

JFSP Synthesis Proposal

Synthesis Title: (15 words or less)	Fire and Aquatic Ecosystems in the Context of Climate Change: A Synthesis for Improved Management
Announcement for Proposals and task statement this proposal is responding to:	Joint Fire Sciences AFP 2008-2 Task 1
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Publishing outlet:	Government publication
Duration of Project:	1.5 calendar years (05/2008 through 03/2010)
Start Date	05/01/2008
End Date	03/01/2010
Annual Funding Requested:	FY2009: \$ 118,726 FY2010: \$ 30,900
Total JFSP Funding Requested:	\$149,626
Total Value of In-Kind Contributions:	\$125,000 (primarily writing time and workshop attendance)

Abstract: Managing the balance between aquatic resources, wildfire, and fuel conditions has always been difficult, and is becoming further complicated by changes in climate that alter both aquatic ecosystems and wildfire characteristics. An important question is how we expect the changing nature of fire in the landscape and our shifting management responses to interact with the changing hydrologic and aquatic systems. Multiple federal agencies face this challenge and are looking for solutions. Several summaries of the effects of fire on aquatic ecosystems exist (Minshall et al., 1997, Gresswell, 1999, Rieman et al, 2003, Luce, 2005, Shakesby and Doerr, 2006). Since the last major summary, many results have come from National Fire Plan and Joint Fire Sciences Program funded studies. In addition a great deal has been recognized about the nature of climate change, how it affects fire, and how it directly affects aquatic systems. Finally, the fire management community has made dramatic changes in their approach to wildfire using Appropriate Management Response, giving fire a much larger role in landscape-scale vegetation management. Within hours of weather updates, decisions are now made that affect thousands to tens of thousands of acres. The stakes are higher and the decisions more complex. There is a need for an updated review and synthesis of how fire affects aquatic ecosystems, how it interacts with land, fuel, and fire management decisions, and how this all fits into the context of a changing climate. We propose a combination of workshops, compiled chapters, and a web site to provide updated information and syntheses that will support management policies and decisions incorporating the best available science.

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Signature of Co-PI:		
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Signature of Co-PI:	<i>/s/ Penelope Morgan</i>	November 5, 2007
Signature of Co-PI:	<i>/s/ Zachary A. Holden</i>	November 5, 2007
Signature of Co-PI:		
Signature of Co-PI:		
Signature of Co-PI:	<i>/s/ Kathleen A. Dwire</i>	November 5, 2007
Signature of Co-PI:		
Signature of Federal Cooperator:		
Signature of Federal Fiscal Representative:		

I. Methods

Briefly describe your approach to conducting this synthesis.

We propose to review and synthesize (AFP 2008-2 Task 1) research on fire related to aquatic systems in the Western United States in two phases: 1) as a workshop with policy makers, and 2) as an electronic publication with a cohesive set of chapters organized by sections addressing the objectives. Within 6 months of the award, we would like to hold a workshop where the lead authors of each section present their basic synthesis and understanding to a group of high level line officers and key influential staff members from land management, regulatory, and fire-fighting organizations. The purpose of the workshop would be to have individuals making policy decisions see how well the concepts, reviews, and syntheses serve their decisions and engage in a discussion about the contents and format of the final publication. The presentations from the workshop and edited portions of ensuing discussion would be recorded for web presentations, to provide multimedia access to the synthesis. Following the workshop, the presenters and writing teams would complete their chapters, which will be edited to be cohesive in appearance and style. At this stage we envision chapters organized by sections, with each chapter covering a major issue in five or so pages. Such a format is conducive to use in a wikipedia-like presentation, but we do not wish to describe an exact presentation format without the opportunity to first receive feedback from likely users. The benefit to such an approach is the flexibility to expound on new topics as new issues arise or to update contents and citations as new information becomes available. Such a format also provides more targeted answers to users who are in a hurry. The synthesis would not only review previous and recent work, it would also discuss implications for alternative management approaches and policies, and discuss the key uncertainties constraining management choices. It is here that the value of the workshop should come through, as feedback from the policy makers will define the most important management issues. We will frame alternative hypotheses for some of the key uncertainties to show the value of reducing those uncertainties to help research organizations prioritize future work. Chapters will be posted electronically along with the videos. DVD's with the same information will be made available for users who may lack web access periodically (e.g. remote fire assignment). An independent web site will be used and linked to FRAMES. The synthesis would be summarized for a Fire Science Digest article and for Fire Management Today. Finally, since this is a synthesis directly related to the mission of the Joint Fire Sciences Program, we would like to provide a brief summary presentation to the Board.

II. Data sources

What sources of information are available to support a synthesis? Seminal publications and other highly referenced scientific papers should be part of the collection of information.

This work would focus on published literature and synthesize observations, studies and current ecological theory relevant to disturbance, wildfire, climate change, fish, and aquatic habitats and their management in the Western US. Early work on fire and aquatic ecosystems focused on reach-scale processes and the direct effects of fire. Longer term predictions were based largely on extrapolation of limited observations and rapidly emerging theory. Gresswell (1999) provides a thorough synthesis of the general understanding at the turn of the century. A subsequent special issue of Forest Ecology and Management on Fire and Aquatic Ecosystems (Young et al., 2003) summarized understanding of physical hydrologic and geomorphic process along with biological processes in terrestrial and aquatic systems, and offered insights over broader space-time scales. Since then, additional studies of the effects of fire on aquatic habitats and species (particularly invertebrates and fishes) has occurred in distinctly different systems, allowing a broader temporal and spatial perspective. Furthermore, there is an expanding body of work on population resilience and resistance to disturbance that is relevant to understanding the

