

FY 2012

National Fire Decision Support Center 2012 Report



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

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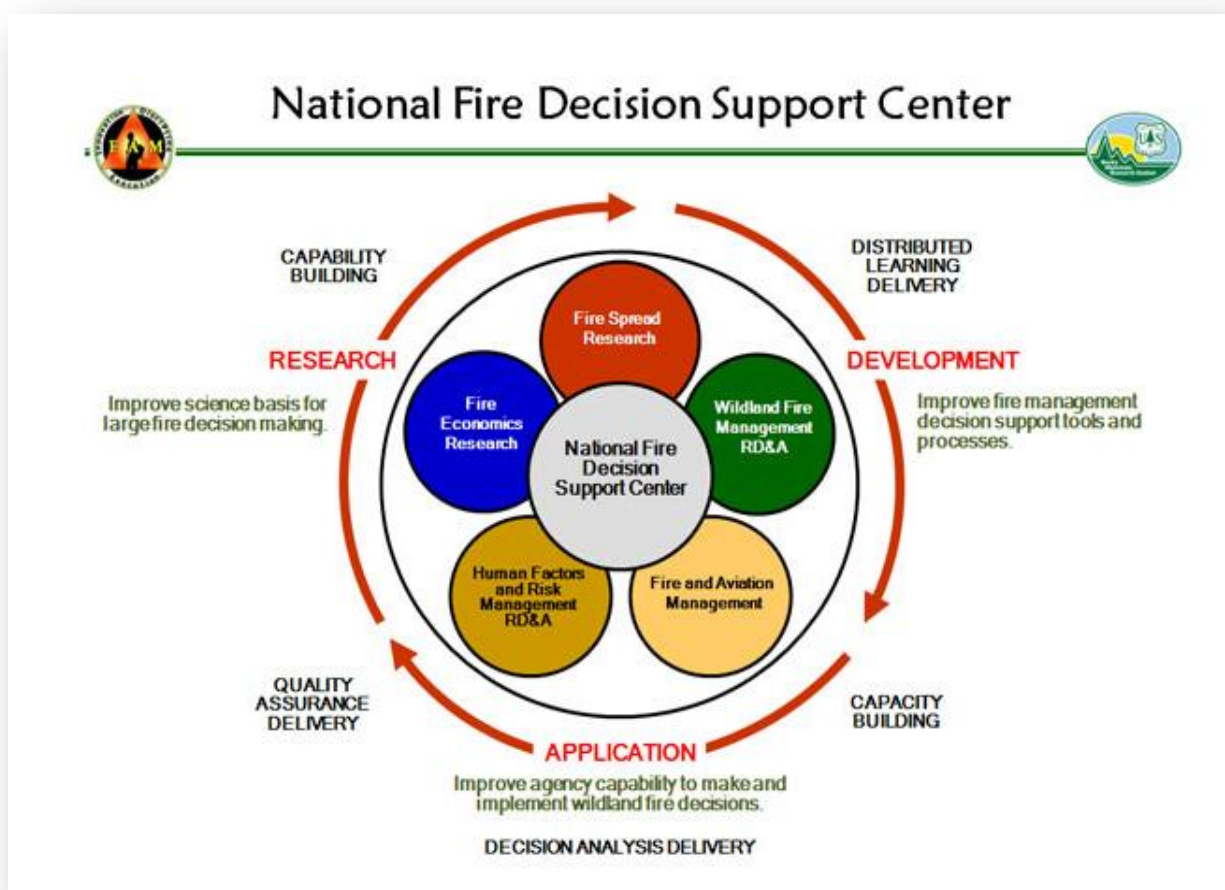
Introduction

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 three 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.



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), (RMRS, FAM, 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).

This report describes the NFDSC's accomplishments for fiscal year 2012. The main body of the report provides summary information highlighting projects and programs, while the appendix provides detailed lists of accomplishments and planned activities for 2013.

Figure 2. A firefighter monitors a burnout operation



NFDSC Emphasis Areas

- Advance fire modeling tools and capability
- Improve economic analysis of fire management decisions and actions
- Improve fire management performance measures
- Utilized 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 large fire decision making and management.

Fire and Aviation Management

Providing the means to accomplish research, development, and applications

The US Forest Service (USFS) is the largest forestry research organization in the world, with research stations and fire labs across the country conducting leading research in many fields of wildland fire science. Leveraging this science for field application and improved decision-making is the focus of the National Fire Decision Support Center (NFDSC) because science has changed the way we think about wildland fire and the way we manage it.

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.



Background photo: Saddle Fire, Bitterroot NF, Montana (Opperman). Right: Burnout on the Gallatin NF (Opperman). Lower left: NFDSC partners and cooperators.

● Fire Economics Research

FY12 Development & Application of Risk Assessment Tools

The wildfire economics team is a leader in the development and application of tools to understand the economic implication of wildfire management and wildfire risk assessment. The team explores the costs and benefits of investments in wildfire management in terms of expected net value change to the suite of developed and natural resources that society values. Primary research topics include integrated spatial risk assessment modeling, econometric modeling of fire management expenditures, effectiveness of suppression resource utilization, managerial incentives, and performance measurement.

Prioritizing Hazardous Fuels Treatments

In 2012 the wildfire economics team continued to demonstrate innovation, leadership, and a commitment to science delivery in the realm of wildfire economics and wildfire risk assessment. Building off of earlier research developing a spatial risk assessment framework, the team worked closely with partners in the Rocky Mountain Region to implement this framework to directly inform land management and budgetary allocation decisions (**Figure 3**). The Washington Office requested our involvement on an effort with the Region to demonstrate how risk principles could be more strongly incorporated into the Hazardous Fuels Priority Allocation System. Notably, the team traveled to Denver to collaborate closely with Paul Langowski, Branch Chief for Fire and Fuels in the Region, in order to incorporate a large fire risk assessment into regional hazardous fuels and preparedness allocation decisions. In FY 2013 the Region is allocating hazardous fuels and preparedness funding across Forests using the results of our assessment, with planned work continuing for FY 2014.

The team also travelled to Pueblo to work with the Pike and San Isabel National Forests on a similar process at the forest level, with plans to use the

assessment results for future fuel treatment prioritization efforts. Currently geospatial analysts within the Region are beta-testing a spatial risk calculation tool developed by members of the team that is ultimately intended for broader distribution as a computer-based decision support tool. Related work by the team in 2012 included participating in risk assessment workshops for the Bridger-Teton National Forest and the Grand Teton National Park, and providing risk and cost analysis results for the Deschutes National Forest as part of the Collaborative Forest Landscape Restoration Program.

Estimating Suppression Costs

The team has continued support and development of suppression cost models and performance measures. The cost model used in WFDSS, known as the Stratified Cost Index (SCI), was updated for the 2012 season using data from 2010 and 2011. Also, an SCI-based spreadsheet cost estimate tool was developed as a pilot project for fire management officers in the Northern Rockies region. This tool was created as a complement to the WFDSS SCI tool to allow managers in the field to quickly create a first estimate of potential suppression costs. Evaluation of the Northern Rockies cost tool is currently underway.

Figure 2. The Fire Economics team.



