National Fire Decision Support Center

Annual Report

FY2013

Prepared by the Wildland Fire Management RD&A on behalf of the NFDSC

December 2013

Contents

Introduction

The National Fire Decision Support Center (NFDSC) (Figure 1) is a collaborative effort between Fire and Aviation Management, and Research and Development. It was created to support wildland fire decision making by directly linking fire and economic sciences to operational applications. It has been operational for four fire seasons. The NFDSC provides a key link between wildland fire science and the application of that science to benefit field practitioners, decision-makers, and agency stakeholders.

The purpose of the NFDSC is to:

- Improve the science to support large fire decision-making
- Improve fire management decision support tools and processes
- Improve agency capability to make and implement wildland fire decisions
- Improve agency capability to manage fire expenditures
- Maintain centralized decision support capabilities for fires
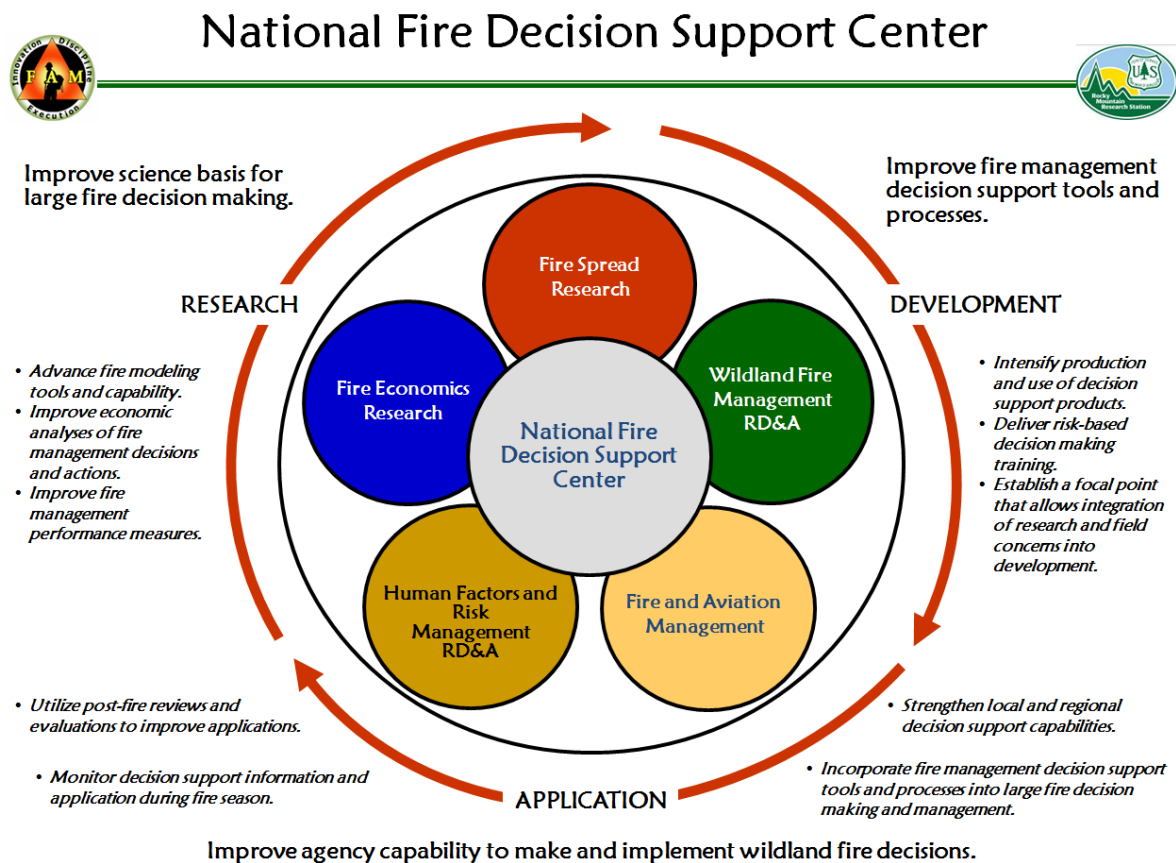- Continue development of a safety culture that systematically approaches management of risk.

Figure 1. Relationships within the NFDSC

A Virtual Organization

The NFDSC is a virtual organization comprised of team members from multiple USFS research and management programs, Department of Interior (DOI), and other cooperators. Existing Forest Service units that provide staff for integration in this effort include: Wildland Fire Management Research Development and Application (WFM RD&A), (Rocky Mountain Research Station, Fire and Aviation Management RMRS, and DOI involvement); Human Factors and Risk Management RD&A (RMRS); Fire Spread Research (Fire, Fuels, and Smoke Program, RMRS); and Fire Economics Research (Human Dimensions Program, RMRS).

The NFDSC's areas of emphasis are as follows:

- Advance fire modeling tools and capability.
- Improve economic analysis of fire management decisions and actions.
- Improve fire management performance measures.
- Utilize post-fire reviews and evaluations to improve applications.
- Monitor decision support information and application during fire season.
- Intensify production and use of decision support products.
- Deliver risk-based decision making training.
- Establish a focal point that allows integration of research and field concerns into development.
- Strengthen local and regional decision support capabilities.
- Incorporate fire management decision support tools and processes into laree fire decision making and management.
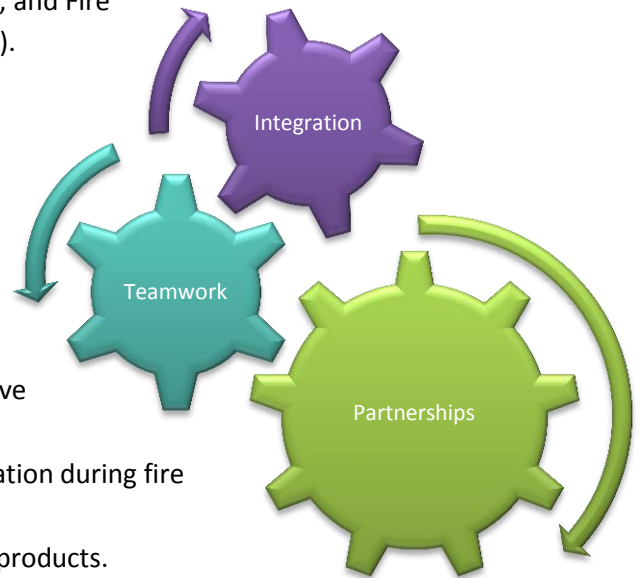
This report describes the NFDSC's accomplishments for fiscal year 2013, and includes specifics related to presentations, publications, cooperative agreements, partnerships and more. The report also contains NFDSC planned activities for FY 2014.

Fire and Aviation Management

The US Forest Service (USFS) provides exemplary natural resource research, with stations and labs across the US leading research in the many facets of wildland fire management. The NFDSC works to leverage this science for improved risk assessment and decision making for the all levels of the fire organization.

The USFS Fire and Aviation Management program provides funding and oversight as needed to the units within the NFDSC. Some positions are funded directly by the Department of Interior and are fully integrated as part of the WFM RD&A staff. This oversight, funding, and integration allows the NFDSC to work collaboratively and produce meaningful and useful research and applications for a wide variety of internal and external audiences.

Images courtesy of the National Interagency Fuels, Fire, and Vegetation Technology Transfer (NIFTT)

Fire Economics Research

FY 2013 Accomplishments

The wildfire economics team is a leader in the development and application of knowledge and tools to understand the economic implication of wildfire management and wildfire risk assessment to improve the science basis for wildfire management. The team explores the costs and benefits of investments across the spectrum of wildfire management. Primary research topics include integrated spatial risk assessment modeling, econometric modeling of fire management expenditures, and the effectiveness of suppression resource utilization, managerial incentives, and performance measurement.