implications of wildfire. Moreover, efforts to explore the processes linking terrestrial and aquatic systems and their simultaneous management are yielding approaches that may reduce conflicting management (JFSP 05-4-3-15, Luce et al., and JFSP 05-2-1-101, Morgan et al.) Coincident to these advances, contemporary climate change appears to be increasing the frequency and magnitude of fires (Westerling et al. 2006; Morgan et al., 2007), which suggests an increased role of this disturbance mechanism in future landscapes. The pervasive nature of climate change, however, also implies that it will act independently and could begin to compromise the adaptive capacity of aquatic ecosystems (Thomas 2004; Rieman et al. 2007). Any new synthesis of fire and aquatic ecosystems should account for these complex relationships to achieve maximum relevance. Scientists developing many of these new ideas were on the team building the 2003 special issue and are part of the team proposing and collaborating in this synthesis.

III. Interaction with land managers

Please describe activities you would conduct to solicit manager's input to help refine the scope of your work, to help identify and describe management implications, and to share the outcome of your assessment. Consider the use of a management advisor to strengthen the link to land managers.

An understanding of management issues focusing much of the recent research by team members on the relationship between fire and aquatic habitats and populations has grown out of our pervasive interactions with field and regional-level specialists and program managers. The managers have worked in the diverse disciplines covered in the outline below and include hydrologists, fish biologists, terrestrial ecologists, fuels specialists, riparian ecologists, and soil scientists. We have an ongoing dialogue with this community through regional workshops and joint research projects. We will carry this synthesis into that ongoing dialogue through presentations and discussions at regional and forest level workshops. We will also use some of this cadre to review the papers for their utility in field applications, such as citation in NEPA documents.

Our team has had less interaction with line officers, such as Forest Supervisors, Regional Foresters, BLM District Managers, State Directors, and Incident Commanders. Two of the purposes of this proposal are to solicit their input on the kinds of information needed from this synthesis and to introduce higher-level policy makers to the available science. Responding to the challenges posed by changing climate and wildfire will require that managers with broad discretion have a basic understanding of interactions between terrestrial and aquatic management. In particular, how decisions made before fires occur can dramatically alter risks to resources and people associated with decisions during fires. We will accomplish this goal using a highly interactive workshop, with low presentation time and high discussion time. Discussion stimulating exercises will be used when informal questions slow down. We will issue an open invitation to members of the JFSP Board to participate in this workshop because their multi-agency perspective would be valuable in honing the syntheses.

IV. General outline

Please list the major section headings you anticipate using in your manuscript.

1. Hydrology – water and energy (including temperature, and flow);
2. Geomorphology – (including erosion, sediment routing, channel evolution, wood);
3. Terrestrial vegetation dynamics and fire severity;
4. Riparian vegetation dynamics;
5. Foodwebs, nutrient dynamics, macroinvertebrates, and ecological process;
6. Fishes and amphibians;
7. Management before, during, and after fire to conserve fish;

8. Summary paper – including synthesis and prioritization of research needs.

Each chapter would review and synthesize each topic, highlighting new findings relevant to management issues. The review would include discussion of relevant aspects of climate change affecting the process and management choices. Each chapter should explicitly discuss consequences of alternative management strategies or choices, and will highlight the uncertainties that will most confound management decisions. Suggestions may be made for measurements and research studies that could decrease the uncertainties.

V. Schedule

[Please list the dates for major phases or milestones of your work.](#)

Dates Assuming April 2008 award notification. Timing shifts would need to accommodate periods when meetings are impractical.

October 2008 – Chapter outlines due

November 2008 – Policy maker workshop

May 2009 – Chapters due, drafts posted to website and sent for review

November 2009 – Completed revisions of reviewed chapters to Rocky Mountain Research Station publication office

February 2010 – Articles prepared for Fire Science Digest and Fire Management Today

March 2010 – Website completed

VI. Deliverables

[Please list the products you plan to produce. Multimedia DVDs are encouraged.](#)

1. Workshop
2. Videos of Workshop available from website and DVD
3. Chapters reviewing and synthesizing specific fields of work and an overall synthesis (Probably government publication. Also, possibly published as a living document in Wiki format that can be updated and added to over time).
4. Summary articles in Fire Science Digest and Fire Management Today
5. Presentation of summary and discussion with the board

VII. Budget

[Budget description and justification](#)

The budget will be used to support travel, video production, publication, and partial salary costs. Salary will be paid for one emeritus scientist and three post doctoral researchers who will each be leading production of a chapter. We have also allocated 6 months of salary for a writer-editor to coordinate and speed the completion of chapter reviews, simplify writing styles, and get each chapter into publication format. Travel expenses are associated with the workshop, with a small amount reserved to assist with coordinating groups of authors during writing. We have allocated sufficient funds for 4 hours of video production in materials and supplies to capture the meeting presentations. Substantial time will be provided by chapter coordinators, authors, National Forest System collaborators, and support personnel to accomplish the synthesis and meetings. We will work with collaborators to provide meeting space and may seek additional funds from the National Fire Plan to support further time for the writer-editor and augment travel and publishing costs if necessary.

Proposal Budget Summary:

Budget Item	FY 2009		FY 2010		TOTAL
	Requested	Contributed	Requested	Contributed	
Labor:	61,268	100,000	25,000	25,000	211,268
Travel:	22,000				22,000
Materials and Supplies:	32,000				32,000
Publishing costs			5,000		5,000
Other					
Total Direct Costs	115,268		30,000		145,268
Indirect Costs: 3% - all costs	3,458		900		4,358
Total Contributed Funding		100,000		25,000	125,000
Total Requested Funding	118,726		30,900		149,626

VIII: Collaborators

Our intent is to be inclusive of the scientific and professional community in building a resource to make the job of using science easier. Below is a partial list of collaborators who have been contacted and would like to help us create this resource. Some are potential writers, some are reviewers, and some have the know-how to help us present the materials better. There are many other opportunities for collaboration that we have not pursued while developing this proposal, but plan to do so should it be funded.