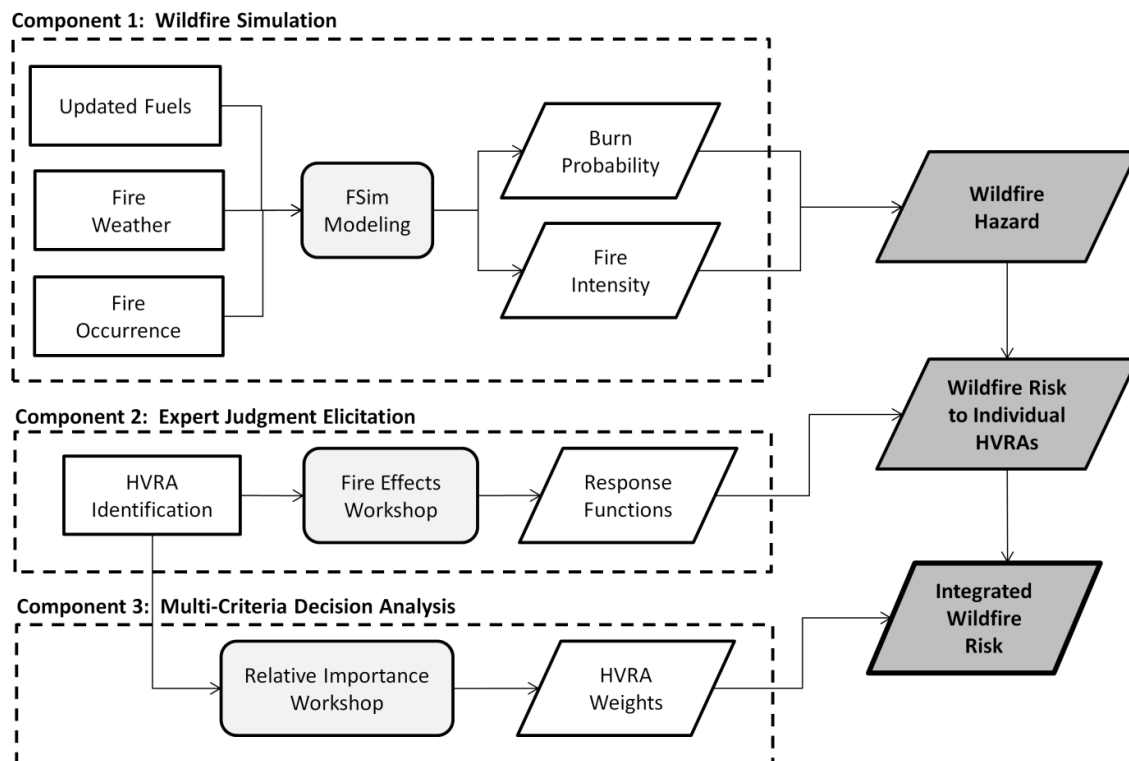
Perception of Risk in Fire Management

The team has made significant progress in better understanding risk perceptions and how risk preferences play a role in fire management decision making. Research completed to date indicates that fire managers weight the risks of fire outcomes differently depending on how much is at stake and the likelihood of different outcomes. These types of risk preferences make it difficult to select management strategies that efficiently manage risk in the fire management program. Ongoing research is investigating how the framing of information in decision support tools may affect risk preferences and strategy choices. This research also further explores how managers make tradeoffs between potential fire outcomes under circumstances where the worst potential outcomes have a very low chance of occurring (i.e., high-consequence, low-probability events) (**Figure 4**).

Effective Utilization of Suppression Resources

The wildfire economics team continues to explore how suppression resources are utilized to bring wildfires to containment. The team's research suggests that developed containment line progresses at a slower rate than estimated by the summation of the estimated productivity of individual suppression resources. Ongoing research is exploring how geography, fire weather, values at risk and team composition affect the efficiency of incident management teams and implications to firefighter exposure and safety. A focus area of this line of research is on the use and effectiveness of large air tankers in initial attack and large fire support. Improved understanding of the conditions under which suppression is most effective could lead to more efficient less costly wildfire suppression while reducing the exposure of firefighters to the hazards inherent to wildland firefighting.

Figure 3. This flowchart depicts the three primary analytical components of the risk assessment framework; wildfire simulation characterizes spatial variation in wildfire hazard, expert judgment elicitation captures knowledge on fire effects to highly valued resources and assets (HVRAs), and multi-criteria decision analysis differentiates the relative importance of HVRAs in the context of land and fire management priorities. Reference: Thompson et al., forthcoming, Integrated Environmental Assessment and Management.



Human Factors & Risk Management RDA

FY12 Investigation of Human Factors in Fire Management

The Human Factors & Risk Management (HFRM) RD&A leads the federal fire effort to understand and improve individual and organizational performance. The focus centers on understanding and building skills that promote safe, effective, and reliable wildland fire operations; designing this knowledge into decision-support tools and training; and partnering with field units to refine, deliver, and assess effectiveness. FY12 efforts funded in full or in part through the NFDSC include building a solid, science-based understanding of current decision-making at all levels of incident management, identifying strengths and gaps in critical leadership and group skills necessary to promote high performance, and providing expertise to the interagency wildland fire community.

Understanding the basis of safe decision-making at all levels of incident management

There are three separate efforts to better understand: (1) decision and learning processes in incident operations from Incident Management Teams to Agency representatives to hotshot crews (**Figure 5**); (2) crew interaction and communication practices that facilitate development of a strong safety and learning climate; (3) the leadership attributes that best facilitate development of a reflective capacity that underlies a strong safety climate and improves decision-making abilities. Funding for these projects was provided by the NFDSC, National Fire Plan, and Joint Fire Science Program.

Analysis of a survey of federal fire personnel (US Forest Service, Bureau of Land Management, National Park Service) challenges and enriches current understanding of how intra- and inter-group communications build and maintain situational awareness. Results suggest that mid-level incident positions (e.g. Division Supervisor, Task Force Leaders) are less integrated and connected to both upper and lower levels of the incident; a situation

that can lead to dropped and missed signals and inadequate communication. Results also quantify the influence of leadership and intra-group practices in creating an environment where members feel comfortable in raising safety concerns and alternative perspectives—the basis for group learning and engagement in highly reliable practices. Findings from a related PhD project indicate that the minimal condition for safety is a crew's comfort level with raising in-the-moment safety concerns. FY12 activities focused on separate analysis, presentation and preparation of results, including: four conference presentations, three extended abstracts, two manuscripts, 13 training sessions, and development of five leadership and decision-making assessment tools. In FY13, we plan to merge these three lines to synthesize and strengthen FY12 results and develop application materials.

Improving future decisions by improving organizational learning

With funding assistance from the NFDSC and the inter-agency Joint Fire Science Program, we are assessing existing learning and developing improvements to learning processes in the context of prescribed fire operations and post-incident review. NFDSC and JFSP funding created the opportunity to partner with external experts and institutions to leverage scarce internal staffing and

Figure 4. The HFRM team focuses on decision-making and safety at all levels of the fire management organization.



expand capabilities. In this project, we are partnered with Valparaiso University to obtain the expertise of their head of Department of Communications, and a contractor with knowledge of federal wildland fire, High Reliability, podcast production and dialogue. The project provided input to the National Wildfire Coordination Group's current effort to review and update the Interagency Prescribed Fire Guide. Results are also generating a clearer picture of the general climate for learning, and activities and processes that facilitate or impair individual and organizational learning. Activities in fiscal year 2012 focused on analysis, development and delivery of results to management and academic communities, with two white papers of initial findings released and 11 presentations made to management and scientific groups. Four manuscripts and six podcasts are in production with expected delivery dates in FY13.

Providing assistance to the interagency wildland fire community

Managing wildland fire, particularly large complex incidents, requires constant evolution in response to evolving environmental, social and organizational conditions (**Figure 6**). NFDSC staffs were invited to lead and/or participate in a number of interagency efforts to better position managers and the organization at large for the future. These included support to several National Wildfire Coordination Group sub-committees and task forces: the Incident Management Organization Succession Planning Team (developed, conducted, analyzed and presented Stakeholder Feedback); the Fuels Committee (lead interagency effort to update and revise interagency wildland fire implementation guide); the S-482 Advanced Fire Operations Training Cadre (assist with course materials).

Figure 5. Large, complex incidents typically have ever-changing environmental, social, and organizational conditions.



● Fire Spread Research

FY12 Fire Physics Research

Despite widely employed fire behavior models for fire management decision support, the physical explanation for how fires spread remains elusive. Experimental findings to date are often counterintuitive – suggesting that many of the physical mechanisms contributing to the spread and behavior of wildfires are actually misunderstood. Without an understanding of how fires spread, modeling and improvements to models cannot progress.