Risk Assessment and Decision Science

Risk management has been established as the guiding principle of wildfire management. In 2013, the team provided leadership and new research on the application of decision science and risk analysis principles to wildfire management. In particular the team helped publish two prominent publications intended for the land and fire management communities. The first publication, "The science of decision-making: Applications for sustainable forest and grassland management in the National Forest System" (WO-GTR-88;

Figure 2 Geospatial context of wildfire risk assessment framework.

http://treesearch.fs.fed.us/pubs/44326) is intended to provide managers with useful concepts and tools to address risks, stressors, and challenges and to achieve desirable outcomes. The second publication, "A wildfire risk assessment framework for land and resource management" (RMRS-GTR-315; http://treesearch.fs.fed.us/pubs/44723) is intended to provide fire and land managers with a helpful set of guiding principles and tools for assessing and mitigating wildfire risk. The team helped put these principles into practice by working directly with the field, most recently including fuel treatment planning on the Helena National Forest in Montana, large landscape risk assessment for the Inyo, Sequoia, Sierra, and Stanislaus National Forests in California, community based risk assessment for the State of Utah, and participation on the 2013 Large Fire Cost Review. Further, the team has engaged in several research efforts to better understand and model community exposure to wildfire including improved techniques to identify the source fire ignitions and conditions that lead to significant impacts to residentially developed areas.
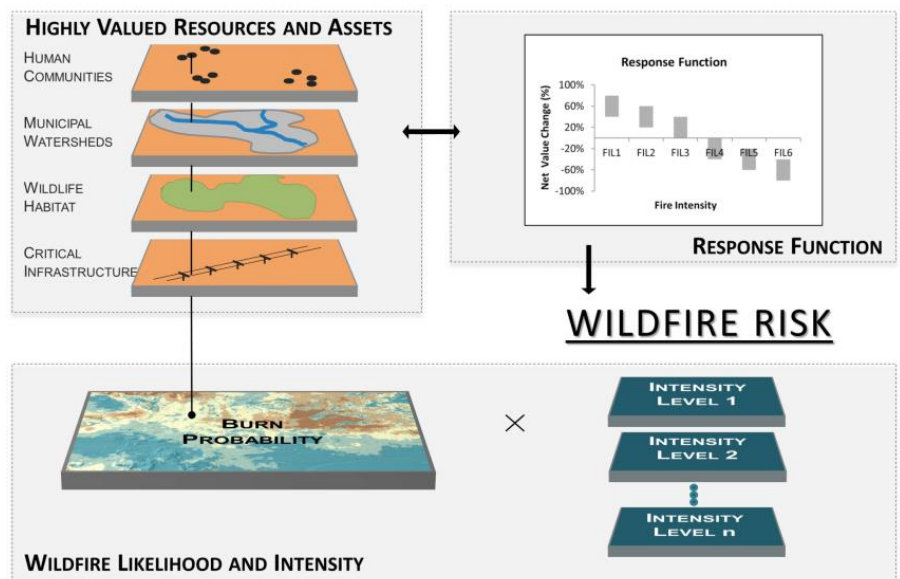
Suppression resource use, cost and effectiveness

In 2013 suppression cost exceeded the appropriated budget by over $400 million requiring the Agency to temporarily transfer funding across programs to cover this shortfall. The team continued its efforts to better understand factors that influence fire suppression costs at the individual fire and the programmatic levels. Research explored the variation in suppression resource use among incident management teams, and the effectiveness of suppression resources under varying conditions in bringing wildfires to containment. Several of these efforts including daily production capacity used on major wildfire incidents, firefighter exposure metrics and fire cost models are being incorporated into the Risk Console to provide critical real time decision support information to senior fire leaders. The team continues to explore the fundamental question of how wildfire suppression strategies are developed and the effectiveness of resources in bringing a fire to conclusion.

Aviation use, effectiveness, exposure and managerial risk perception and attitudes

The team continued to investigate the use and effectiveness of large airtankers to better understand where and when retardant drops are requested and methods to estimate the effectiveness of drops in containing fires. The team integrated historic aviation accident rates across platforms with large fire utilization to determine the expected accident rates on a per fire basis for incorporation with the Risk Console. Results from a survey of federal wildfire manager's risk attitudes and perceptions regarding the use of aviation resources were published in a report titled Preliminary Results from a Survey of U.S. Forest Service Wildfire Managers' Attitudes Toward Aviation personnel Exposure and Risk (http://www.fs.fed.us/rm/pubs/rmrs_rn050.html).
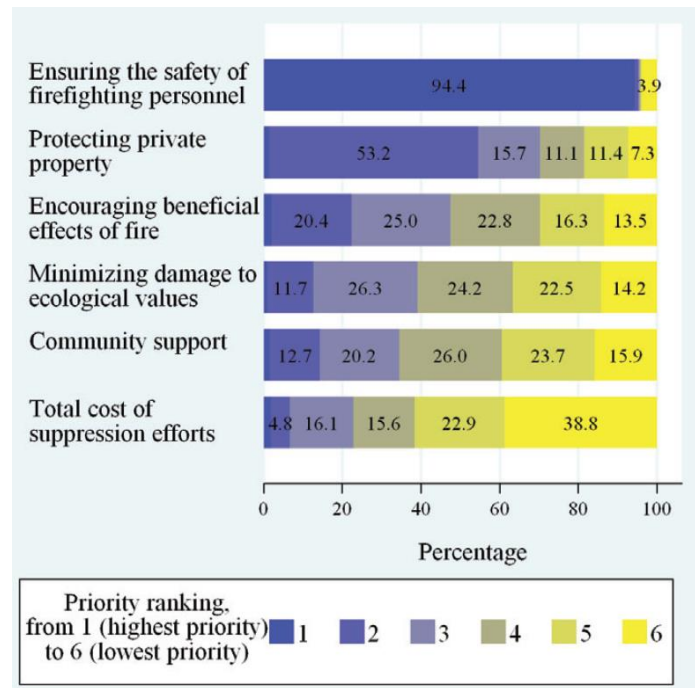
Figure 3. Excerpt from the preliminary results of a survey of USFS Wildfire Managers' Attitude Toward Aviation Personnel Exposure and Risk

FY 2013 Presentations

- Calkin,D. Wildfire Risk Management: "PIROS (Wildfire Planning, Prevention and Fighting in Mediterranean Areas)", University of Sassari, Sardinia, Italy. April 17-19, 2013.
- Hand, M., M. Wibbenmeyer, D. Calkin, M. Thompson. "Risk Preferences and Decision Making in a Wildland Fire Context: Insights from a Multi-Attribute Lottery Experiment." Poster, Society for Risk Analysis Annual Meeting, San Francisco, CA. December 10, 2012.
- Hand, M. "Factors Affecting Fire Manager Decisions and Fire Outcomes." Wildfire Risk Perceptions and Attitudes Symposium, Society for Risk Analysis Annual Meeting, San Francisco, CA. December 10, 2012.

- Calkin, D. Dakota Chapter Society of American Foresters Annual Meeting. Wildfire and Public Land Management: Risks and Opportunities in the First Half of the 21st Century. Spearfish, S.D. October 10, 2012.
- McHugh, C., J. Cohen and D. Calkin. Missoula Fire Sciences Lab Seminar Series. "Fourmile Canyon Fire Science Review Findings." Missoula, MT. October 25, 2012.
- Calkin, D. Prescribed fire risk assessment workshop. "Economic issues of prescribed fire; risks and opportunities". Washington DC. December 13, 2012.
- Calkin, D. Oregon State University Wildfire Suppression Symposium Series. "Unknown Knowns of Federal Wildfire Management." Corvallis, OR. January 16, 2013.
- Calkin, D. International Association of Wildland Fire Fuels Conference. Plenary talk. "Can risk assessment help us untangle the wildfire paradox?" Raleigh, NC. February 20, 2013.
- Calkin, D. and M. Finney. Workshop on prescribed fire risk assessment in Colorado. "Wildfire risk to developed lands on the Colorado Front Range." Workshop with staff members of Senator Udall and leadership of Colorado Agencies with wildfire management responsibilities. Denver, CO. March 14, 2013.
- Hand, M., M. Wibbenmeyer, D. Calkin, M. Thompson. "Risk Preferences and Decision Making in a Wildland Fire Context: Insights from a Multi-Attribute Lottery Experiment." Poster, Society for Risk Analysis Annual Meeting, San Francisco, CA. December 10, 2012.
- Hand, M. "Factors Affecting Fire Manager Decisions and Fire Outcomes." Wildfire Risk Perceptions and Attitudes Symposium, Society for Risk Analysis Annual Meeting, San Francisco, CA. December 10, 2012.
- Hand, M., D. Calkin, M. Thompson. "Do Expenditures on Wildfires Save Homes? Evidence from the 2012 Fire Season." Selected presentation at the Western Agricultural Economics Association Annual Meeting, Monterey, CA. June 27, 2013.
- Thompson, M. Association for Fire Ecology: (Portland, OR) Applying a wildfire risk framework at multiple planning scales – case studies and lessons learned
- Thompson, M. Association for Fire Ecology: (Portland, OR) Safe & Effective Response: Cohesive Strategy
- Thompson, M. Society of American Foresters: (Spokane W) Modeling the Consequences of Escaped Large Wildland Fires
- Thompson, M. Society of American Foresters: (Spokane, WA) Applying Wildfire Risk Assessment to Inform Strategic Fuel Treatment Prioritization
- Thompson, M. Society for Risk Analysis: (San Francisco, CA) Informing Hazardous Fuels Prioritization at National and Regional Scales
- Thompson, M. Society for Risk Analysis: (San Francisco, CA) Human Dimensions of Wildfire Risk Management
- Thompson, M. IV International Symposium on Fire Economics, Planning, and Policy: (Mexico City) Wildfire Economics Research and the National Fire Decision Support Center
- Thompson, M. IV International Symposium on Fire Economics, Planning, and Policy: (Mexico City) Hazardous Fuel Treatments, Suppression Cost Impacts, and Risk Mitigation
- Thompson, M. National Fuels & Fire Ecology Workshop: (Albuquerque, NM) R2 Wildfire Risk Assessment & Prioritization Process
- Thompson, M. NEPA Knowledge Café Webinar: Structured Decision Making, NEPA, & the National Forest System
- Thompson, M. Association for Fire Ecology: Does 1% of the land area account for 99% of the wildfire threat?