Mike Young, Research Fisheries Biologist
 Bob Gresswell, Research Fisheries Biologist
 Jim McKean, Research Geomorphologist
 Mike Furniss, Technology Transfer Specialist
 Jason Dunham, Research Fisheries Biologist
 Amanda Rosenberger, Research Fisheries Biologist
 John Chatel, Forest Fisheries Biologist
 Tim Burton, BLM State Office Fisheries Biologist
 Rick Hopson, Regional Hydrologist
 Brian Staab, Regional Hydrologist
 Kerry Overton, Acting Program Manager and Technology Transfer Specialist

IX. Literature Cited

Morgan, P., EK Heyerdahl, and CE Gibson. In press. Multi-season climate synchronized widespread forest fires throughout the 20th-century, Northern Rocky Mountains, USA Ecology.

Thomas, C.D. 2004. Extinction risk from climate change. Nature 427:145-148.

Westerling, A.L. H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increases western U.S. forest wildfire activity. Science 313:940-943.

Rieman, B.E., D.J. Isaak, S. Adams, D. Horan, D. Nagel, C. Luce, and D. Myers. In Press. Anticipated climate warming effects on bull trout and their habitats across the Interior Columbia River Basin. Transactions of the American Fisheries Society.

Minshall, G.W., Robinson, C.T., Lawrence, D.E. 1997. Postfire responses of lotic ecosystems in

- Yellowstone National Park, U. S. A. *Canadian Journal Fisheries Aquatic Sciences* 54, 2509-2525.
- Gresswell, R.E. 1999. Fire and aquatic ecosystems in forested biomes of North America. *Transactions of the American fisheries society* 128, 193-221.
- Luce, C. H., 2005, Fire Effects on Runoff Generation Processes, in Anderson M.G. and J.J. McDonnell eds., *Encyclopedia of Hydrological Sciences*, Vol 3, John Wiley and Sons, Chichester. pp. 1831-1838.
- Shakesby, R.A. & Doerr, S.H. (2006) Wildfire as a hydrological and geomorphological agent. *Earth Science Reviews*, 74, 269-307. (doi: 10.1016/j.earscirev.2005.10.006).
- Rieman, B. E., Gresswell, R.E., Young, M. K., Luce, C. H. 2003, Introduction to the effects of wildland fire on aquatic ecosystems in the Western USA., *Forest Ecology and Management* 178 (1-2): 1-3.
- Young, M. K., Gresswell, R.E., Luce, C. H., Eds., 2003, Special Issue on Fire and Aquatic Ecosystems in the Western USA, *Forest Ecology and Management* 178 (1-2)

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Education

- Ph.D. Civil Engineering Utah State University 2000
Dissertation: Scale Influences on the Representation of Snowpack Processes
M.S. Forest Hydrology University of Washington 1990
Thesis: Analysis of Infiltration and Overland Flow from Small Plots on Forest Roads
B.S. Forest Management University of Washington 1986, *Magna Cum Laude*
Thesis: Review of Forest Canopy Effects on Snowpack Structure and Stability

Professional Experience

- 2002-pres.: Science Team Leader, Rocky Mountain Research Station, Boise, Idaho.
1998-2002: Research Hydrologist, Rocky Mountain Research Station, Boise, Idaho.
1991-1998: Research Hydrologist, Intermountain Research Station, Moscow, Idaho.
1989-1991: District Hydrologist, Siskiyou National Forest, Powers, Oregon.
1989-1990: Research Assistant, Dept. of Forestry, University of Washington, Seattle.
1988-1989: Natural Resource Planning Intern, King County, Seattle, Washington.
1985: Teaching Assistant, Dept. of Forestry, University of Washington, Seattle.
1983-1987 (periodically): Research Assistant, Dept. of Geophysics, Univ. of Washington.

Professional Recognition

- Water Resources Research Editors' Citation for Excellence in Refereeing, 2003
2nd Place, Paper Competition, Utah State Chapter American Water Resources Association, 1995
Certificate of Merit, USDA Forest Service Intermountain Research Station: "For the rapid development of a hydrology model of road surfaces." 1991.
Xi Sigma Pi National Scholarship, 1985
Scottish Rite Foundation of Washington Scholarship, 1983 & 1984
Member of Xi Sigma Pi National Forestry Honor Society, 1983-present

Editorial Experience

- Guest Editor, Earth Surface Processes and Landforms, Special Issue on Forest Roads, V. 26, No. 2-3, February and March, 2001.
Guest Editor, Forest Ecology and Management, Special Issue on the effects of Wildland Fire on Aquatic Ecosystems in the Western USA, V. 178 No. 1-2, 2003.

Selected Relevant Publication

- Tonina, D., **Luce, C.H.**, Clayton, S., Ali, M.D., Barry, J.J., Rieman, B.E., Goodwin, P., Buffington, J.M., Berenbrock, C. 2007, Hydrological Response to Timber Harvest in Northern Idaho: Implications for Channel Scour and Persistence of Salmonids, Hydrological Processes, in Press.
- Rieman, B.E., D.J. Isaak, S. Adams, D. Horan, D. Nagel, **C.H. Luce**, and D. Myers. 2007. Spatial variation in anticipated climate change effects on bull trout habitats across the Interior Columbia River Basin. Transactions of the American Fisheries Society, In Press.