The fire science team is working to develop sufficient physical understanding of fire spread processes to permit practical improvements or replacements for operational models of fire behavior. The state of experimental research conducted by the NFDSC fire science team has been recently published¹. Fire spread is produced by a series of ignitions, so the first steps involve identifying key questions concerning combustion and heat transfer affecting ignition of wildland fuel particles. The second step is designing and conducting experiments to isolate and measure the specific responses. Specialized experiments have been conducted to 1) isolate radiative from convective heating of fuel particles, 2) examine the chemistry of live fuels when rapidly heated to ignition, and 3) to study flame structure and convective heating in spreading fires.

It is common knowledge that the “fine” fuels “carry” wildland fires. Fine fuels (pine needles, grasses) must, therefore, be easier to ignite than thicker fuel particles. But, when different heat

transfer mechanisms are explored experimentally, the experiments and analysis of radiation sources demonstrate a counterintuitive fact that radiant heating of fine particles does not result in ignition! A special set of experiments (**Figure 7**) conducted by the fire science team show that the radiant energy absorbed at the surface of small particles is removed very efficiently by convection – essentially cooling particles by convection as fast as they heat by radiation. Even in the presence of a long-duration radiant source, the small particles remain permanently far below ignition temperatures. Thus, if radiation (at fluxes common to wildland fires) can’t ignite the fine fuels, but the fine fuels carry the fire, then some other process must be responsible for ignition. Large particles (pencil sized sticks and greater) will ignite in about 20 seconds.

Figure 6. Grasses exposed to radiant heat but not igniting. These fine fuels require flame contact for ignition.



¹ Finney, M.A., J. Cohen, S. McAllister, and W.M. Jolly. “On the need for a theory of fire spread,” *International Journal of Wildland Fire*, special issue, 2012.

Convective heating and heating chemistry of live fuels

If radiation is insufficient to ignite fine fuel particles, then convective heating is the only heat transfer mechanism that remains capable of heating the particles. A special apparatus was constructed to provide a very hot convective heat source without radiation or contamination by other combustion reactions (such as a propane flame). This apparatus (**Figure 8**) uses electric heaters to produce a stream of hot air (above 600 C or 1100 F) into which various live and dead fuel materials can be subjected. Experiments show that fine fuels will ignite in seconds whereas larger particles require almost a minute before ignition – exactly the opposite of the radiation experiments!

Figure 7. A grand fir branch subjected to high temperature air (650 C), explosively releasing cell contents that ignite. High-speed imagery is used to investigate convective heating.

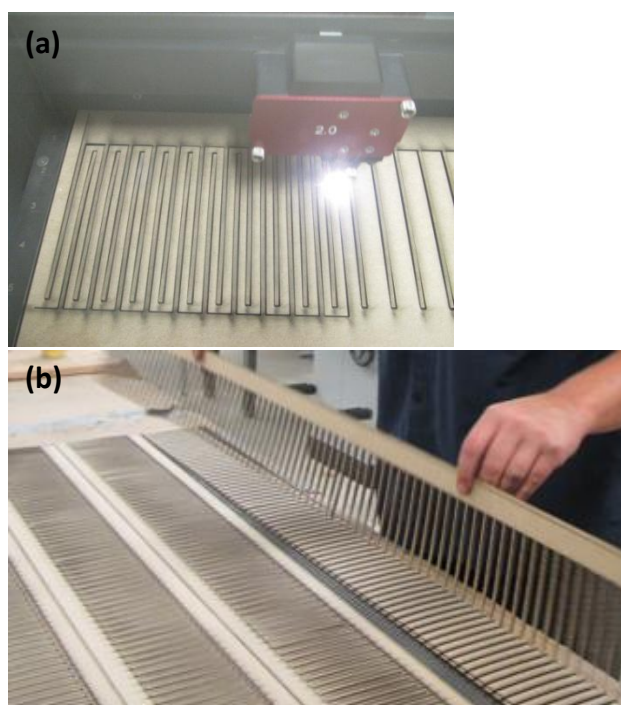


We use high-speed video to observe what happens to live vegetation subjected to the convective heating. This has shown that live conifer needles rapidly lose moisture when the cell walls explosively fail –ejecting the moisture and other cell contents into the hot environment. The chemical nature of this ejected material is not yet known, but is the subject of a first-of-its-kind collaborative effort with the University of Montana to use a Mass Spectrometer. The work is new but is anticipated to reveal the chemical signatures of plant matter released at different temperatures.

Fire behavior in engineered fuel beds

The source of convection in wildland fires is another key area of investigation. If fuel particle ignition requires flame contact, a crucial question emerges: what kind of flame contact environments exist at the leading edge of a fire to produce ignition? Ahead of an advancing fire, flames extend into the fuel bed, producing a non-steady or intermittent heating pattern on the fuel particles. This highly variable flame structure, and the fluid dynamics responsible for it, is the subject of laboratory experiments in precisely engineered fuel beds. The fire science team acquired a laser-engraver/cutter (**Figure 9**) that is used to cut precise fuel particles from cardboard. Cardboard “combs” are arranged vertically in long beds in the Missoula Fire Laboratory wind tunnel (see photo on Report cover). This is a revolution in experimental fuel bed construction compared to the use of excelsior or pine needles, allowing, for the first time, filming of instabilities and coherent structures in spreading fires that could be critical to understanding wildfire convective heat sources.

Figure 8. (a) Laser cutter used to produce uniformly engineered cardboard fuel beds, and (b) the laser-cut comb fuel bed that is created.



Wildland Fire Management RD&A

FY12 Science, Research, and Application Support

A leader in research, development, and application, the RD&A focuses on the following areas:

Developing, improving, and increasing production & use of decision support products

The use of decision support products increased in FY2012. WFDSS Lite, the mobile version of WFDSS, allows fire managers to use the application on their mobile devices. In coordination with the FS Line Officer Team the RD&A produced the Line Officer Desk Reference for Fire Program Managers (draft) to provide line officers with a reference for managing fires from pre to post-season. A 24/7 WFDSS helpdesk supports users with needs from password resets to technical assistance. Google Earth compatible downloads are available with more incident information from WFDSS to increase use and communication of the decision support products. The RD&A worked with Fire & Aviation Management IT to provide the Dashboard program (a national and regional resource for incident risk assessment information) with WFDSS outputs on risk assessment and economic products (**Figure 10**).

Providing mentoring and other means to strengthen decision support capacity

The detailer program provided opportunities for five people to work with Decision Support for 2 week virtual assignments. Detailers worked with WFM RD&A analysts to support incidents and on-going project work of the RD&A. The RD&A also maintained a list of Call-When-Needed (CWN) analysts and utilized them to increase capacity during periods of high activity. Both the Detailer and the CWN program provide the field with opportunities to increase decision support capacity.

Integrating new knowledge into existing wildland fire curricula

RD&A staff participates as instructors, mentors, committee members, and chairs of many 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. WFM RD&A staff also teach at regional and local workshops, through videos and online lessons. The National Interagency Fuels Technology Transfer (NIFTT) has recently been added to the RD&A, providing numerous courses, tools, tutorials, and user guides on analysis tools in fire behavior, effects, regimes, and vegetation dynamics.

Conducting Decision Support Analyses in support of fires

The RD&A staff supported 113 incidents and five Decision Support Centers in FY2012. Support was provided to the FS and all DOI agencies and other non-federal agencies. Virtual and on-scene support included fire behavior, decision documentation, analysis narratives and more.

Providing communication between scientists and field managers- and as an advisor to program administrators.

Collaboration resulted in changes to WFDSS fuel moisture calculations, utilizing an automated State of the Weather (SOW) to improve WFDSS fire behavior tool functionality, adding the 7 day fire potential outlook from Predictive Services and an estimated evacuation time map. The RD&A worked with many NWCG committees, scientists, and research groups. A full report of the 2012 WFM RD&A activities is available at, www.wfmrda.nwcg.gov

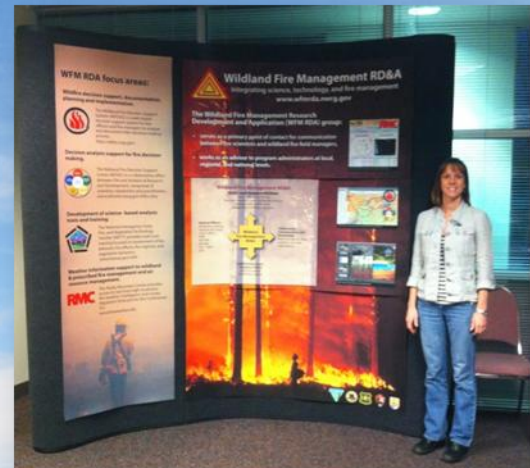


Figure 9. Providing real-time decision support.