- Thompson, M. International Association of Wildland Fire: Integrating knowledge bases and preference structures within wildfire risk assessment

FY 2013 Publications

- Calkin, D.E., T.J. Venn, M. Wibbenmeyer, and M.P. Thompson. 2013. Estimating US federal wildland fire managers' tradeoffs among strategic suppression objectives. International Journal of Wildland Fire. 22(2): 212-222.
- Haas, J. R., Calkin, D. E., & Thompson, M. P. (2013). A national approach for integrating wildfire simulation modeling into Wildland Urban Interface risk assessments within the United States. Landscape and Urban Planning, 119, 44-53.
- Hansen, A.J. N.B. Piekielek, C. Davis, J.R. Haas, D.M. Theobald, J.E. Gross,W.B. Monahan, T. Olliff, S.W. Running (2013) Exposure of US National Parks to Land Use and Climate Change 1900-2100 Ecological Applications http://dx.doi.org/10.1890/13-0905.1
- Holmes, T.P.; Calkin, David E. 2013. Econometric analysis of fire suppression production functions for large wildland fires. International Journal of Wildland Fire. 22(13): 234-245.
- Houtman, R.M.; Montgomery, C.A.; Calkin, David E.; Dietterich, T.G. 2013. Allowing a wildfire to burn: estimating the effect on future fire suppression costs. International Journal of Wildland Fire. Online early: http://dx.doi.org/10.1071/WF12157.
- Hyde, Kevin D.; Dickinson, M.B.; Bohrer, G.; Calkin, David E.; Evers, L.; Gilbertson-Day, Julie; Nicolet, T.; Tague, C. 2013. Research and development supporting risk-based wildfire effects prediction for fuels and fire management: status and needs. International Journal of Wildland Fire. 22: 37-50.
- Marcot, B. G., M. P. Thompson, M. C. Runge, F. R. Thompson, S. McNulty, D. Cleaves, M. Tomosy, L. Fisher, and A. Bliss. 2012. Recent advances in applying decision science to managing national forests. Forest Ecology and Management 285: 123-132.
- Scott, J., D.Helmbrecht, M.P. Thompson, D.E. Calkin, and K. Marcille. 2012. Probabilistic assessment of wildfire hazard and municipal watershed exposure. Natural Hazards. 64(1): 707-728.
- Thompson, Matthew P.; Stonesifer, Crystal S.; Seli, R.C.; Hovorka, M. [In Press] Developing Standardized Strategic Response Categories for Fire Management Units. Fire Management Today.
- Thompson, Matthew P.; Marcot, B.G.; Thompson, F.R.; McNulty, S.; Fisher, L.A.; Runge, M.C.; Cleaves, D.; Tomosy, M. 2013. The science of decision-making: Applications for sustainable forest and grassland management in the National Forest System. General Technical Report WO-GTR-88. Washington, D.C.: USDA Forest Service. 54pp.
- Thompson, Matthew P.; Hand, Michael S.; Gilbertson-Day, Julie W.; Vaillant, Nicole M.; Nalle, Darek J. 2013. Hazardous fuel treatments, suppression cost impacts, and risk mitigation. In: González-Cabán, Armando, tech. coord. Proceedings of the fourth international symposium on fire economics, planning, and policy: climate change and wildfires. Gen. Tech. Rep. PSW-GTR-245 (English). Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station: 66-80.
- Thompson, M.P., Calkin, D.E., Finney, M.A., Gebert, K.M., and M.S. Hand. 2013. A risk-based approach to wildland fire budgetary planning. Forest Science 59(1): 63-77.
- Thompson, M.P., Vaillant, N.M., Haas, J.R., Gebert, K.M., and K.D. Stockmann. 2013. Quantifying the potential impacts of fuel treatments on wildfire suppression costs. Journal of Forestry. 111(1): 49-58.

- Thompson, Matthew P.; Ager, Alan A.; Finney, Mark A.; Calkin, Dave E.; Vaillant, Nicole M. 2012. The science and opportunity of wildfire risk assessment (Chapter 6). In: Luo, Yuzhou, ed. Novel Approaches and Their Applications in Risk Assessment. New York, NY: InTech. p. 99-120.
- Thompson, Matthew P.; Calkin, David E.; Herynk, Jason; McHugh, Charles W.; Short, Karen C. 2012. Airtankers and wildfire management in the US Forest Service: examining data availability and exploring usage and cost trends. International Journal of Wildland Fire 22(2): 223-233
- Thompson, M. P., Scott, J., Kaiden, J. D., & Gilbertson-Day, J. W. (2013). A polygon-based modeling approach to assess exposure of resources and assets to wildfire. Natural Hazards 67: 627-644.
- Thompson, M.P., J. Scott, D. Helmbrecht, D.E. Calkin. 2013. Integrated wildfire risk assessment: framework development and application on the Lewis and Clark National Forest in Montana, USA. Integrated Environmental Assessment and Management 9(2): 329-342.
- Thompson, M. P. (2013). Modeling wildfire incident complexity dynamics. PloS one, 8(5), e63297.
- Wibbenmeyer, M., M. Hand, D. Calkin. 2012. Preliminary Results from a Survey of U.S. Forest Service Wildfire Managers' Attitudes Toward Aviation personnel Exposure and Risk, Research Note RMRS-RN-50WWW.

FY 2013 Cooperative Agreements/Partnerships

- University of Montana
- Oregon State University
- West Virginia University
- Southern Research Station
- Pacific Northwest Research Station, Threat Center
- Pacific Southwest Research Station
- US Geological Survey

FY 2014 Planned Activities

- Developing risk based performance metrics for the new Fire Investment Planning System to inform wildfire management budgeting and improve risk based tradeoff analysis
- Explore modeling concepts and potential impacts to highly valued resources at the community level using the "fireshed" concept.
- Provide study design and research analysis support to the Aerial Firefighting Use and Effectiveness (AFUE) Study
- Continue exploration of the interaction of suppression resource use, strategy development and physical factors to better understand and predict suppression efficacy.
- Initiate research into the potential of scenario based wildfire management strategy games.
- Continue analysis of risk attitudes and perceptions of managers using data from survey conducted in 2012. Ongoing research focuses on identifying the magnitude of various risk biases in manager decisions during an incident and their consequences for efficient allocation of suppression resources.
- Examine the relationships between geospatial characteristics and landscape heterogeneity with wildfire suppression costs.
- Improve models of daily suppression resource use by incident management teams to support incident decision support efforts.
- Examine factors affecting initial attack success, including use of aviation resources.