- Dunham, J.B., A.E. Rosenberger, **C.H. Luce**, B.E. Rieman. 2007. Influences of Wildfire and Channel Reorganization on Spatial and Temporal Variation in Stream Temperature and the Distribution of Fish and Amphibians. *Ecosystems* 10: 335–346
- Troendle, C., L. MacDonald, and **C. Luce**, 2006. Fuels Management and Water Yields. In, Elliot, W.J. and Audin, L.J., (Eds.). *DRAFT Cumulative Watershed Effects of Fuels Management in the Western United States*. [Online]. Available: <http://forest.moscowfsl.wsu.edu/engr/cwe/> [2006, March 22-access date].
- Luce, C.H.** and B. Rieman, 2006. Landscape scale effects of Fuel Management or Fire on water resources: The Future of Cumulative Effects Analysis?. In, Elliot, W.J. and Audin, L.J., (Eds.). *DRAFT Cumulative Watershed Effects of Fuels Management in the Western United States*. [Online]. Available: <http://forest.moscowfsl.wsu.edu/engr/cwe/> [2006, March 22-access date].
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- Rieman, B., J. Dunham, **C. Luce**, and A. Rosenberger, A. 2005. Implications of changing fire regimes for aquatic ecosystems. Pages: 187-191 In Taylor, L.; Zelnik, J.; Cadwallader, S., Hughes, (editors) *Mixed Severity Fire Regimes: Ecology and Management*. Symposium Proceedings, Spokane WA. November 15-19, 2004. Association for Fire Ecology and Washington State University, Pullman, WA.
- Luce, C.H.**, E. Istanbuluoglu, D.G. Tarboton, and R.T.Pack, 2005, Reply to Comment on Istanbuluoglu, Erkan; Tarboton, David G.; Pack, Robert T.; Luce, Charles H. Modeling of the interactions between forest vegetation, disturbances, and sediment yields. *J. Geophys. Res.*, 110, No. F1, F01013, doi:10.1029/2004JF000279.
- Istanbuluoglu, E., D.G. Tarboton, R.T.Pack and **C.H. Luce**, 2004, Modeling of the Interactions between Forest Vegetation, Disturbances and Sediment Yields, *JGR - Earth Surface* , 109(F1): F01009, doi: 10.1029/2003JF000041.
- Istanbuluoglu, E., D. G. Tarboton, R. T. Pack and **C. H. Luce**, 2003, A Sediment Transport Model for Incising Gullies On Steep Topography, *Water Resour. Res.* 39(4): doi: 10.1029/2002WR001467.
- Rieman, B. E., Gresswell, R.E., Young, M. K., **Luce, C. H.** 2003, Introduction to the effects of wildland fire on aquatic ecosystems in the Western USA., *Forest Ecology and Management* 178 (1-2): 1-3.
- Bisson, P. A., B. E. Rieman, **C. H. Luce**, P. F. Hessburg, D. C. Lee, J. L. Kershner, G. H. Reeves, and R. E. Gresswell. 2003, Fire and aquatic ecosystems of the western USA: current knowledge and key questions. *Forest Ecology and Management* 178 (1-2): 213-229.
- Miller, D., **Luce, C.**, Benda, L. E., 2003, Time and space scale and episodicity of physical disturbance in streams, *Forest Ecology and Management*, 178 (1-2), 121-140.
- Istanbuluoglu, E., D. G. Tarboton, R. T. Pack and **C. Luce**, 2002, A probabilistic approach for channel initiation, *Water Resources Research*, 38: 1325, doi:10.1029/2001WR000782.
- Luce, C.H., B.E. Reiman, J.B. Dunham, J.L. Clayton, J.G. King, and T.A. Black, 2001, Incorporating Aquatic Ecology into Decisions on Prioritization of Road Decommissioning. *Water Resources Impact*, 3(3): 8-14.
- Luce, C. H.**, 1995, Forests and Wetlands, Chapter 8 in *Environmental Hydrology*. Edited by A. D. Ward and W. J. Elliot. CRC Press. Boca Raton, Florida.

Bruce E. Rieman: Emeritus Scientist (retired 2007), U.S. Forest Service

Education:

BS: Zoology, University of Idaho 1973

M.S. Fisheries Management, University of Idaho 1976

Ph.D. Forestry, Wildlife and Range Sciences, University of Idaho 1987

Professional Experience:

1983-1985: Regional Fisheries Manager, Idaho Department of Fish and Game,

1986: Instructor and Research Associate, College of Forestry Wildlife and Range Sciences, U of I Moscow, ID

1986-1988: Fish Research Biologist 3, Oregon Department of Fish and Wildlife,

1988-1992: Principal Fisheries Research Biologist, Idaho Department of Fish and Game,

1992-2007: Research Fishery Scientist; Team Leader; Project Leader and Director's Representative, U.S. Forest Service Rocky Mountain Research Station,

Professional Recognition:

Most Significant Paper published in Trans. American Fisheries Society, Volume 120, 1991
Alumni Achievement Award, University of Idaho, College of Forestry, Wildlife and Range Sciences, Commencement 1997

U.S. Forest Service Chief's "New Century of Service" award for "integrity, leadership, and unique approaches to fisheries issues", 2003

Robert L. Kendall Award for Best Paper in the Transactions of the American Fisheries Society, Volume 132 (2004)

American Fisheries Society President's Fishery Conservation Award, for advancing understanding of fishes and fisheries management in the Columbia River Basin, 2005

Idaho Chapter American Fisheries Society, "Richard L. Wallace Native Species Conservation Award" for contributions to the conservation of Idaho fishes, 2006

Selected Publications:

Rieman, B. E., and J. Clayton. 1997. Fire and fish: issues of forest health and conservation of native fishes. *Fisheries* 22(11):6-15.