Background photo: Sawmill Fire, Cibola National Forest New Mexico, photograph by Erin Noonan-Wright; Upper right photo: Morgan Pence at the Pacific Northwest Fire Behavior Workshop, Vancouver, WA: Presenting information about WFDSS, fire behavior modeling, and the WFM RD&A. Photograph by Mary Taber;

Lower right: Screen captures from WFDSS showing the 7-day Fire Potential Product in WFDSS from Predictive Services and a 3-day Near Term Fire Behavior projection completed by RD&A detailer Faith Ann Heinsch for the Weasel Fire Complex.

Lower left: WFDSS Lite, the mobile version of the WFDSS interface.



Appendix

● Fire Economics Research

Cooperative Agreements/Partnerships

- University of Montana
- Oregon State University
- South Dakota State University
- University of Idaho
- USDA Forest Service Western and Eastern Threat Assessment Centers
- Southern Research Station

Publications

- Calkin D.E., Venn T.J., Wibbenmeyer M., and M.P. Thompson. 2012. Estimating US federal wildland fire managers' preferences toward competing strategic suppression objectives. *International Journal of Wildland Fire* doi:10.1071/WF11075.
- Calkin, D., J. Phipps, T. Holmes, J. Rieck, and M. Thompson. 2011. The exposure index: Developing firefighter safety performance measures. *Fire Management Today*. 71(4): 9-12.
- Chung, Woodam; Venn, Tyron; Loeffler, Dan; Jones, Greg; Han, Han-Sup; Calkin, David. 2012. Assessing the Potential for Log Sort Yards to Improve Financial Viability of Forest Restoration Treatments. *Forest Science*. Available at: <http://dx.doi.org/10.5849/forsci.10-016>.
- Graham, Russell; Finney, Mark; McHugh, Chuck; Cohen, Jack; Calkin, Dave; Stratton, Rick; Bradshaw, Larry; Ned Nikolov. 2012. Fourmile Canyon Fire Findings. Gen. Tech. Rep. RMRS-GTR-289. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 110 p.
- Han, H.-S., T. Bilek, R. Dramm, D. Loeffler, and D. Calkin. 2011. Financial feasibility of a log sort yard handling small-diameter logs. Submitted to *Western Journal of Applied Forestry*. 26(4):174-182.
- Marcot, B.G., Thompson, M.P., Runge, M.C., Thompson, F.R., McNulty, S., Cleaves, D., Tomosy, M., Fisher, L.A., Bliss, A. 2012. Recent advances in applying decision science for managing national forests. *Forest Ecology and Management* doi: 10.1016/j.foreco.2012.08.024
- Scott, J., Helmbrecht, D., Thompson, M.P., Calkin, D.E., and K. Marcille. 2012. Probabilistic assessment of wildfire hazard and municipal watershed exposure. *Natural Hazards* 64(1): 707-728.
- 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*.
- Thompson, M.P., D.E. Calkin, M. Finney, K.M. Gebert, and M.S. Hand. 2012. A risk-based premium approach to wildland fire finance and planning. *Forest Science* doi: 10.5849/forsci.09-124.
- Thompson, M.P., Ager, A.A., Finney, M.A., Calkin, D.E., and N.M. Vaillant. 2012. The Science and Opportunity of Wildfire Risk Assessment. Chapter 6 in *Novel Approaches and Their Applications in Risk Assessment*, InTech, Rijeka, Croatia.
- Wibbenmeyer, M.J., Hand, M.S., Calkin, D.E., Venn, T.J., and M.P. Thompson. 2012. Risk Preferences in Strategic Wildfire Decision Making: A Choice Experiment with U.S. Wildfire Managers. *Risk Analysis* doi: 10.1111/j.1539-6924.2012.01894.x.

Presentations Oral/Poster

- Calkin, D. "Firefighter Exposure, Production Capacity and the Dashboard". National Fire Decision Support Center Seminar Series. June 7, 2012.
- Calkin, D. E. Four Mile Canyon Fire Public Release of the Science Review. "Economic and Social Aspects of the Four-Mile Canyon Fire". Boulder, CO, October 14, 2011.
- Calkin, D.E. Wildfire Risk Assessment in the United States. University of Sassari, Sardinia, Italy, May 29, 2012.
- Calkin D., and M. Wibbenmeyer. Seminar to Department of Engineering and Public Policy – Carnegie Mellon University. "US federal wildland fire managers' preferences toward competing strategic suppression objectives." February 7, 2012.
- Calkin, D.E., Venn, T.J., Wibbenmeyer, M. and Thompson, M.P. Society for Risk Analysis. "Estimating US federal wildland fire managers' preferences toward competing strategic suppression objectives." Charleston, SC. December 8, 2011.
- Gebert, K., Stockmann, K., and M. Thompson. 2012. Quantifying the Potential Impacts of Fuel Treatments on Wildfire Suppression Costs: Pilot Study of Deschutes National Forest. Western Forest Economists Meeting, Newport, OR, June 10-12, 2012.
- Gilbertson-Day, J. (2011). Sensitivity of fire behavior metrics to change in fuel data resolution and implications for landscape wildfire risk analysis. Interior West Fire Ecology Conference. Snowbird Utah, Nov. 14-18, 2011.
- Haas, J. Utility of GCMs and fire models for dealing with uncertainty in risk assessments. RMRS Climate Seminar Series oral presentation, January 19, 2012.
- Hand, M. 2012. A fire cost tool for the Northern Rockies region. Invited presentation to the Northern Rockies region FMO Spring meeting. Missoula, MT, April 10, 2012.
- Hand, M., D. Calkin. 2011. Availability of Suppression Resources As a Determinant of Fire Outcomes: The Role of Mega Fires. Selected presentation, Forest Ecology and Management Conference: Exploring the Mega Fire Reality. Tallahassee, FL, Nov. 16, 2011.
- Hand, M., D. Calkin, M. Thompson. 2012. Effects of Fire Prioritization and Regional Resource Allocations on Fire Outcomes. International Association of Wildland Fire 3rd Human Dimensions Conference, Seattle, WA. April 18, 2012.
- Thompson, M.P., and D.E. Calkin. 2011. Advancements in integrated wildfire risk assessment. Society for Risk Analysis Annual Meeting, Charleston, SC, December 4-7, 2011.
- Thompson, M.P. 2012. Wildfire Risk Assessment and Fuels Prioritization. National Fuels and Fire Ecology Conference. Denver, CO, March 27-29, 2012.
- Thompson, M., D. Calkin, M. Hand. 2012. Integrating Knowledge Bases and Preference Structures Within Wildfire Risk Assessment. International Association of Wildland Fire 3rd Human Dimensions Conference, Seattle, WA. April 19, 2012.

- Wibbenmeyer, M., M. Hand, D. Calkin, T. Venn, M. Thompson. 2012. Risk Preferences and Probability Weighting in Strategic Wildfire Decision Making: A Choice Experiment with U.S. Federal Wildfire Managers. Selected presentation at W2133 Annual Meeting. Park City, UT, Feb. 23, 2012.
- Wibbenmeyer, M., M. Hand, D. Calkin, T. Venn, M. Thompson. 2012. Risk Preferences and Probability Weighting in Strategic Wildfire Decision Making: A Choice Experiment with U.S. Federal Wildfire Managers. International Association of Wildland Fire 3rd Human Dimensions Conference, Seattle, WA. April 19, 2012.