- Work with the Southwest Region (R3) to perform a wildfire risk assessment across the National Forests and Grasslands in that region
- Work with the USGS and TNC, among other partners, to assess the risks of post-wildfire debris flows on the Sandia and Jemez Mountains in New Mexico
- Model fuel treatment impacts on future wildfire activity and suppression costs
- Analyze the effect of past wildfire scars on suppression costs

Human Factors & Risk Management RD&A

FY 2013 Accomplishments

'Soft-skills' underly safe, reliable performance

In FY2013, the first comprehensive, empirical study of crew interaction and communication practices in federal wildland fire operations related to safety climate was completed. We focused on practices that facilitate development of a strong safety and learning climate (high reliability) in workgroups and the leadership attributes that best facilitate development of the reflective capacity that underlies a strong safety climate and improves decision-making abilities. With critical support from the NFDSC, our study identified key dimensions underlying respondents' experiences of wildland fire events within their work groups, and relationships between these dimensions (Fig. 4).
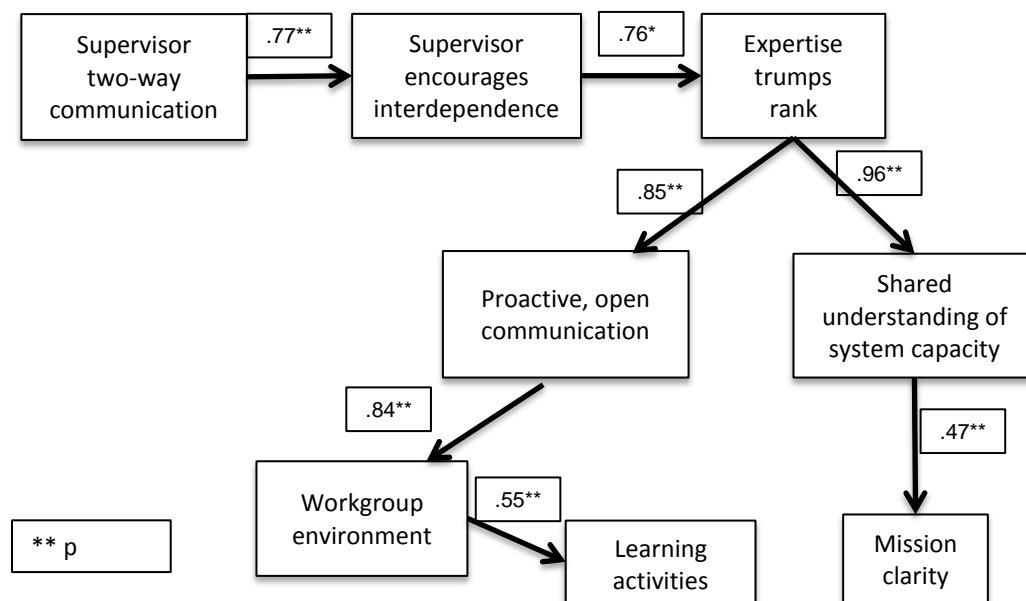

Figure 4. Structural equation model identifying significant paths among the dimensions of the safety climate in federal wildland fire operations. Paths are noted with weights and significant.

The dimensions of safety climate include: a suite of 'high reliability' practices that describe the ability of a system to empower expertise instead of default deference to rank, build rich group-level awareness and capacity for safe, effective action through open communications, and ensure cross-hierarchy flow of information to support a shared understanding of system capacity; two critical leadership skills that promote robust dialogue and teamwork; a suite describing curiosity and respect among workgroup members; practices associated with during- and after-action learning; and importance of open communication flow for clarity of mission and task.

While the overall perception of safely climate among federal wildland fire personnel is positive, there is room for improvement. For instance, while overall ratings for *Mission Clarity* are relatively high, results suggest that increasing attention on larger, more complex fires, particularly suppression events, would

be valuable. (Clarity was significantly higher for prescribed fire and wildland fire use events.) Paying close attention to ensure all units on these incidents have a clear understanding of their overall and daily mission as well as comfort in knowing how to achieve those is likely to improve *Mission Clarity*. Analysis also indicates that while most individuals serving in operational roles engage frequently in the safety practices measured, those serving either at the bottom or at the top who work within single, well-defined groups (such as Type 1 firefighters and incident command) score higher than those who supervise independent and often multiple tight-knit units (division supervisors, single resource, for instance). The strikingly lower ratings regarding the suite of high reliability practices and workgroup environment by those who knit the bottom and the top together is somewhat disconcerting, as these practices reflect the health of the critical information and knowledge flows that create the rich, nuanced situational awareness required for safety. Lower ratings at this location in the hierarchy indicates that potentially critical information about the broader goals of the incident may not be moving down to the ground, and/or signals indicating an important change in the fire environment may not be moving up and out. This creates a weak link in safety, particularly so as uncertainty increases, such as is likely on large, complex fires. Results suggest that incident managers may improve safety and performance by ensuring these positions are well integrated into incident communications, culture and feedback systems.

Findings deepen our understanding of the underpinnings of high performance in wildland fire, and point towards critical, concrete behaviors and practices that wildland fire incident management teams, crews and other resources can practice to support high reliability and safety. These include being attentive to the different perspectives and communication environment of key incident positions, building awareness of and capacity for high emotional quotient among supervisors through training, and building skills of all through practice.

Results are being integrated into both Apprentice Academy and Type 1 incident command courses. Results have also been presented at the Bureau of Land Managements' National High Reliability conference, and the Australian Bushfire Cooperative Research Centre's Research meeting in Melbourne. Project collaborators include: Dr. Anne Black (HFRM, NFDSC – lead), Dr. Jody Jahn, University of Colorado-Boulder, Dr. Brooke McBride, University of Montana. Partners include: National Forest Systems, Bureau of Land Management, and National Park Service.

Improving performance through improving organizational learning
Managing fuels – for ecosystem health and/or human safety at the Wildland-Urban Interface- continues to be both necessary and risky. Because these events are relatively rare, successful planning and executing of activities - whether proactively reducing fuels through prescribed fire, or reactively managing wildland ignitions – requires that managers learn as much as possible from each event and fold those lessons into the next activity cycle. All too often, however, analysis of unwanted events – escaped prescribed fire or fire-line accidents – reveal similar characteristics across time and location. Are current post-incident review processes as effective as possible? What might be done to improve learning?

With funding from the NFDSC and Joint Fire Science Program, we conducted multi-agency workshops across the United States to identify strengths and weaknesses in current prescribed fire review processes and key characteristics of successful learning efforts. Efforts also included mentoring a Middle Leader Program participant interested in improving her Region's prescribed fire program. Results of this are being presented to regional leadership.

Results of the multi-agency workshops indicate several key characteristics for effective learning, as well as areas for improvement. Key characteristics begin with the Line Officer in charge clearly establishing a learning as opposed to a retributive environment. Compiling an objective review team with excellent technical *and* soft skills (facilitative, high emotional and social intelligence), who are considered peers by those on the event, particularly if they have a prior relationship with the local unit greatly reduces organizational and individual defensiveness. These will be most effective in building skill and resiliency within the local unit. However, unless the lessons learned in the process are captured and actively introduced in relevant format to other units, little organization-wide learning will occur. The National Wildfire Coordinating Group based the new Interagency Prescribed Fire review process on these findings. Results also support the US Forest Service's new Coordinated Protocol. Findings provide concrete suggestions for Line Officers, Review Team members and subjects of reviews for establishing a tone and environment for most effective sense-making and subsequent learning.

Project collaborators include Dr. Anne Black (HFRM, NFDSC) – lead; Dr. Jennifer Ziegler, Valparaiso University; Dave Thomas, Renoveling, Inc.; and Dr. Jim Saveland, HFRM program lead. Partners include: National Forest Systems, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, Fish and Wildlife Service; and National Wildfire Coordinating Group, Fuels Committee.

Additional information on this research is available on-line on our web-page:
http://www.fs.fed.us/rm/human-factors/projects/escaped-fire/. The final report is also available at:
www.treesearch.fs.fed.us/pubs/44517.

FY 2013 Presentations, Oral & Poster

Short-courses
- Black, A.E. 2013. Northern Rockies Wildland Fire Management Teams (Hutton, McBratney). 'The Communication link: why team dynamics matter. HRO in the wildland fire community'. April 17, 2013, Missoula, MT.
- Black, A.E. 2013. High Reliability Organizing – in context, on your ground. S520- Advanced Fire Management , National Advanced Fire and Resource Institute (NAFRI), Tucson, AZ. March 11, 2013.
- Christenson, D., Black, A.E. HRO Simulation. S520- Advanced Fire Management , National Advanced Fire and Resource Institute (NAFRI), Tucson, AZ. March 11, 2013.
- Jahn, J.L.S. Reframing HRO: a focus on behavior. BLM National HRO Conference. Boise, ID. March 11, 2013.

Conference Presentations

- Black, A.E. 2013. From theory to practicality: High Reliability Organizing (HRO) in wildland fire management. Bushfire Cooperative Research Centre, Sept 1, 2013, Melbourne, Victoria, Australia.

Posters

- Black, AE, Thomas, D., Ziegler, J, Saveland, J. (2013) Tips and Techniques for Improving Learning from Events - Lessons from an assessment of learning from escaped prescribed fire reviews. (conference proceedings, poster abstract). Bushfire Cooperative Research Centre/ Australasian Fire and Emergency Service Authorities Council 'Shaping Tomorrow Together', Sept 1, 2013, Melbourne, Victoria, Australia.
- Ziegler, J, Black, A. (2013) Getting a 'shut down' culture to 'open up' for learning.. (conference proceedings, poster abstract). Bushfire Cooperative Research Centre/ Australasian Fire and Emergency Service Authorities Council 'Shaping Tomorrow Together', Sept 1, 2013, Melbourne, Victoria, Australia.