Rieman, B. E., D.C. Lee, R.F. Thurow, P.F. Hessburg, and J.R. Sedell. 2000. Toward an integrated classification of ecosystems: defining opportunities for managing fish and forest health. *Environmental Management* 25(4):425-444.

Rieman, B.E., J.T. Peterson, J.L. Clayton, P. Howell, R.F. Thurow, W. Thompson and D.C. Lee. 2001. Evaluation of potential effects of federal land management alternatives on trends of salmonids and their habitats in the interior Columbia River basin. *Forest Ecology and Management* 153 (1-3):43-62

Rieman, B.E.; D. Lee, D. Burns, R. Gresswell, M. Young, R. Stowell, and P. Howell. 2003. Status of native fishes in the Western United States and issues for fire and fuels management. *Forest Ecology and Management*. 178(1-2):19-212.

Bisson, P.A., B.E. Rieman, C. Luce, P.F. Hessburg, D.C. Lee, J.L. Kershner, G.H. Reeves, and R.E. Gresswell. 2003. Fire and aquatic ecosystems of the western USA: Current knowledge and key questions. *For Ecol and Mgmt* 178 (1-2): 213-229

Dunham, J.B., M.K. Young, R.E. Gresswell, and B.E. Rieman, B.E. 2003. Effects of fires on fish populations: landscape perspectives on persistence of native fishes and nonnative fish invasions. *Forest Ecology and Management* 178 (1-2): 183-196.

Rieman, B.E., D. Isaak, S. Adams, D. Horan, D. Nagel, and C. Luce. In Press. Anticipated climate warming effects on bull trout habitats and populations across the Interior Columbia River basin. *Transactions of the American Fisheries Society*.

Qualifications of investigators

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Education:

B.A., Geology & Geophysics, University of California, Berkeley, 1988
M.Sc., Geomorphology, University of Washington, 1995
PhD, Geomorphology, University of Washington, 1998

Professional Experience:

Research Geomorphologist, USFS, Rocky Mountain Research Station, Boise, 2004-
Assistant Professor of Civil Engineering, Center for Ecohydraulics Research, Univ. of Idaho, Boise, 2000-
2004 (Affiliate Faculty, 2004-)
Postdoctoral Researcher, National Research Council, stationed at U.S. Geological Survey, National
Research Program, Water Resources Division, Boulder, 1998-2000
Hydrologist, USFS, Pacific Northwest Research Station, Juneau, 1989-1991

Selected Publications:

Tonina, D., C.H. Luce, B. Rieman, J.M. Buffington, P. Goodwin, S.R. Clayton, S.M. Ali, J.J. Barry, and C. Berenbrock. in press. Hydrological responses to timber harvest in northern Idaho: Implications for channel scour and persistence of salmonids. *Hydrological Processes*.

Jorde, K., A.E. Rosenberger, N.E. Scheidt, C.W. Welcker, B.E. Rieman, C.H. Luce, J.M. Buffington, J.A. McKean, and J.B. Dunham. 2007. Stream ecosystem response to wildfire. Joint venture agreement 02-JV-11222014-196. Univ. of Idaho and USFS Rocky Mountain Research Station. Final Report. 201 pp.

Tonina, D., and J.M. Buffington. 2007. Hyporheic exchange in gravel-bed rivers with pool-riffle morphology: Laboratory experiments and three-dimensional modeling. *Water Resour. Res.* 43:W01421.

Buffington, J.M., D.R. Montgomery and H.M. Greenberg. 2004. Basin-scale availability of salmonid spawning gravel as influenced by channel type and hydraulic roughness in mountain catchments. *Canadian Journal of Fisheries and Aquatic Sciences* 61:2085-2096.

Buffington, J.M., R.D. Woodsmith, D.B. Booth and D.R. Montgomery. 2003. Fluvial processes in Puget Sound Rivers and the Pacific Northwest. In D.R. Montgomery, S. Bolton, D.B. Booth and L. Wall (eds.) *Restoration of Puget Sound Rivers*. University of Washington Press, Seattle, WA, pp. 46-78.

Montgomery, D.R., B.D. Collins, J.M. Buffington and T.B. Abbe. 2003. Geomorphic effects of wood in rivers. In S. Gregory, K. Boyer and A.M. Gurnell (eds.) *The Ecology and Management of Wood in World Rivers*. American Fisheries Society Symposium 37:21-47.

Buffington, J.M., T.E. Lisle, R.D. Woodsmith and S. Hilton. 2002. Controls on the size and occurrence of pools in coarse-grained forest rivers. *River Research and Applications* 18:507-531.

Buffington, J.M. and D.R. Montgomery. 1999b. Effects of hydraulic roughness on surface textures of gravel-bed rivers. *Water Resources Research* 35:3507-3522.

Buffington, J.M. and D.R. Montgomery. 1999c. Effects of sediment supply on surface textures of gravel-bed rivers. *Water Resources Research* 35:3523-3530.