Organizations/Representation

- Cohesive Strategy Science Team
- Fourmile Canyon Fire Review Team
- FPA Interagency Science Team
- Wildland Fire Performance Measures Science Team
- Large Airtanker Contract Review Team
- Prescribed Fire Strategic Risk Assessment Science Team
- Decision Science Synthesis Team

FY2013 Planned activities

- Spatial analysis of suppression costs – The team is working to incorporate spatially-explicit information to better understand the determinants of suppression costs. Using data from final fire perimeters, this modeling effort can provide a more accurate and detailed description of how landscape characteristics and management actions are related to costs. Results from these models will be used to complement current models for evaluating cost-based performance on large wildfires.
- Determinants of initial attack success – Data gathering using WFDSS during the past three fire seasons will allow us to analyze the effectiveness of initial attack efforts in avoiding large and costly fires. We plan to model the likelihood that fire ignitions escape initial attack efforts based on landscape characteristics, availability of suppression resources and site access (e.g., roads), and use of aviation resources during initial attack. WFDSS data will be combined with fire simulation outputs of fire ignitions to model fire behavior in the absence of initial attack; this data can indicate which fires had a high or low probability of escaping, and whether initial attack effort altered that probability.
- Fire manager decision making and risk preferences – We will continue to investigate how managers make suppression strategy decisions in risk-based scenarios relevant to fire management. A survey of fire managers conducted in spring 2012 asked managers to make hypothetical fire management strategy decisions when firefighters were exposed to different levels of risk, and potential damage and suppression costs varied in a risk-management framework. Analysis of this survey data will indicate how managers respond to changes in the probability of fire outcomes, and how tradeoffs are made between exposure of firefighters to risk and other costs. The analysis will also examine how decisions vary when information on firefighter risk is presented in different formats.
- Management team suppression resource utilization – We will investigate how incident management teams respond to different fire situations when assigned to a new incident, and how resource utilization develops over the course of an incident. This research will use resource ordering data paired with IMT

incident assignments to examine the roles of landscape and fire characteristics relative to IMT characteristics in determining the scale and resource mix used during suppression efforts.

- Spatiotemporal dynamics of fire and fuels – We will leverage recently developed techniques that integrate spatial fire models with forest growth models. Coupling these models will enable us to better examine landscape changes through time in response to fuel treatments and wildfire disturbance. Not only will we be able to evaluate trajectories of wildfire exposure and risks through time, but we will also be able to incorporate research findings into an economics framework considering treatment costs, expected suppression costs, and fire effects to valued resources and assets, enabling a more comprehensive approach to long-term cost-effectiveness analysis.
- Historical analysis of fuel treatment effectiveness – Together with Dr. Mark Cochrane of South Dakota State University, we will examine how past fuel treatments that interacted with fire changed likely outcomes. With a robust dataset of 85 historical fires that burned extant fuel treatments, we can estimate likely fire sizes had the treatments not been implemented. We will then combine these fire projections with a suite of geospatial layers representing highly valued resources and assets to quantify how treatments altered likely exposure. An auxiliary analysis will explore potential changes in final suppression costs due to altered fire sizes.
- Fuel investment tradeoffs – As part of the Collaborative Forest Landscape Restoration Program, members of the team examined how a landscape fuel treatment strategy on the Deschutes NF would alter expected future suppression costs. This work is forthcoming in the Journal of Forestry. In FY 2013, we will use these methods to examine a range of potential treatment levels and strategies, to better quantify tradeoffs between treatment costs and potential avoided costs.
- WFDSS, Incident decision making, and spatial fire management plans – A forthcoming article in Fire Management Today presents results of a study that evaluated Fire Management Unit (FMU) strategic objectives as uploaded into WFDSS. In FY 2013 we will look to published incident decisions in WFDSS and assess the degree to which pre-fire objectives align with decisions made on the incident. Additionally, we will work with RD&A to examine opportunities for refinement of FMU objectives and development of geospatial fire management plans that more clearly delineate areas of differential response according to wildfire risks.
- Financial risk analysis – We published an article in Forest Science outlining the pathway and rationale for adoption of actuarial principles into large fire financial planning, in particular the quantification of premium rates that reflect a given Forest's financial risk associated with suppression expenditures. Forests with greater financial risk will see higher premiums; adjustment of premiums in response to fuel treatment investments, or observed changes in fire management, provides a feedback loop into the system. We worked with professors from the University of Wisconsin School of Business.
- Colorado Front Range Risk Assessment – We will examine wildfire risk to populated areas and highly valued watersheds along the Front Range of Colorado. We will explore issues associated with transmission of wildfire risk between public and private lands and opportunities for fuel treatments to mitigate risk.
- Large Air tanker utilization - The team will expand analysis of large air tanker use and effectiveness. Examine patterns of current use and effectiveness and explore implications of basing and prepositioning

strategies. Scientists will continue to support the Large Air tanker Contract Study in the role of Agency subject matter experts.

- Efficiency of wildfire suppression resources – We will examine the factors that determine the effectiveness and efficiency of suppression resources in containing large wildfires through the use of daily perimeter maps and associated geographic conditions.
- Influence of climate change on future wildfire potential – We will quantify projected changes in national fire danger rating indices under future climate change. Additionally we will quantify projected changes in aridity and land cover/fuels under future climate change. Additionally, we will explore the physical characteristics, such as regionally synchronous fire weather, which provoke high national preparedness levels.

Cooperative Agreements/Partnerships

Universities

- University of California, Santa Barbara – Department of Communications
- Valparaiso University, Department of Communications
- Notre Dame, Mendoza College of Business, University of Notre Dame, Notre Dame, IN.
- 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
- Yale University, School of Forestry
- Pennsylvania State University
- University of Idaho

Joint Fire Science Program

- National Wildland Fire Coordinating Group
- Incident Management Organization Succession Management
- Fire Use Subcommittee
- National Fuels Committee
- USFWS National Fuels Group
- USFS National Fuels
- NPS National Fuels Program
- Wildland Fire Lessons Learned Center
- Northern Rockies Fire Science Consortium

External and International

- Country Fire Authority, Victoria AU
- Latrobe University, Australia
- Renoveling, Inc
- Guidance Group
- Digital Visions Enterprise Team
- Organization Development Enterprise Team
- RMRS Safety Practitioner's Team
- Inter-Agency

Publications

- Black, A.E. 2011. *Incident Management Organization Succession Planning: Stakeholder Feedback Data Summary*. National Wildfire Coordinating Group, November 17, 2011.
- Gebert, K.M; Black, A.E. 2012. Effects of suppression strategies on federal wildland fire expenditures. *Journal of Forestry* 110(2):65-73. <http://www.treeseearch.fs.fed.us/pubs/41937>
- Black, A.E. (In Press). *Incident Management Organization Succession Planning: Stakeholder Feedback*. USDA Forest Service, Rocky Mountain Research Station General Technical Report. Fort Collins, CO.
- Black, A.E.; Thomas, D.; Ziegler, J.; Saveland, J. (In Press) *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.