FY 2013 Publications

Peer-reviewed:

- Black, A.E.; McBride, B.B. 2013. *Safety climate in the US federal wildland fire management community: influences of organizational, environmental, group, and individual characteristics.* International Journal of Wildland Fire. http://dx.doi.org/10.1071/WF12154
- Black, A.E.; Thomas, D.; Ziegler, J.; Saveland, J. 2013. Learning as a shared responsibility: Insights from a series of dialogic workshops with practitioners, leaders, and researchers. [Extended Abstract] Proceedings of 3rd Human Dimensions of Wildland Fire, April 17 - 19, 2012, Seattle, Washington, USA. Published by the International Association of Wildland Fire, Missoula, Montana, USA.
- Jahn, J.L.S.; Black, A.E. (submitted). Integrating Approaches to High Reliability for a More Complex Theory: A Study of the US Wildland Firefighting Organization.

General Technical Reports:

- Black, A.E. (2013). *Incident Management Organization Succession Planning: Stakeholder Feedback*. USDA Forest Service, Rocky Mountain Research Station General Technical Report. Fort Collins, CO.
- Black, A.E.; McBride, B.B. (2013) Assessing high reliability practices in wildland fire management: an exploration and benchmarking of organizational culture. RMRS-RN-55. USDA Forest Service, Rocky Mountain Research Station General Technical Report. Fort Collins, CO.

Podcasts:

- *Overview: Learning from Escaped Prescribed Fire Reviews.* Thomas, D., Black, AE.
- *Part 1: Building a Prescribed Fire Learning Organization at the Local Unit Level*. Thomas, D., Black, AE.
- *Part 2: Establishing a Robust Learning Culture.* Thomas, D., Black, AE.
- *Part 3: Creating, Sharing, and Using Prescribed Fire Insights Locally.* Thomas, D., Black, AE.
- *Part 4: Using Dialogue to Improve Learning from Prescribed Fire Operations.* Thomas, D., Black, AE.
- *Part 5: Tips and Techniques to Deepend Prescribed Fire Organizational Learning.* Thomas, D., Black, AE.
- *Part 6: Leading Organizational Learning in Prescribed Fire Operations.* Thomas, D., Black, AE.

- *Stories aren't sterilized*: a discussion with Persephone Whelan, Assistant FMO Huron-Mantisee NF. Thomas, Dave.
- *Benefits of Staff Rides*: an interview with Dr. Elena Gabor, Asst Professor of Communications, Bradley University. Thomas, Dave.

Websites:
- HFRM website http://www.fs.fed.us/rm/human-factors/
- 22 project-specific web-pages, including:
  - Learning from Escaped Prescribed Fire: http://www.fs.fed.us/rm/human-factors//escaped-fire/;
  - Benchmarking High Reliability Practices in Wildland Fire http://www.fs.fed.us/rm/human-factors/projects/benchmarking-practices/

FY 2013 Cooperative Agreements/Partnerships

Universities
- University of California, Santa Barbara – Department of Communications
- Valparaiso University, Department of Communications
- Portland State University
- Notre Dame, Mendoza College of Business, University of Notre Dame
- University of Montana, School of Natural Resources; Department of Psychology
- Oregon State University– College of Health and Human Sciences, Department of Nutrition and Exercise Sciences
- Case Western Reserve University, Weatherhead School of Management

Federal Organizations
- Joint Fire Science Program
- National Advanced Fire Resource Institute (NAFRI)
- National Wildland Fire Coordinating Group (NWCG)
- S-520 HRO Faculty Cadre
- Wildland Fire Lessons Learned Center
- Northern Rockies Fire Science Consortium
- Organization Development Enterprise Team
- RMRS Safety Practitioner's Team

External and International Organizations
- Country Fire Authority, Victoria AU
- Latrobe University, Australia
- University of Melbourne, Australia
- Renoveling, Inc
- Guidance Group
- Digital Visions Enterprise Team
- Organization Development Enterprise Team
- RMRS Safety Practitioner's Team

FY 2013 Organizations and Representation

- RMRS Science Application and Integration (SAI),
- Human Factors and Risk Management Research, Development & Application Organizational Rep.
- 2013 Large Fire Analysis team

FY 2014 Planned Activities

- Expand current investigation of communications in wildland fire operations, particularly as it relates to the identification and communication of risks. This project is being developed in collaboration with several US and international Universities, including: Valparaiso, Bradley, Texas State Universities in the US; LaTrobe University and Kaplan Business School, Australia; Aix en Marseilles, France; and Scion research, New Zealand.
- Integration of research findings into modules for S-520 (Advanced Incident Management) course at the National Advanced Fire and Resource Institute (NAFRI). Development and submission of additional articles for both peer-review and wildland fire audiences.
- Development of three modules on Human Performance (mindfulness and resiliency) for the Basic Academy courses at the US Forest Service's Fire Academy in McClellan, CA.
- Support Regional and local pilot-tests of comprehensive well-being programs adapted from cutting-edge, internationally recognized leadership and performance curricula and training for the wildland fire community.
- Continued development of the SHARP individual job-aid tool designed to assist in real-time risk management by operational wildland fire staff.
- Continue development and testing of the Crew and Supervisor Perceived Leadership Scales that stem from recently completed PhD thesis. These scales provide a promising empirical mechanism for both benchmarking leadership competencies and measuring impact of training and intervention programs, such as those listed above.
- Build relationships with internationally recognized research institutions. Two projects are envisioned for FY14. Both seek to further develop and refine emerging human performance research linking and clarifying the impact of leadership competencies on team performance. One is with the Weatherhead Business School and Cleveland Clinic at Case Western Reserve University; the other with the NIOSH Center of Excellence at Oregon Healthy Workforce Center, through Portland State University.

Fire Spread Research

FY 2013 Accomplishments

The goal of the fundamental fire research program is to understand how wildfires spread so that practical improvements in modeling, training, and mitigation can be developed based on the actual physics of fire phenomena. For decades, models of wildfire spread have been developed and used, but they lack a common approach to representing and organizing the fundamental physical processes. The physical processes that produce fire spread can be easily listed (heat transfer, combustion, and ignition, entrainment etc.) but the organization, order, and required amounts are subjectively and speculatively applied in models because the experimental basis has never determined. This deficit in basic knowledge cripples our ability to make advancements in prediction, train and educate fire fighters in understanding their field observations, and mitigate fire losses and behaviors.   Without knowing how fire spread depends on fuels, topography, and weather, management decisions are dependent upon empirical and often incorrect formulations.

By the end of FY2013, our research program has revealed some surprising insights into how wildfires spread. Specifically, fire spread derives mainly from buoyant dynamics of the flame zone rather than the steady-state combustion and heat transfer or energy balance concepts that dominated approaches up to this point. Such a simple explanation implies that simple but physically-based modeling advances are within reach that can describe many of today's un-modeled fire behaviors.

Particle Heating and ignition

For several years now, we have been working to substantiate the details of fuel particle heating and ignition because work by the NFDSC has shown unequivocally that particle heating requires flame contact. This finding directly contradicts the assumptions used in almost all fire modeling for the past half-century. Previously, radiation has been assumed to be sufficient and necessary for heating and ignition of wildland fuel particles (grasses, leaves, needles, small branches) – but that is now known to be false.

Figure 5. Photo by Richard Barnes, NY Times, showing an experimental fire burning a laser-cut cardboard fuelbed in the Missoula Fire Laboratory wind tunnel.

These fine particles that dominate wildland fuel complexes are able to cool so efficiently from ambient air flow that they will not ignite from radiation. Thus, the remarkable conclusion is that flame contact (convective heating) is required for particle ignition and spread – and is only occurring in very close proximity to the active flame edge.

Buoyant Dynamics of Wildland Fires

Fire spread experiments conducted in Missoula by the NFDSC, and cooperators at the University of Kentucky and the University of Maryland, have found that flame structure and heat transfer is dependent upon buoyant instabilities. Instabilities represent the interplay between the hot gasses of the flame zone and the in-drafts to the fire front. They produce very clear patterns that are recognizable from well-known features of fluid flow in boundary layers. Thus, the surprising conclusion is that fire behavior is little different from other well-known fluid problems and not unique as a natural phenomenon. Flame fluctuations produced by buoyant instabilities result in non-steady heating by the flame (pulsation) that ignites fuels by intermittent convection. The first publications of these results were made in summer 2013 (see Finney et al. 2013, and Adam et al. 2013). The exciting implication of this work is that scale modeling based on other buoyant phenomena could rapidly lead to the ability to develop practical tools that apply equally well to small surface fires and to large-scale crown fires.