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CURRICULUM VITAE

Dr. Penelope Morgan

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Education:

1984	Ph.D.	Fire Ecology and Management	University of Idaho
1979	M.S.	Forest Ecology	Utah State University
1977	B.S.	Biology	Utah State University

Current & Previous Positions:

1999-present	Professor, Department of Forest Resources, Univ. of Idaho
1997-2002	Co-director, Natural Resources Ecol. & Conservation Biology Program
1986-1999	Asst. Professor and Associate Professor, Dept. of Forest Res., Univ. of Idaho
1985-1986	Asst. Professor, School of Renewable Natural Resources, Univ. of Arizona

Selected Publications, in chronological order, chosen for relevance to proposal:

- Heyerdahl, EK, P. Morgan and JP Riser, II. In press. Multi-season climate synchronized widespread historical fires in dry forests (1650-1900), Northern Rockies, USA. *Ecology*.
- Morgan, P., EK Heyerdahl, and CE Gibson. In press. Multi-season climate synchronized widespread forest fires throughout the 20th-century, Northern Rocky Mountains, USA *Ecology*.
- Holden, Z. A., P. Morgan, M. Crimmins, R. Steinhorst and A. Smith. 2007. Fire season precipitation variability influences fire extent and severity in a large southwestern wilderness area, USA. *Geophysical Research letters* 34 : 1-5.
- Lentile LB, Holden ZA, Smith AMS, Falkowski MJ, Hudak AT, Morgan P, Gessler PE, Benson NC. 2006. Remote sensing techniques to assess active fire and post-fire effects. *International Journal of Wildland Fire* 15(3) 319–345.
- Hudak, A.T., P. Morgan, M. Bobbitt and L.B. Lentile. 2006. Characterizing stand-replacing harvest and fire disturbance patches in a forested landscape: A case study from Cooney Ridge, Montana. In: Ch. 8; *Forest Disturbance and Spatial Patterns, GIS and Remote Sensing Approaches* (M. Wulder and S. Franklin, eds.), Taylor & Francis, London.
- Holden, Z. A., P. Morgan, M. G. Rollins, and G. R. Wright. 2005a. Ponderosa pine snag densities following multiple fires in the Gila Wilderness, NM. *Forest Ecology and Management* 221:140-146.
- Holden, Z. A., A. M. S. Smith, P. Morgan, M. Rollins, and P. Gessler. 2005b. Evaluation of novel thermally enhanced spectral indices for mapping fire perimeters and comparison with fire atlas data. *International Journal of Remote Sensing* 26:4801-4808.
- Morgan, P., G. E. Defosse, and N.F. Rodriguez. 2003. Management implications of fire and climate changes in the western Americas. Chap. 15 in T. Veblen and others, *Fire and climate change in temperate ecosystems of the western Americas*.
- Rollins, M.G., T.W. Swetnam, and P. Morgan. 2001. Evaluating a century of fire patterns in two Rocky Mountain wilderness areas using digital fire atlases. *Canadian Journal of Forest Research*. 31(12): 2107-2123.
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Education:

2004-present PhD, Forest Resources, University of Idaho. (Expected November, 2007)
2002-2004 M.S., Forest Resources, University of Idaho
1992-1996 B.S., Oberlin College

Experience:

2002-present Graduate research assistant, Department of Forest Resources, University of Idaho.
1999-2002 Biologist (GS-401-11) Pea Ridge National Military Park
1997-1999 Peace Corps Volunteer, Agroforestry extension program, Senegal, West Africa.
May-July 1996 Research Assistant, Konza Prairie Long Term Ecological Research station.

Peer-Reviewed Publications and Reports

- Holden, Z. A.**, P. Morgan, M. Crimmins, R. Steinhorst and A. Smith (2007). Fire season precipitation variability influences fire extent and severity in a large southwestern wilderness area, USA. *Geophysical Research letters* (34) 1-5.
- Holden, Z. A.**, P. Morgan, M. G. Rollins, and G. R. Wright. 2005a. Ponderosa pine snag densities following multiple fires in the Gila Wilderness, NM. *Forest Ecology and Management* 221:140-146.
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- Lentile, L. B., **Z. A. Holden**, A. M. Smith, M. J. Falkowski, A. T. Hudak, P. Morgan, P. E. Gessler, and N. C. Benson (2006). Remote sensing techniques to assess active fire characteristics and post-fire effects. *International Journal of Wildland Fire*.26: 319-345.
- Smith, A. M. S., N. Drake, M. J. Wooster, A. T. Hudak, and **Z. A. Holden**. (in press). Production of Landsat ETM+ reference imagery of burned areas within Southern African Savannas: Comparison of methods and application to MODIS. *International Journal of Remote Sensing*.
- Holden, Z. A.**, Morgan, P., Rollins, M. G., Kavanagh, K., (In review). Thirty Years of Wildland Fire Use: Effects of Multiple Fires on stand structure in two southwestern wilderness areas. *Journal of Fire Ecology*
- Holden, Z. A.**, Smith, A., Morgan, P. and Vierling, L. (in review). Beyond Landsat: A multi-sensor assessment of burn severity on the Gila Wilderness, NM. *International Journal of Wildland Fire*.

Matthew R. Dare, Ph. D.

Ecologist

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Education

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M. S., Biology, Central Michigan University, 1997

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Employment history

May 2006 – Present: Ecologist, U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station, Boise, Idaho.

July 2003 – May 2006: Research Professor, Boise State University, Boise, Idaho.

July 2001 – July 2003: Fisheries Research Biologist, Biomark, Inc., Boise, Idaho.

Publications

Benjamin, J. R., J. B. Dunham, M. R. Dare. 2007. Invasion by non-native brook trout in Panther Creek, Idaho: roles of habitat quality, biotic resistance, and connectivity to source habitats. *Transactions of the American Fisheries Society* 136:875-888.

Dare, M.R. 2006. Integration and application of radio telemetry data collected on a mobile fish species: a synthesis of bull trout movement research. Project Completion Report, Contract 143303G098. 67pp.

Dare, M. R. 2003. Mortality and long-term retention of passive integrated transponder tags by spring Chinook salmon. *North American Journal of Fisheries Management* 23:1015-1019.

