, presented at Park Headquarters, Talkeetna Ranger Station and to Commercial Service Providers, Alaska.	A. Watson
Research report and workshop for Parks Canada, Describing Visitor Experiences to Arctic Parks. Ontario, Canada	A. Watson
Participated in the presentation of final results from the Trust (JFSP & BEMRP) study to Bitterroot National Forest Employees.	A. Watson, A. Liljebblad, K. Knotek
Worked with Tom Wordell from Joint Fire Science Program to develop a project highlight about the project “Can WFU restore natural fire regimes in wilderness?”	C. Miller
Provided fire atlas CD for Frank Church (developed by Brett Davis) to Snake River Field Station, Forest and Rangeland Ecosystem Science Center, U.S.G.S.	C. Miller
Met with Superior NF staff about possible follow up this fall to assist them in auditing Rx burns in the BWCA.	A. Black
Wrote and submitted a 2 page ‘chapter’ on the Fire Effects Planning Framework for inclusion in a GTR on available fire tools	A. Black
Consulted with Bitterroot Forest and Western Montana Planning Zone fire staff regarding use of FEPP during Western Montana Planning Zone Land Management Plan revision process.	A. Black
Facilitator for and participant in Managing the Unexpected in Prescribed Fire and Fire Use Operations Workshop, Jacksonville, FL	A. Black
Facilitator for the National Healthy Forest Restoration Act review, Odgen, UT	A. Black
Met with R01 National Pilot project researchers and R01 staff to discuss FuelsTools and integrating these with the N. Butte Project.	A. Black

## Activities

Met with Dave Brownlie (Regional Ecologist, USFWS) and Fred Wetzel (FMO, Okefenokee) regarding possible follow-up HRO 'audit' work with the Greater Okefenokee Association of Landowners (GOAL) of which USFWS is a member.	A. Black
Participant on a steering committee to develop a training video for line officers highlighting footage from the recent Hawkins staff ride as requested by R4 Regional Forester Jack Troyer.	A. Black
Invited participant with Dr. Kathleen Sutcliffe (UMich) on a field trip to the Dixie National Forest to apply HRO principles to WFU and Rx events	A. Black
Met with Marcia Andre, Gila National Forest Supervisor while in Silver City, NM about their WFU program.	A. Black
Consulted with Bitterroot National Forest staff about using FEPP, and the Wildlife Habitat Response Model BEMRP.	A. Black
Developed the following Nutshells on recent Institute publications: - The Feasibility of Wildland Fire Use (WFU) For Restoring Natural Fire Regimes - Managing Recreational Impacts to Mountain Vegetation: Plant Response to Trampling - Understanding Wilderness Visitor Experiences at Gates of The Arctic - Wilderness Land Use Conflicts in The Far North - Relationship Between Native People And The Western Arctic National Parklands - Community Values in The Bitterroot Valley As Input To Fuels Reduction - Idaho's Salmon River: Legislative Intent, Science, And Special Provisions In Wilderness	V. Wright
Led discussion about overcoming barriers to the use of new knowledge, tools, and ideas at George Wright Society Conference. Philadelphia, PA	V. Wright
Led discussion with an interagency group of fire and fuels managers about influences to the success of fire science delivery. Jacksonville, FL	V. Wright
Led discussion with USFS fire and fuels researchers and managers about influences to the success of fire science delivery. Albuquerque, NM	V. Wright
Met with BLM inter-regional group to gather perspectives about influences to the integration of scientific research by BLM managers and practitioners	V. Wright

In FY2005, Leopold Institute staff and collaborators published the following papers. Publications can be ordered from the Leopold Institute's web site: <http://leopold.wilderness.net/pubs.cfm>.

Black, Anne. 2004. Wildland Fire Use: the 'other' treatment option. Environmental Consequences Fact Sheet 6; Fuels planning: science synthesis and integration. Res. Note RMRS-RN-23-6-WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.

Black, Anne. 2005. The Fire Effects Planning Framework. *International Journal of Wilderness*. 11(1):19-20.

Callaway, R.M.; Ridenour, W.M. 2004. Novel weapons: invasive success and the evolution of increased competitive ability. *Frontiers in Ecology and the Environment* 2:436-443.

Campbell, D. H.; Muths, E.; Turk, J. T.; Corn, P. S. 2004. Sensitivity to acidification of subalpine ponds and lakes in northwestern Colorado. *Hydrological Processes*. 18:2817-2834.

Carey, Cynthia; Corn, Paul Stephen; Jones Mark S.; Livo, Lauren J.; Muths, Erin; Loeffler, Charles W. 2005. Factors limiting the recovery of boreal toads (*Bufo b. boreas*). In: Lannoo, Michael, editor. *Amphibian declines: the conservation status of United States species*. Berkeley: University of California Press: 222-236.

Cole, David N. 2003. Degradation. In Jenkins, John M.; Pigram, John J. eds.; *Encyclopedia of Leisure and Outdoor Recreation*. London: Routledge: 103-105.

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

Cole, David N. 2005. Symbolic values: the overlooked values that make wilderness unique. *International Journal of Wilderness*. 11(2): 23-27, 10.

Cole, David N.; Manning, Robert; Lime, David. 2005. Addressing visitor capacity of parks and rivers. *Parks and Recreation*. 40(3): 8, 10, 12.