Figure 6. Photograph of large wooden crib (4'x4') burning for the study of flame structure and burning rate

Burning Rates of Fuel Complexes

The flame residence time is critical to the spread of wildland fires because if it is less than the ignition time, the fire won't spread. This is of particular concern when discussing the thresholds for crown fire spread (but even surface fires demonstrate spread thresholds), a currently poorly understood aspect of wildland fire. Curiously, no one theory exists for the prediction of residence time. The burning rate of wood cribs is pursued as an avenue toward a better understanding of the residence time because the two quantities are inversely related and the burning rate of cribs is highly repeatable. To vary the burning rate, cribs are built with different stick thicknesses and densities. Even though wildland fuels do not have the same predictable arrangement as wood cribs, we are interested in whether a fundamental understanding of what governs the burning rate of a crib will apply to the wildland fire context.

Convective heating and heating chemistry of live fuels

Recent evidence demonstrates that fine fuels require flame contact (very rapid convective heating) before ignition because convective cooling offsets radiative heating sufficiently to prevent ignition. Unlike dead fuels, live foliage can be up to half non-structural carbohydrates like sugars and starches which vary from physiological changes throughout the growing season. There is a complicated and unknown relation

between the chemical composition and moisture content that has a significant effect on the ignition of live fuels. In the first set of experiments, a wide range of both live and dead forest fuels were convectively heated with air temperatures ranging from 100°C to 600°C. In collaboration with the University of Montana, a high accuracy, fast response mass spectrometer was used to sample and analyze the pyrolysis products. The evolution of both water and carbon dioxide was measured along with the ignition time.

FY 2013 Presentations

- S. McAllister and M. Finney, "Effect of crib dimensions on burning rate," Seventh International Seminar on Fire and Explosion Hazards (ISFEH7), Providence, RI May 5-10, 2013.
- S. McAllister and M. Finney, "Using crib fires to predict flame residence time," Poster presentation, 4th Fire Behavior and Fuels Conference, Raleigh, NC, February 18-22, 2013.
- S. McAllister and M. Finney, "Convective ignition of forest fuels," 8th U. S. National Combustion Meeting, Park City, UT, May 19-22, 2013.
- Finney, M.A. . November, Portland Oregon. Presentation: Basic fire science and its role in supporting fire risk assessment
- Finney, M.A. . January, Helena MT. Presentation by Helena NF Fire Management Officer David Nunn to Forest Service, Helena City and community groups regarding fuel treatment and watershed damage in the 10-mile watershed.
- Finney, M.A. , K. Short. February. Oklahoma City, OK. Special session "Comparisons of Modern and Historical Risk Estimates Among Vegetation Types of the Continental US.
- Finney, M.A. . March, Helena MT. Presentation to general public on the condition of fuels in the northern Rockies and the magnitude of changes required to mitigate risk.
- Finney, M.A. August, Hirosaki, Japan. keynote address to the 7th International Symposium on Scale Modeling. Paper was titled: Fire spread in engineered cardboard fuelbeds: Part 1 Observations and Correlations". See Factor 4.D. publ. #111.
- Finney, M.A. and J.D. Cohen. October, Maryland. Smoke management meeting, presentation titled Operational Fire Modeling and Critical Research Questions.
- Finney, M.A., D.E. Calkin, A.A. Ager, J. Haas, C.W. McHugh. March. Denver, CO. Presentation to Colorado Governor's staff and Senate staff on Risk Analysis of Prescribed Fire Opportunities along the Front Range of Colorado
- Finney, M.A., D.E. Calkin, A.A. Ager, J. Haas, C.W. McHugh. June, Salt Lake City, UT. Presentation on Wildfire Risk and Mitigation: Examples for the State of Utah.
- McHugh, C.W. April 2013. Presentation on Geospatial support systems for improved forest fire management, Kathmandu, Nepal.
- McHugh, C.W. April 2013. FlamMap5 presentation to the Northern Rockies Fire Behavior Workshop.

FY 2013 Publications

- McAllister S. and M. Finney. 2013. Effect of crib dimensions on burning rate," Bradley, D.; Makhviladze, G.; Molkov, V.; Sunderland, P.; Tamanini, F., eds. Proceedings of the Seventh International Seminar on Fire and Explosion Hazards (ISFEH7). College Park, MD: University of Maryland, Research Publishing. doi: 10.3850/978-981-08-7724-8_0x-0x.
- McAllister S. and M. Finney, 2013. Convective ignition of forest fuels. 8th U. S. National Combustion Meeting, Park City, Utah, May 19-22, 2013.

- McAllister S. in press. "Critical mass flux for flaming ignition of wet wood," *Fire Safety Journal*, in press.
- Thompson, M.P, D.E. Calkin and M.A. Finney, K.M. Gebert, and M.S. Hand. 2013. A risk-based premium approach to wildland fire finance and planning. Journal: Forest Science. 59(1):63-77.
- Salis, M., A.A. Ager, B. Arca, M.A. Finney, V. Bacciu, P. Duce, D. Spano. 2013. Assessing exposure of human and ecological values to wildfire in Sardinia, Italy. Intl. J. Wildl. Fire. 22, 549–565
- Ager, A.A., M. Buonopane, A. Reger, M.A. Finney. 2013. Wildfire Exposure Analysis on the National Forests in the Pacific Northwest, USA. Risk Analysis. 33(6):1000-1020.
- Finney, M.A., J.D. Cohen, S.S. McAllister, and W.M. Jolly. 2013. On the need for a theory of wildland fire spread. Intl. J. Wildl. Fire. 22(1) 25-36.
- Finney, M.A., J.D. Forthofer, I.C. Grenfell, B.A. Adam, N.K., Akafuah, K. Saito. 2013. A study of flame spread in engineered cardboard fuel beds, Part I: Correlations and Observations. Seventh International Symposium on Scale Modeling, Hirosaki, Japan, August 6-9, 2013.
- Adam, B.A., N.K. Akafuah, M.A. Finney, J.D Forthofer, and K. Saito. 2013. A study of flame spread in engineered cardboard fuel beds, Part II: Scaling Law Approach. Seventh International Symposium on Scale Modeling, Hirosaki, Japan, August 6-9. 2013.
- Finney, M.A., T.B. Maynard, S.S. McAllister, I.J. Grob. 2013. A study of ignition by rifle bullets. RMRS Research Paper RMS-RP-104. Fort Collins, CO. 31p.
- Short, K. C. 2013. A spatial database of wildfires in the United States, 1992–2011, Earth Syst. Sci. Data Discuss., 6, 297-366, doi:10.5194/essdd-6-297-2013, 2013.

FY 2013 Cooperative Agreements/Partnerships

- University of Montana, Department of Chemistry
- University of Kentucky, Department of Mechanical Engineering
- University of Maryland, Department of Fire Protection Engineering

FY 2014 Planned Activities

- **Buoyancy Scaling** – Test existing buoyant-instability scaling relationships outside of the range of laboratory experiments with data collected from field burns and large-scale artificial fuel beds.
- **Burning Rates** – Extend crib-scaling to test applicability to spreading fires and to large scale artificial fuel beds
- **Ignition Experiments and Modeling** – Use of thermal camera to examine heating dynamics in spreading laboratory fires, continue experiments on individual particles in the laboratory with forced and natural convective cooling, continue numerical modeling of particle response to radiant heating, convective, heating, and convective cooling
- **Flame fluid dynamics** – continue work with experiments and modeling of fluid flow in flame zone.

Wildland Fire Management RD&A

FY 2013 Accomplishments

Develop, improve, and increase production & use of decision support products

Staff aided the use of decision support products for assessing and managing incident risk with the document, USFS Fire Response Protocol's 7 Standards for Managing Incident Risk & Wildland Fire Decision Support System, which addresses how the Standards for Managing Incident Risk is supported by and fits together with WFDSS. Staff worked with the Fire Use Subcommittee to produce a decision reference guide, to aid decision makers in application of principles to specific decision documentation structures such as WFDSS. FY2013 WFDSS enhancements improved functionality and usability for fire managers and decision makers including: functionality to spatially represent fire management plans which can help managers in their decision making, ability to create a delegation of authority within the system, and ability to create groups for multi-incident management.