Dare, M. R., W. A. Hubert, K. G. Gerow. 2002. Changes in habitat availability and habitat use and movements by two trout species in response to declining discharge in a regulated river during winter. *North American Journal of Fisheries Management* 22:917-928.

Dare, M. R., W. A. Hubert, and J. S. Meyer. 2001. Influence of stream flow on hydrogen sulfide concentrations and distributions of two trout species in a Rocky Mountain tailwater. *North American Journal of Fisheries Management* 21:971-975.

Claire C. McGrath

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Education

- 2004 – Ph.D., Ecology and Evolutionary Biology, University of Colorado, Boulder, CO.
1998 – M.S., Environmental Science, Western Washington University, Bellingham, WA.
1993 – B.A. with High Honors, Biology, Oberlin College, Oberlin, OH.

Experience

- 2006 – Present. Postdoctoral Ecologist, US Forest Service Rocky Mountain Research Station, Boise, ID.
2005 – 2006. Staff Biologist, Idaho Department of Fish and Game, Nampa, ID.
1998 – 2004. Graduate Teaching Assistant, Department of Ecology and Evolutionary Biology, University of Colorado, Boulder CO (6 semesters).
1998 – 2004. Graduate Research Assistant, Center for Limnology, CIRES, University of Colorado, Boulder, CO (6 semesters).
1998 – 2004. Independent Consultant in Fisheries and Aquatic Ecology, Boulder, CO.
2000. Research Fellow, Rocky Mountain Nature Assn. and Rocky Mountain National Park, Estes Park, CO.
1996 – 1998. Aquatic Biologist, Cascades Environmental Services, Bellingham, WA.
1996 – 1997. Graduate Teaching Assistant, Western Washington University, Bellingham, WA.

Publications

- McGrath, C.C. and W.M. Lewis, Jr. 2007. Competition and predation as mechanisms for displacement of greenback cutthroat trout by brook trout. *Transactions of the American Fisheries Society* 136:1381-1392.
- McCutchan, J.H., Jr., W.M. Lewis, Jr., C. Kendall, and C.C. McGrath. 2003. Variation in trophic shift for stable isotope ratios of carbon, nitrogen, and sulfur. *Oikos* 102:378-390.
- McGrath, C.C. and R.A. Matthews. 2000. Cellulase activity in the amphipod *Gammarus lacustris*. *Journal of the North American Benthological Society*, 19(2):298-307.
- McGrath, C.C. and A.R. Berkowitz. 1995. Competition for water and nitrogen between corn and a living mulch. *Occasional Publication of the Institute of Ecosystem Studies* 10:87-92.
- McGrath, C.C. 1997-1998. Primary author on three technical reports submitted to the Mt. Baker-Snoqualmie National Forest, U.S. Forest Service: Canyon Creek Watershed Level II and Modified Level II Stream Surveys; Beckler River Level II Stream Survey; Tye River Level II Stream Survey. Cascades Environmental Services, Inc., Bellingham, WA.

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EDUCATION:

Ph.D. 2001. Riparian Ecology; Oregon State University, Corvallis, OR.
M.S. 1983. Plant Ecology, University of California, Davis, CA.
B.A. 1975. Environmental Biology, University of California, Santa Barbara, CA.

WORK EXPERIENCE:

Research Riparian Ecologist; USDA Forest Service, Rocky Mountain Research Station, Laramie, WY, November 2001 to May 2005; Fort Collins, CO, June 2005 to present.
Ecologist; Post-Doctoral Research Associate - Oregon State University, Department of Forest Science and USDA Forest Service, Pacific Northwest Research Station, La Grande, OR. May- October 2001.
Consultant; Riparian Ecologist - City of Corvallis, OR; November 1999 to March 2001.
Graduate Teaching Assistant and Graduate Research Assistant; June 1996 to December 2000. Oregon State University, Department of Fisheries and Wildlife, Corvallis OR.
Riparian/Wetlands Ecologist, Senior Scientist; 1990 to 1996; Dynamac Corporation and ManTech Environmental Research Services Corp.; US EPA National Health and Environmental Effects Research Laboratory, Corvallis, OR.

SELECTED PUBLICATIONS:

- Dwire, K.A., C.C. Rhoades, and M.K. Young. 2006. Potential effects of fuel management activities on riparian areas. *In:* W. J. Elliott and L. J. Audin (eds): Cumulative Watershed Effects (CWE) of Fuels Management in the Western United States. Available online: <http://forest.moscowfs.wsu.edu/engr/cwe/>
- Dwire, K.A., S.E. Ryan, L.J. Shirley, D. Lytjen, N. Otting, and M.K. Dixon. 2006. Influence of herbivory on regrowth of riparian shrubs following a wildland fire. *Journal of the American Water Resources Association* 42 (1): 201-212.
- Dwire, K. A., J. B. Kauffman, and J. Baham. 2006. Plant species distribution in relation to water table depth and soil redox potential in montane riparian meadows. *Wetlands* 26 (1): 131 – 146.
- Dwire, K. A., J. B. Kauffman, E.N.J. Brookshire, and J. Baham. 2004. Plant biomass and species composition along an environmental gradient in montane riparian meadows. *Oecologia* 139 (2): 309-317.
- Dwire, K.A. and J. B. Kauffman. 2003. Fire and riparian ecosystems in landscapes of the western USA. *Forest Ecology and Management* 178 (1-2): 61-74.

PROFESSIONAL AFFILIATIONS:

Ecological Society of America
Society of Wetland Scientists
American Geophysical Union

North American Benthological Society
American Fisheries Society
American Water Resources Association

Dan Isaak, Ph.D.