- Black, A.E.; Thomas, D.; Ziegler, J.; Saveland, J. *Learning as a shared responsibility: Insights from a series of dialogic workshops with practitioners, leaders, and researchers*. [Abstract] In: Robinson, M. comp. Program and Abstracts of 3rd Human Dimensions in Wildland Fire Conference; 17-19 April 2012; Seattle, WA. p. 107. <http://www.treeseearch.fs.fed.us/pubs/41940>
- Black, A.E.; Thomas, D.; Ziegler, J.; Saveland, J. *Tips, techniques, and suggestions for improving learning from escaped prescribed fire reviews*. [Poster Abstract] In: Robinson, M. comp. Program and Abstracts of 3rd Human Dimensions in Wildland Fire Conference; 17-19 April 2012; Seattle, WA. P 136. <http://www.treeseearch.fs.fed.us/pubs/41939>
- McBride, B.B.; Black, A.E. (In Press) *Variations in high reliability practices in the federal fire community: Relative contributions of agency affiliation, years of experience, and position hierarchy and function*. Proceedings of 3rd Human Dimensions of Wildland Fire, April 17 - 19, 2012, Seattle, Washington, USA. International Association of Wildland Fire, Missoula, Montana, USA.
- Black, A.E.; McBride, B.B. (submitted) *Safety climate in the US federal wildland fire management community: influences of organizational, environmental, group, and individual characteristics*. International Journal of Wildland Fire.
- Black, A.E.; McBride, B.B. *Safety climate in the US federal wildland fire management community: influences of organizational, environmental, group, and individual characteristics*. [Abstract] . In: Robinson, M. comp. Program and Abstracts of 3rd Human Dimensions in Wildland Fire Conference; 17-19 April 2012; Seattle, WA. p. 54. <http://www.treeseearch.fs.fed.us/pubs/41948>
- Black, AE; Saveland, J; Thomas, D; Ziegler, J. 2012. *Using escaped prescribed fire reviews to improve organizational learning*. Final Report to Joint Fire Science Program (JFSP project 10-2-05-1). <http://www.treeseearch.fs.fed.us/pubs/41938>
- Jahn, JLS; Putnam, LL; & Black, AE. 2012. *The Communicative Construction of Safety in Wildland Firefighting. Final Project Report* (JFSP Project Number: 10-3-01-4). July 10, 2012. Santa Barbara, CA. <http://www.treeseearch.fs.fed.us/pubs/41950>
- Black, A.E.; Thomas, D.; Saveland, J. 2011. *Learning from escaped prescribed fire reviews – A Joint Fire Science Project – Initial Findings*. White paper posted to Joint Fire Science Program’s project website. 2p.
- Black, A.E.; Norman, A.; Rowley, A.; Mark, C.; Fay, B.; Hutton, D.; Irwin, E.. April 20, 2012. Reference Guide for Risk-informed Wildfire Decision-making. Report submitted to NWCG Working Team Fire Use Subcommittee (Taber).
- Black, A.E.; McBride, B.B. [abstract]. Types and status of high reliability practices in the federal fire community. In: Robinson, M. comp. Program and Abstracts of 3rd Human Dimensions in Wildland Fire Conference; 17-19 April 2012; Seattle, WA. p. 52-53. <http://www.treeseearch.fs.fed.us/pubs/41941>
- Ziegler, J.; Black, A.E. 2012. *Pleasing some of the people some of the time: how authors, subjects, and readers assess the complex landscape of ‘audience’ in wildland fire incident reviews*. [Abstract] In: Robinson, M. comp. Program and Abstracts of 3rd Human Dimensions in Wildland Fire Conference; 17-19 April 2012; Seattle, WA. p. 56. <http://www.treeseearch.fs.fed.us/pubs/419481>
- Black, A.E.; McBride, B.B. (In prep). High reliability practices in wildland fire management: an exploration and benchmarking of organizational culture.
- Thomas, D.; Black, A.E. A series of six short (4-8 minute) Podcasts (in final production)
 - Learning from Escaped Prescribed Fire Reviews – Overview
 - Podcast 1: Building a Prescribed Fire Learning Organization at the Local Unit Level

- *Podcast 2: Workplace Culture and the Prescribed Fire Learning Organization*
- *Podcast 3: Capturing, Sharing and Using Prescribed Fire Insights Locally*
- *Podcast 4: Using Dialogue to Improve Learning in Prescribed Fire Operations*
- *Podcast 5: Tips and Techniques to Deepen Prescribed Fire Organizational Learning*
- *Podcast 6: Creating a Learning Environment: Tips for Line Officers*

Presentations Oral/ Posters

Management Community Presentations - Knowledge Transfer Workshops and Advisory Meetings

- Black, A.E. 2011. *Learning from Escaped Prescribed Fire Reviews*. NWCG Fire Use Subcommittee: Black, A.E. Dec 14, 2011. Invited extended presentation and briefing of NWCG's Fire Use Subcommittee. Lakewood, CO.
- Black, A.E. 2012. *Learning from Escaped Prescribed Fire Reviews*. USFWS National Fuels Meeting. January 25, 2012. Learning from Escaped Prescribed Fire. Invited session conducted via VTC – Missoula-Atlanta).
- Black, A.E. 2012. *Learning from Escaped Prescribed Fire Reviews*. NWCG Fuels Management Committee. Invited extended presentation and briefing of NWCG's Fuels Management Committee. February 2, 2012. Boise, ID.
- Black, A.E. 2012. *Learning from Escaped Prescribed Fire Reviews*. Invited international Webinar (Wildland Fire Lessons Learned Center). February 21, 2012.
- Black, A.E. 2012. *Learning from Escaped Prescribed Fire Reviews*. USFS National Fuels Group. Invited extended presentation and briefing March 29, 2012. Lakewood, CO.

Professional Conference Presentations

- Black, A.E.; Ziegler, J.; Saveland, J.; Thomas, D. 2012. *Learning as a Shared Responsibility: insights from a series of dialogic workshops with practitioners, leaders, and researchers*. 3rd Human Dimensions in Wildland Fire Conference, International Association of Wildland Fire, Seattle, WA April 17-19, 2012.
- Ziegler, J.; Black, A.E. 2012. *Pleasing some of the people some of the time: how authors, subjects, and readers assess the complex landscape of audience in wildland fire incident reviews*. 3rd Human Dimensions in Wildland Fire Conference, International Association of Wildland Fire, Seattle, WA April 17-19, 2012.
- Black, A.E. 2012. *Tips, Techniques, and Suggestions for Improving Learning from Escaped Prescribed Fire Reviews*. (poster) 3rd Human Dimensions in Wildland Fire Conference, International Association of Wildland Fire, Seattle, WA April 17-19, 2012.
- Black, A.E.; McBride, BB. 2012. *Types and Status of High Reliability Practices in the federal Fire Community*. 3rd Human Dimensions in Wildland Fire Conference, International Association of Wildland Fire, Seattle, WA April 17-19, 2012.
- McBride, BB; Black, A.E. 2012. *Variations in High Reliability Practices in the Federal Fire Community: Relative Contributions of Agency Affiliation, Years of Experience, and Position Hierarchy and Function*. 3rd Human Dimensions in Wildland Fire Conference, International Association of Wildland Fire, Seattle, WA April 17-19, 2012.

Workshops/Conference Attendance

- 3rd Human Dimensions in Wildland Fire Conference, International Association of Wildland Fire, Seattle, WA April 17-19, 2012.

Training

- S-482 Advanced Fire Management

Organizational Representation

- RMRS Science Application and Integration (SAI), HFRM RDA Organizational Rep.

FY13 Planned Activities

Planned activities for FY13 call for a continued focus on research, development and application of human factors and organizational knowledge and tools to assess and improve wildland fire decisions. This includes:

- Identification of the primary and secondary influences on team/group/crew safety and situational awareness;
- Development of international partnerships, manuscripts and outreach materials to assist in improving organizational learning;
- Further development of structures to assist in the development and assessment of risk-based decision making; continuing to provide requested assistance to the interagency wildland fire community.
- Widely distribute results and provide training leads for integration into various training programs.

Fire Spread Research

Cooperative Agreements/Partnerships

- Challenge-cost-share agreement with Dr. Bob Yokelson, University of Montana for “Measuring high resolution mass spectra, at high time resolution of the products of fast pyrolysis of wildland fuels and standards”.
- Challenge-cost-share agreement with Prof. Kozo Saito and Prof. Nelson Akafua for “experimental investigation of fire whirls and flame structure of free burning laboratory fires”.
- Contract with GCS Research for programming on initial attack modeling for Fire Program Analysis.
- Joint Fire Science Program funding for “Determination of Effects of Heating Mechanisms on Ignition of Live Fuels”. Partners include David Weise – PNW Research Station, Thomas Fletcher – BYU, Sara McAllister, Matt Jolly, Shankar Mahalingham – University of Alabama, Huntsville, Babak Shotorban – University of Alabama, Huntsville.
- Partnership with Missoula Technology Development Center and San Dimas Technology Development Center on new research into gunfire related ignitions in wildfires.
- Fire program analysis (FPA). NFDSC has close partnership with the FPA team for large fire modeling and for research into improvements to initial attack modeling.