Provide mentoring and other means to strengthen decision support capacity

The RDA mentee program provided opportunities for six individuals from the FS, NPS, FWS, and BLM to work with the RD&A in staggered 2 week virtual stints. Mentees worked with RD&A analysts to support wildland fires with fire behavior analysis and on-going projects. Four detailers worked with the RD&A as well: two focused on fuels related work and two filled in rotation with RD&A analysts to support fires. The RD&A coordinated a workshop at the International Association of Wildland Fire (IAWF) 4th Fire Behavior and Fuels Conference- at the Crossroads: Looking Toward the Future in Changing Environment in Raleigh, North Carolina February 2013. The workshop titled Advanced Fire Behavior Analysis Lessons Learned was attended by 10 participants and focused on advanced techniques used in geospatial fire analysis. Topics included challenges in modeling beyond the design limitations of the models, fire modeling challenges and solutions in the Lake States, and challenges and solutions in modeling fires in Alaska. RD&A analysts participated in regional fire behavior workshops in Regions 1 and 2, providing refresher/update information about WFDSS and fire behavior assessment.

Figure 7. The WFM RDA team, Fall 2013.

Integrate new knowledge into existing wildland fire curricula

RD&A staff are creating training modules for utilizing WFDSS in risk assessment and decision support. These modules can be embedded into current NWCG courses to ensure students are able to learn and utilize current applications and technology. Staff continue to participate as cadre of numerous courses:

S-590 Advanced Fire Behavior Interpretation, S-495 Geospatial Fire Analysis, Interpretation, and Application, S-490 Advanced Fire Behavior Calculations, S-520 Advanced Incident Management, Rx-510 Advanced Fire Effects, and FML Fire Management Leadership, and numerous regional trainings and workshops.

Provide Decision Support Analyses

Staff members also supported the Yarnell Fire Investigation team and developed fire perimeters and fire behavior information for July 30th since it was not available due to the rapidly changing fire environment. This reconstruction was completed using Moderate Resolution Imaging Spectroradiometer (MODIS), Short Term Fire Behavior modeling, digital photographs, and Wind Wizard wind outputs. The progression map provided assisted the investigation team in determining the fire location and fire behavior at many critical points during the incident. This information was served up in various KMZ files which can be used in developing teaching tools, reviewing the incident, and supported the investigation report.

The RD&A staff supported 86 incidents (FS, DOI, and other non-fed agencies) in eight geographic areas and one Decision Support Center in the Eastern Great Basin in FY2013. Virtual and on-scene support included fire behavior, decision documentation, analysis narratives and more (Figures 8-11).
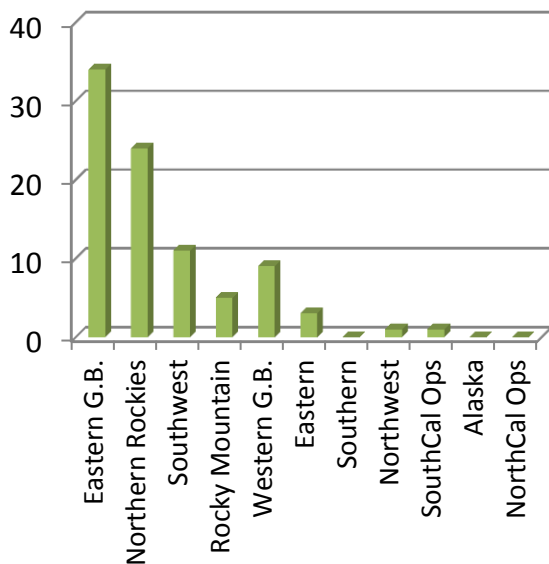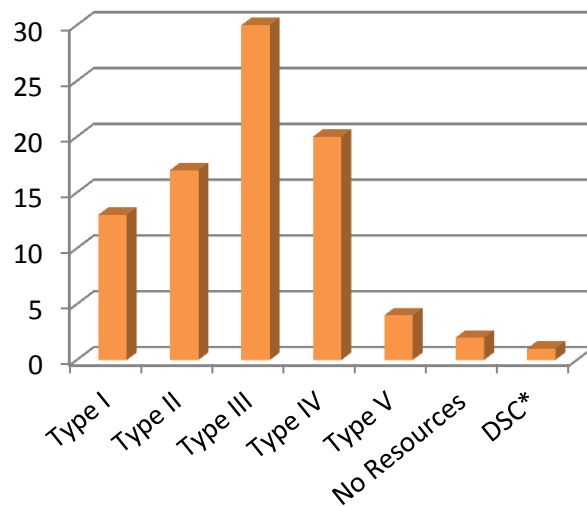

Figure 8. Support by Geographic Area in FY2013

*DSC = Decsision Support Center

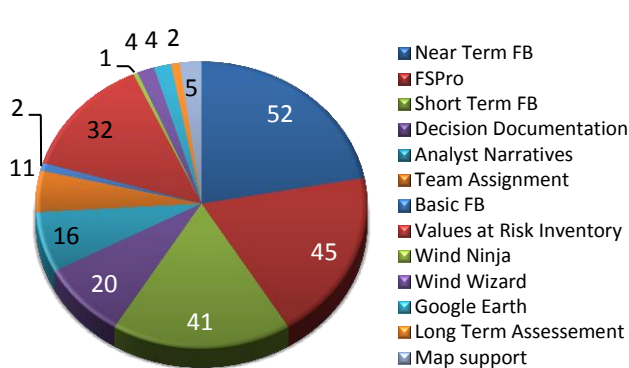Figure 9. Incident Type Supported in FY2013
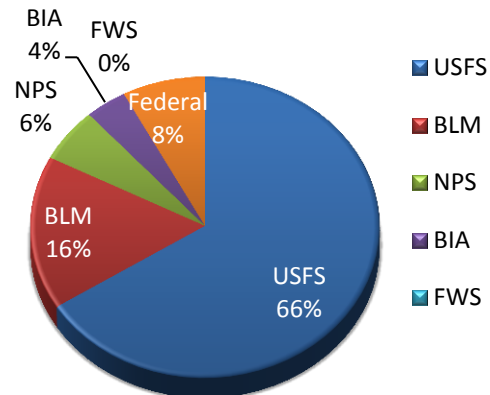
Figure 10. Support Products Provided in FY2013

Figure 11. Support Provided by Agency in FY2013

Provide link between scientists and field managers & advisor to program administrators

Collaboration resulted in an initial release of the Incident Risk Console (RisC), which provides a glimpse of fire activity, an early alert to developing situations, and risk assessment information at an incident level. The Risk Console (RisC) is a 'dashboard' concept that was designed at the request of the Washington Office as a tool for quickly assessing 8 primary elements of risk on large and emerging wildland fires in real time. The online tool consolidates data from WFDSS, ICS-209 and ROSS. Additionally, RisC incorporates cutting edge research on suppression capability, aviation exposure and probability of containment that are not currently available in any other system. Users of RisC can evaluate and compare overall risk between multiple incidents and further drill down into an individual incident to look at more detailed and specific metrics.   RisC will be available to authorized users as an extension of the Enterprise Geo-database (EGP) in 2014. To assist with building the 2013 prototype the WFM RD&A collaborated with WO-FAM, Forest Service Research (Economics and Fire Spread), and FAM-IT.

A full report of the 2013 WFM RD&A activities is available at, www.wfmrda.nwcg.gov

FY 2013 Presentations, Oral & Poster

- Advanced Fire Behavior Practices- Workshop presentation, facilitators. Raleigh, North Carolina. 4th Fire Behavior and Fuels Conference, Feb. 18-22, 2013
- Fuel Treatment Effectiveness and Longevity in California Coniferous Forests. Raleigh, North Carolina. 4th Fire Behavior and Fuels Conference, Feb. 18-22, 2013
- A Day in the Life of a Virtual Analyst- STFB and Holloway Fire. S-495 Missoula, Montana, April 12th, 2013.
- Risk Assessment in WFDSS. Local Fire Management Leadership. Missoula, April 9th, 2013.
- Effectiveness and Longevity of Fuel Treatments in Coniferous Forests across California. Webinar presentation to California Joint Fire Science Consortium, May 16th, 2013.
- Estimated Ground Medevac Layer and intended use in WFDSS. NWCG Risk Management Committee, January 30th, 2013.
- Fire Ecology and History. Fire Ecology in the Crown of the Continent, Polebridge, Montana. January 22, 2013.

- Refresher on WFDSS Analysis for Alaska users. Webinar for Alaska Modeling Workshop.
- Fire Weather and Fire Ecology. Workshop presentation for Wyoming Women in Science. October 12, 2012
- Use of the Wildland Fire Decision Support System for Implementation of the Greater Yellowstone Coordinating Committee's Whitebark Pine Strategy. 5th International Fire Ecology and Management Congress: Uniting Research, Education, and Management. Portland, Oregon. December, 2012.