Cole, David N., comp. 2005. Simulation of recreation use: current status, case studies and future directions. Gen. Tech. Rep. RMRS-GTR-143. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 75 pp.

Corn, Paul Stephen; Muths, Erin. 2004. Variable breeding phenology affects the exposure of amphibian embryos to ultraviolet radiation: reply. *Ecology*. 85:1759-1763.

Corn, Paul Stephen; Adams, Michael J.; Battaglin, William A.; Gallant, Alisa L.; James, Daniel L.; Knutson, Melinda; Langtimm, Catherine A.; Sauer, John R. 2005. Amphibian Research and Monitoring Initiative: concepts and implementation. Reston, VA: U. S. Geological Survey. Scientific Investigations Report 2005-5015. 23 p.

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- Corn, Paul Stephen; Hossack, Blake R.; Muths, Erin; Patla, Debra A.; Peterson, Charles R.; Gallant, Alisa L. 2005. Status of amphibians on the Continental Divide: surveys on a transect from Montana to Colorado, USA. *Alytes*. 22:85–94.
- Corn, Paul Stephen; Muths, Erin; Adams, Michael J.; Dodd, C. Kenneth, Jr. 2005. The U.S. Geological Survey's Amphibian Research and Monitoring Initiative. *Alytes*. 22:65–71.
- Doane, D., O'Laughlin, J., Morgan, P. and Miller, C. 2005. Barriers to Wildland Fire Use in USDA Forest Service Wilderness Areas as Perceived by Wilderness Fire Managers. Contribution No. 1006, College of Natural Resources Experiment Station, University of Idaho Moscow, Idaho.
- Funk, Chris W.; Blouin, Michael S.; Corn, Paul Stephen; Maxell, Bryce A.; Pilliod, David S.; Amish, Stephen; Allendorf, Fred W. 2005. Population structure of Columbia spotted frogs (*Rana luteiventris*) is strongly affected by the landscape. *Molecular Ecology*. 14:483–496.
- Funk, Chris W.; Greene, Allison E.; Corn, Paul Stephen; Allendorf, Fred W. 2005. High dispersal in a frog species suggests that it is vulnerable to habitat fragmentation. *Biology Letters*. 1:13–16.
- Gutzwiller, Kevin J.; Cole, David N. 2005. Assessment and management of wildland recreation disturbance. In: Braun, Clait E. ed. *Techniques for wildlife investigations and management*. Sixth edition. The Wildlife Society: Bethesda, MD: 779-796.
- Landres, Peter. 2004. Developing Indicators to Monitor the “Outstanding Opportunities” Quality of Wilderness Character. *International Journal of Wilderness*. 10(3):8-11, 20.
- Landres, Peter. 2004. Managing wildness in designated wilderness. *Frontiers in Ecology and the Environment* 2:498-499.
- Landres, Peter. 2004. The Wilderness Stewardship Reference System. *International Journal of Wilderness*. 10(2):34, 22.
- Landres, Peter; Boutcher, Steve; Merigliano, Linda; Barns, Chris; Davis, Denis; Hall, Troy; Henry, Steve; Hunter, Brad; Janiga, Patrice; Laker, Mark; McPherson, Al; Powell, Douglas S.; Rowan, Mike; Sater, Susan. 2005. Monitoring selected conditions related to Wilderness character: a national framework. U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station. 38 p. General Technical Report RMRS-GTR-151. Fort Collins, CO.
- Liljeblad, Adam. 2005. Towards a comprehensive definition of trust: Understanding the public's trust in natural resource management. Master's Thesis. The University of Montana, Missoula.
- Miller, Carol. 2005. When to prescribe. *Wildfire Magazine*. July/August: 16-21.
- Odum, R. Andrew; Corn, Paul Stephen. 2005. *Bufo baxteri* Porter, 1968. Wyoming toad. In: Lannoo, Michael, editor. *Amphibian declines: the conservation status of United States species*. Berkeley: University of California Press: 390–392.
- Parsons, David J. 2004. Science and the management of protected areas. In Harmon, D.; and Worboys, G.L. eds., *Managing Mountain Protected Areas: Challenges and Responses for the 21<sup>st</sup> Century*. Proceedings of the Mountain Protected Areas Workshop, 5<sup>th</sup>

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- World Parks Congress, Durban, South Africa, September 2003. Colledara, Italy: Andromeda Editrice: 36-40.
- 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.
- Watson, Alan E. 2004. Human relationships with wilderness: The fundamental definition of wilderness character. *International Journal of Wilderness*. 10(3): 4-7.
- Watson, Alan E. 2005. Denali National Park & Preserve: A different kind of wilderness. *International Journal of Wilderness*. 11(2): 3.
- Watson, Alan E. 2005. Guest Editor, Special Issue of *International Journal of Wilderness*. 11(2) 48 p.
- Watson, Alan E. 2005. Research on the relationship between humans and wilderness in Alaska. *International Journal of Wilderness*. 11(2): 30, 36.
- Watson, Alan E.; Knotek, Katie; Christensen, Neal. 2005. Voices from Denali: "It's bigger than wilderness." *International Journal of Wilderness*. 11(2): 4-7.