Publications

- Ager, A.A., N.M. Vaillant, and M.A. Finney. 2011. Integrating fire behavior models and geospatial analysis for wildland fire risk assessment and fuel management planning. *J. Comb.* Article ID 572452, 19pp
- Ager, A.A., N.M. Vaillant, M.A. Finney, H.K. Priesler. 2012. Analyzing wildfire exposure and source–sink relationships on a fire prone forest landscape. *For. Ecol. Mgt.* 267:271-283
- Ager, A.A., M.A. Finney, N.M. Vaillant. 2012. Analyzing the spatial transmission of wildfire risk from large fires. In *Modelling Fire Behaviour and Risk*, Eds: D. Spano, V. Bacciu, M. Salis, C. Sirca. Nuova StampaColor. ISBN: 978-88-904409-7-7. p 108-113
- Cochrane, M.A., C.J. Moran, M.C. Wimberly, A.D. Baer, M.A. Finney, K.L. Beckendorf, J. Eidenshink, Z. Zhu. 2012. Estimation of wildfire size and risk changes due to fuels treatments. *Intl. J. Wildl. Fire*
- Finney, M.A., J. Cohen, S. McAllister, and W.M. Jolly. “On the need for a theory of fire spread,” *International Journal of Wildland Fire*, special issue, 2012.
- Graham, Russell; Finney, Mark; McHugh, Chuck; Cohen, Jack; Calkin, Dave; Stratton, Rick; Bradshaw, Larry; Nikolov, Ned. 2012. Fourmile Canyon Fire Findings. Gen. Tech. Rep. RMRS-GTR-289. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 110 p
- Jolly, W.M. , R.A. Parsons, A.M. Hadlow, G.M. Cohn, S.S. McAllister, J.B. Popp, R.M. Hubbard, and J.F. Negron. “Relationships between moisture, chemistry, and ignition of *Pinus contorta* needles during the early stages of mountain pine beetle attack,” *Forest Ecology and Management* 269: 52-59, 2012.
- McAllister, S.S. I. Grenfell, A. Hadlow, W.M. Jolly, M. Finney, and J. Cohen. “Piloted ignition of live forest fuels,” *Fire Safety Journal* 51: 133-142, 2012.

- Werth, P.A. , B.E. Potter, C.B. Clements, M.A. Finney, S.L. Goodrick, M.E. Alexander, M.G. Cruz, J.A. Forthofer, and S.S. McAllister. "Synthesis of Knowledge of Extreme Fire Behavior: Volume 1 for Fire Managers," General Technical Report, PNW-GTR-854, Pacific Northwest Research Station, 144p., 2011.

Presentations Oral/Posters

- F.A. Heinsch, S. McAllister, R. Loehman, and P. Sikkink, "A look forward – perspectives on wildland fire during the next 30 years," Missoula Fire Laboratory Seminar Series, May 3, 2012.
- McAllister, S.S., M. Finney, and J. Cohen. "Critical Mass Flux (CMF) for Flaming Ignition of Wet Wood," Poster presentation *34th International Symposium on Combustion*, Warsaw, Poland, July 29-Aug 3, 2012.

FY13 Planned Activities

- Radiant heating dynamics of fuel particles. This is a continuation of work to understand the response of fuel particles (small and large) to radiant heating. Fuel particle clusters of various densities will also be investigated.
- Convective heating of live and dead fuel particles. Continuing with the convective heating work, live and dead fuel of varying types (broad leaf shrubs and trees and needles) to examine moisture loss and ignition.
- Mass spectrometer analysis of live fuels during rapid convective heating. Analysis of chemical signatures during live and dead fuel heating will continue so that the process of live fuel ignition and combustion can be understood.
- Flame structure in laboratory burns of engineered fuel beds. The laser-engineered fuel beds are being constructed in different configurations for studying flame structure and convective heating of fuel particles in spreading fires.
- Fuel burning rates in laboratory cribs. The rate of burning of wildland fuels, and consequent energy release rates, is largely unknown. Previous data on fuel consumption rates by many different researchers does not conform to a single theory that explains how long fuels burn. This is critical information for understanding the energetics of the flame zone.
- Initial attack modeling at local to national scales. Initial attack suppression activities are being modeled across spatial scales as part of the effort to improve the modeling used by Fire Program Analysis.
- Aerial Fire Fighting Use and Effectiveness Study. Work is continuing with many partners to document operational effectiveness of aerial fire retardant.
- Investigation of gunfire-related wildfire ignitions. Dozens of fires are determined to be started by target shooters annually. In collaboration with MTDC and SDTDC, experimental research is being conducted to empirically determine factors related to ignitions following bullet impact.
- Assembly of historical fire records from all national sources will be continuing for purposes of use by FPA as well as NFDSC research.
- Testing of improvements to large fire simulation for risk analysis. Numerous improvements to the FSim program have been developed and are being tested for forthcoming uses in large-scale risk assessments.
- Strategic Risk Assessment: Forest Service Prescribed Fire Program. Continuing work to assess and quantify prescribed fire benefits and risks throughout the western U.S.

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>
- 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

Publications

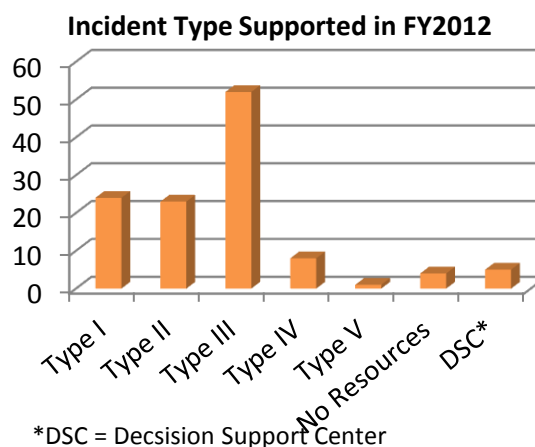
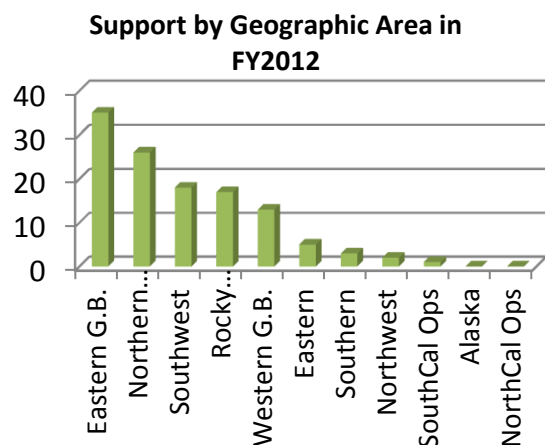
- Draft General Technical Report prepared with Fire Use Subcommittee: "Decision making for Wildfire Incidents: A Reference Guide for Applying Risk Management at the Incident Level"
- Campbell, D., Opperman, T., Lecker, J., Pope, J., and Mangham, R. "Kafue National Park Remote Sensing Trip Report" Oct 2011, prepared for USDA FS International Programs.
- Kurth, Laurie. 2012. Disaster Assistance Support Program. RMRS Explorer Newsletter, January 2012.
- Wildland Fire Management RD&A (main authors Parkinson, Tami and Pence, Morgan). 2012. Draft Line Officer Desk Reference for Fire Program Management (USFS). Produced by the WFM RD&A in coordination with the FS National Line Officer Team. Draft release June 1, 2012.
- Rau, Diane. 2012. WFDSS 101 lessons. <http://wfdss.usgs.gov>
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Presentations Oral/Posters