Dan Isaak is a postdoctoral fisheries biologist with the US Forest Service, Rocky Mountain Research Station in Boise, ID. He functions as a scientist on a team of interdisciplinary collaborators investigating fish population dynamics, habitat relationships, and factors influencing persistence. The mission of the team is to provide new information and techniques for understanding, conserving, and restoring fish populations and critical habitats across the western US. He has extensive experience with salmonids in western landscapes (www.fs.fed.us/rm/boise/) and technical expertise in the areas of patch-based incidence functions, synchrony analysis, path analysis/structural equation modeling, spatial autoregressive techniques, and traditional parametric analyses.

Education:

Ph.D., Zoology and Physiology, University of Wyoming, 1995-2001.

M.S., Fisheries Resources, University of Idaho, 1992-1994.

B.S., Wildlife and Fisheries Sciences, South Dakota State University, 1987-1991.

Recent Employment

2005-present: Postdoctoral Fisheries Biologist, US Forest Service.

2001-present: Postdoctoral Research Fellow, University of Idaho

Recent Publications:

Isaak, D.J., C. Luce, B.E. Rieman, D. Nagel, E. Peterson, D. Horan, S. Parkes, and G. Chandler. In preparation. Effects of fire and recent climate on summer stream temperatures and distribution of thermal habitats for two salmonids in the Boise River basin, Idaho.

McKean, J., D.J. Isaak, and C.W. Wright. In Press. Geomorphic controls on salmon nesting patterns described by a new narrow-beam terrestrial-aquatic lidar. *Frontiers in Ecology and the Environment*.

Rieman, B.E., D.J. Isaak, S. Adams, D. Horan, D. Nagel, C. Luce, and D. Myers. In Press. Anticipated climate warming effects on bull trout and their habitats across the Interior Columbia River Basin. *Transactions of the American Fisheries Society*.

Isaak, D.J., R.F. Thurow, B.E. Rieman, and J.B. Dunham. 2007. Relative roles of habitat quality, size, and connectivity in Chinook salmon use of spawning patches. *Ecological Applications* 17: 352-364.

Neville, H., D.J. Isaak, R.F. Thurow, J.B. Dunham, and B.E. Rieman. 2007. Microsatellite variation reveals weak genetic structure and retention of genetic variability in threatened Chinook salmon (*Oncorhynchus tshawytscha*) within a Snake River watershed. *Conservation Genetics* 8:133-147.

Isaak, D.J., and R.F. Thurow. 2006. Network-scale spatial and temporal variation in Chinook salmon redd distributions: patterns inferred from spatially continuous replicate surveys. *Canadian Journal of Fisheries and Aquatic Sciences* 63:285-296.

File Code: 4300/4400

Date: November 8, 2007

Route To:

Subject: Joint Fire Science Program Research Proposal

To: Charlie Luce, RMRS-Boise

We are writing this letter to express our support for the proposal you and others are submitting to the Joint Fire Science Program AFP 2008-2, Task 1. We have read your proposal titled "Fire and Aquatic Ecosystems in the Context of Climate Change: A Synthesis for Improved Management," and look forward to seeing the outcome of your effort.

We see substantial value for land managers in making information about how fires and climate change affect aquatic habitats more readily available. Having the information needed for supporting management decisions reviewed and summarized improves the efficiency of our planning efforts and saves valuable time for resource specialists. It can also lead to more strategic decisions. The Chief of the Forest Service has expressed the importance of planning for water and climate change as two of her key challenges for the agency. The recent GAO report on climate change highlights the interest of Congress in incorporating climate change into land management decisions, and I can see no more urgent nexus to apply that to than fire and water. The synthesis products you describe will help land managers find useful management and research strategies to address these issues.

We applaud your intent to request feedback from line officers to refine the content and presentation of your synthesis, and see the utility of having that cadre informed about water, climate change, and fire. You should recognize, however, that other priorities can engage them at short notice. Also the Regions and Washington office are undergoing a significant transformation at this time, and there may be more critical lines of communication between you and zoned mission support staffs in the future. We support our regional staff in helping you find the most useful representatives for an interchange that will help the synthesis serve at a strategic level.

We have seen some of the work that you and the proposed team have done in the past. We value its high quality and its focus on key management issues. The team's reputation for working closely with managers gives us confidence that the products will be useful and grounded in sound science.

/s/ Erin S. O'Connor
MARY WAGNER
Acting Regional Forester

cc: Rick G Hopson



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Idaho State Office
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Boise, Idaho 83709
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In Reply Refer To:
6840 (ID931)

November 8, 2007

Mr. Charles H. Luce
USDA Forest Service Rocky Mountain Research Station
322 E Front St., Suite 401
Boise, Idaho 83702

Dear Mr. Luce:

RE: Proposal for Fire and Aquatic Ecosystems in the Context of Climate Change: A synthesis for Improved Management.

The Bureau of Land Management (BLM) agrees that in a time of changing climate, managing the balance between aquatic resources, wildfire, and fuel conditions is an important challenge facing many Federal agencies. We support your proposal and are particularly interested in your proposal to synthesize scientific information on the subject, and to make it easily accessible and understood by managers and practitioners in the BLM. We also agree that dealing with climate change, as related to aquatic systems and fire, is an important concern for the future of land management.

The BLM supports increased involvement by line officers and is interested in having a representative from the State Office attend associated meetings and workshops. Your team has done a lot of excellent research in this area and, in our opinion, should lead this effort.

Sincerely,

Signed by:
Susan Giannettino
Deputy State Director

Authenticated by:
Mikell Galloway
Administrative Specialist