FY 2013 Publications

- "LANDFIRE"—a national vegetation/fuels data base for use in fuels treatment, restoration, and suppression planning" Forest Ecology and Management, Volume 294, 15 April 2013, Pages 208-216
- Kevin C. Ryan (Missoula Fire Sciences Lab), Tonja S. Opperman (WFM RD&A)
- "Leveraging the Geospatial Advantage", Wildfire magazine, March/April 2013, Ben Butler and Andrew Bailey
- "Decision making for wildfires: A guide for applying a risk management process at the incident level", Gen. Tech. Rep. RMRS-GTR-298WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Station ID: GTR-RMRS-298 Pages 58, 2013 Taber, Mary A.; Elenz, Lisa M.; Langowski, Paul G.
- "Fiscal Year 2011 vs. 2012". Fire Season Comparison Infographic. Wildland Fire Management RD&A http://www.wfmrda.nwcg.gov/2011-2012%20Comparison.php
- Linking a Fire Probability Model to Management Decisions: Outcomes from Recent Fires in Yellowstone National Park. Co-Author Tonja Opperman. Paper presentation at 11th Biennial Scientific Conference on the Greater Yellowstone Ecosystem, Mammoth, WY. October, 2012.

FY 2013 Cooperative Agreements/Partnerships

- Air Fire Program, Pacific Northwest Research Station, http://www.airfire.org LANDFIRE Program, www.landfire.gov
- Cooperative agreement and development of Board of Directors for oversight of DOI Fire Application Specialists and their participation in the WRM RD&A and the NFDSC
- Desert Research Institute (DRI), http://www.dri.edu
- National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service NWS
- Fire, Fuel, and Smoke Science Program, RMRS, http://firelab.fire.org Human Dimensions Program, RMRS
- Fire Program Analysis (FPA), http://fpa.nifc.gov University of Idaho Wildland Fire Science Program
- Fire Research And Management Exchange System (FRAMES)- University of Idaho, www.frames.gov
- National Center for Landscape Fire Analysis (NCLFA)- University of Montana, http://firecenter.umt.edu
- Technical Fire Management (TFM), sponsored by the Washington Institute, http://www.washingtoninstitute.net
- Department of Interior- Office of Wildland Fire Coordination (OWFC), www.doi.gov/pmb/owf
- Bureau of Indian Affairs (BIA)
- Bureau of Land Management (BLM)
- Fish and Wildlife Service (FWS)

- National Park Service (NPS)
- US Geological Survey (USGS)
- Joint Fire Science Program (JFSP), www.firescience.gov
- Northern Rockies Fire Science Network, http://nrfirescience.org
- National Wildfire Coordinating Group (NWCG), www.nwcg.gov
- National Predictive Service Program (NIFC), www.predictiveservices.nifc.gov
- USFS Fire & Aviation http://www.fs.fed.us/fire
- Pacific Southwest Research Station, www.fs.fed.us/psw
- Pacific Northwest Research Station, www.fs.fed.us/pnw
- The Nature Conservancy (TNC), www.nature.org

FY 2013 Organizational Representation

- NWCG Forest Service Executive Board Representative
- NWCG Fire Behavior Subcommittee Chair
- NWCG Fire Planning Subcommittee Representative
- NWCG Fire Reporting/209 Subcommittee Representative
- NWCG Fire Danger Subcommittee Member
- NWCG Geospatial Subcommittee
- LANDFIRE Liaison
- Predictive Services/Intelligence Liaison
- RMRS Science Application and Integration (SAI) WFM RD&A Representative
- Fire Research And Management Exchange System (FRAMES) Liaison
- Air/Fire Group Liaison
- S495 Geospatial Fire Analysis, Interpretation, and Application Steering Committee Chairmen, Cadre, Mentors, Coaches
- S590 Advanced Fire Behavior Interpretation- Steering Committee Chairmen, Cadre, Mentor, Coach
- Rx510 Advanced Fire Effects Instructor
- Geospatial Equipment and Technology Applications (GETA) Liaison
- National Incident Management Organizations (NIMO) Liaison
- National Performance Measures Task Group Members
- Interagency IT Roadmap Project Liaison
- USFS Mobile Technologies Integration for Fire & Aviation Management
- Fuels Transition Research Representative
- Northern Rockies Consortium Liaison
- Cohesive Strategy Team Member
- Interagency Fuels Treatment Decision Support System Liaison
- Wildland Fire Science Partnership Liaison
- Fire Consortia for Advanced Modeling of Meteorology and Smoke (FCAMMS) Representative
- Desert Research Institute (DRI) Liaison
- BLM Data Standards Committee Member
- Interagency Fuels Planning Committee Representative
- Wildland Fire Institute Liaison
- Enterprise Geo-spatial Portal (Fire Common Operating Picture) Representative Fire Reporting Mobile Application Development Team Representative
- Dashboard WFM RD&A Representative

FY 2013 Workshops/Conference Attendance

- 5th International Fire Ecology and Management Congress: Uniting Research, Education, and Management. Portland, Oregon. December 3-7, 2012.
- 4th Fire Behavior and Fuels Conference, Raleigh, North Carolina. Feb. 18-22, 2013
- Regional Fire Behavior Workshop, Forest Service Region 1 and 2, Spring 2013.
- IFTDSS (Interagency Fuels Treatment Decision Support System) Evaluation Workshops. 12 workshops throughout winter/spring 2012/2013.

FY 2013 Training/Course Instruction

- Rx-510 Advanced Fire Effects, Tucson, AZ, February, 2013
- S-495 Geospatial Fire Analysis, Interpretation, and Application, Tucson, AZ, April 2013.
- Local Fire Management Leadership (FML), Missoula, Montana, April, 2013 and Boise, Idaho February, 2013
- NAFRI Fire Management Leadership, Tucson, AZ March, 2013
- S-400 Incident Commander, Boise, Idaho, February, 2013
- S-520 Advanced Incident Management, March, 2013
- S482 Advanced Fire Management Applications, Fall, 2013

FY 2014 Planned Activities

Integrate Research and Technology into Decision Support Systems for Better Decision Making
- Develop an online application for real-time downscaling of forecast winds
- Evaluate the Rocky Mountain Center gridded forecast versus the National Digital Forecast Database forecast and its potential use in WFDSS
- Work with partners to support and improve the Risk Console (RisC)
- Support Interagency Spatial Fire Management Planning efforts

Assist the Field to Increase and Improve Inputs for Timely Risk Based Decisions
- Work with the Rocky Mountain GACC to develop a new dynamic Predictive Services Website
- Provide incident decision support to the field
- Work with NFDSC members to develop training modules for decision-making and risk gaming
- Provide direct support to field in Risk Assessment: update/improve maps, tools, models, training

Evaluate, Test, Identify and WFDSS Enhancements that Support the Field
- Investigate and evaluate WFDSS enhancements and improvements for field, area, and national managers including: utilizing User Center Design Review, model improvements, risk assessment, improved fuel and weather data

Develop Applications for Fuels Treatment Planning
- Coordinate with partners on existing fuels risk assessment tools/processes
- Develop and support planning for effective fuels treatment in coordination with Forest Service Fire and Aviation Management Fuels/Fire Ecology program
- Prepare for IFTDSS implementation as interagency involvement is determined
- Manage NIFTT Contractors and University of Idaho agreement and staff

Incorporate Fire Effects into Decision Making
- Investigate methods to help units incorporate fire effects objectives in decision-making on wildland fires

Train the Wildland Fire Community in Utilization of Sponsored Products
- Coordinate with National Wildfire Coordinating Group training
- Provide training/support on RisC and risk products in WFDSS.

- Evaluate, assess, improve the materials and training for field users regarding WFDSS as a risk assessment tool
- Support national and geographic area fire behavior (or other) workshops
- Support national and regional level courses
- Provide training opportunities for field through WFM RD&A detailer/mentee program

Increase Awareness of the Rocky Mountain Center (RMC)

- Develop RMC Training & Outreach
- Continue RMC integration into WFMRDA

Support training for Fuels Treatment Planning

- Assist with integration of 40 FB Fuel Model and Nomograph Online Courses into NWCG fire behavior curriculum
- Provide Help Desk Support for NIFTT tools and online courses
- Participate on Fuels Specialist Workforce Development task team
- Coordinate interagency data standards and support improved Cadastral data
- Coordinate with Wildland Fire Information and Technology (I&T) and support Integrated Reporting of Wildland fire Information (IRWIN).
- Support data acquisition and automation, new imagery layers for WFDSS, and LANDFIRE futuring efforts