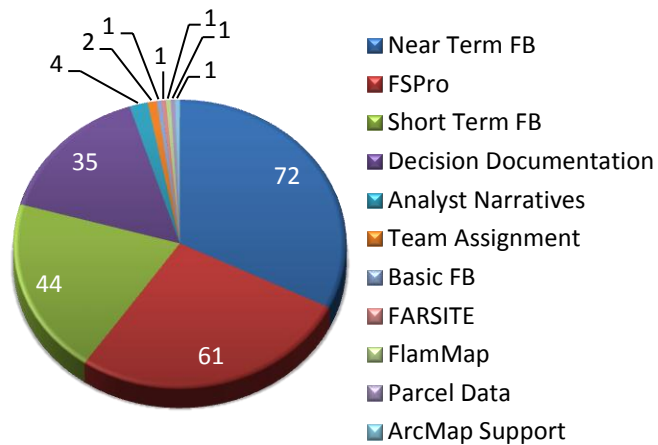
- Opportunities for Change and Influence within the Framework of Wildland Fire. Intermountain West Fire Ecology Conference, Snowbird, UT, November 2011
- Spatial Fire Management Planning within WFDSS. Intermountain West Fire Ecology Conference, Snowbird, UT, November 2011
- WFDSS Use and Issues. National Multi-Agency Coordinating Group and Geographic Multi-Agency Coordinating Group Meeting, Boise, ID, December 2011
- National Interagency Fuels Technology Transfer (NIFTT) status. National Fuels Committee meeting, Boise, ID, April 2012.
- WFDSS long term weather. Russian Scientist Visit, Boise, ID, December 2011.
- Draft Line Officer Desk Reference for Fire Program Management (USFS). National Line Officer Team Meeting, Virtual Presentation, March 2012.
- WFM RD&A and WFDSS status update. WO FAM & R&D, Washington D.C., November 2011.
- WFDSS and the National Fire Decision Support Center. National Predictive Services Subcommittee Meeting, Virtual Presentation, October 2011.
- WFDSS, National Fire Decision Support Center, WFM RD&A. Pacific Northwest Fire Behavior Workshop, Vancouver WA, January 2012.
- Question and Answer session. Secretary Vilsak visit, Boise, ID, July 2012.
- Fire Ecology in Glacier NP, fire modeling and WFDSS. University of Montana, Crown of the Continent Course, Kalispell, MT, June 2012.
- WFDSS Updates. National Park Service FMO Meeting, Virtual Presentation, June 2012.
- WFDSS Landscape Editing. Northern Rockies Fire Behavior Workshop, Virtual, April 2012.
- WFDSS. New Zealand and Australian Fire Managers Visit, Boise, ID, September 2012
- WFDSS. WO Executives and Staff Briefing, Washington D.C. June 2012
- WFDSS. Presentation to International Visitors, Boise, ID, February 2012.
- WFM RD&A goals and mission. NIFC FS Staff, Boise, ID, July 2012.

Projects

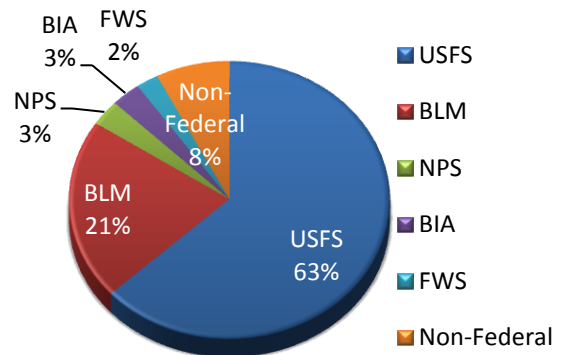
Incident/Decision Support: WFM RD&A staff supported 113 incidents and 5 Decision Support Centers. Graphs below display the following: support by geographic area, support by incident type, support products and tools provided, and support provided by agency.



Support Products Provided in FY2012



Support Provided by Agency in FY2012



Integrate research and technology into decision support systems for better decision making

- Collaborate with the Desert Research Institute (DRI) Climate, Ecosystem, and Fire Applications (CEFA)
- Collaborate with the PNW Air Fire group
- Support FAM IT Dashboard program
- Rocky Mountain Center (RMC) Continental-Scale Evaluation and Verification of Fire-Weather Forecasts
- Integrate historical gridded weather into WFDSS, replacing WIMS
- Complete analysis for DOI Cost Benefit Analysis Project

Assist the field to increase and improve inputs for timely risk based decisions

- Incident/Decision Support
- Prepare Line Officer Desk Reference for Fire Program Management
- Line Officers Survey- WFDSS/Decision Support
- Maintain FBAN/LTAN/GSAN/Tech. Spec. list
- Assist Fire Use Subcommittee in writing, *“Decision Making for Wildfire Incidents: A Reference Guide for Applying the Risk Management at the Incident Level”*

Develop applications for fuels treatment planning

- Provide WFAT Tool 2.2.0, including User Guide and Tutorial
- Evaluation of Fuel Loading Models (FLM) or Fuel Classification System (FCCS) fuel loads for use in estimating fire effects
- Evaluate merits of FOFEM vs. Consume
- Develop Multi-Raster Re-class Tool
- Release FuelCalc 1.1 and User Guide
- Release FRCCmt 3.1.0
- Coordinate incorporation of LANDFIRE fuels data into WFDSS
- Participate in JFSP Fuel Treatment Effectiveness Project

Evaluate, test, identify and suggest WFDSS enhancements that support the field

- Continuing WFDSS Development, responding to users
- WFDSS mobile application development
- WFDSS website content revisions and updates
- WFDSS fire behavior “playground” developed for testing the application
- FSPro validation project to enhance default settings and outputs
- Improve NTFB analysis tool through testing and interface updates
- Query the WFDSS SQL database to gather user statistics

Improve data delivery mechanisms for broader audiences

- Collaborate with IT Road Map planning effort
- Coordinate WFDSS Data among many users and interested parties
- Coordinate/support Cadastral Data as necessary with non-federal partners
- Support interagency data standards
- Integrated Reporting of Wildland Fire Information (iRWin) Collaboration

Train the wildland fire community in utilization of the products we create/sponsor

- Coordinate with the National Fire Offices regarding annual fire season direction
- Develop a Decision Support Knowledge Base
- Support National or Geographic Area Fire Behavior (or other) Workshops
- Support National and Regional level NWCG Courses
- Coordinate the WFM RD&A Detailer Program
- Coordinate with NWCG Training

Increase awareness of the Rocky Mountain Center (RMC)

- Provide RMC Training and outreach

Support training for fuels treatment planning

- Support and identify SMEs of the NIFTT Tools
- Support FRCC and FRCCmt and WFAT tool Workshops
- Support NWCG course delivery on NIFTT.gov
- Provide WFAT 2.2.0 online course and tutorial
- Provide FRCC/FRCCmt Online Course
- Support WIMS Course Development
- Provide “A Guide to Creating Fuel Moisture, Weather, and Wind Files”
- Support LF Total Fuel Change Tool Online Course & Case Study
- Revise the LANDFIRE Online Course
- Support the Guide to Modifying LF Data for Local Applications
- Provide Helpdesk Support for NIFTT Tools and Online Courses
- Improve the efficiency of NIFTT’s HelpDesk

Provide assistance to other countries as invitees, participants, and contributors

Integrate WFDSS, RMC, and NIFTT into the WFM RD&A

- RMC Website Coordination/Integration
- Develop mid-term and long-term objectives for RMC - Fire Consortia for Advanced Modeling and Smoke (FCAMMS)
- Plan strategically for NIFTT Website Coordination/Integration
- Continue NIFTT Integration into the WFM RD&A

Ensure employees are cognizant of current procedures and policies

- Prepare and maintain Internal Decision Support SOPs
- Prepare and maintain External Decision Support SOPs
- Prepare and maintain an Employee Handbook
- Improve Internal Communications
- Provide WFM RD&A Project Management

Communicate with collaborators to improve WFM RD&A functions

- Coordinate GA Editors Monthly Calls
- Facilitate external communications with partners
- Utilize the WFM RD&A website as a conduit for improved communications
- Utilize a WFM RD&A Content Management System
- Provide points of contact for Committees/other needed representation
- Collaborate with LANDFIRE project
- Collaborate with Fire Science Consortia

Provide developmental and continuing education opportunities for WFM RD&A staff

- Maintain agency and government requirements for training, agreements, and qualifications
- Evaluate strategic direction to incorporate known and perceived future needs
- Maintain the WFDSS strategic direction
- Maintain the WFM RD&A strategic plan

Workshops/Conference Attendance

- Intermountain West Fire Ecology Conference, Snowbird, UT
- Northern Rockies Fire Behavior Workshop, Missoula, MT
- Pacific Northwest Fire Behavior Workshop, Vancouver, WA
- Geographic Area Editor After Action Review, Virtual format
- Fire Fighter Performance Measures Workshop, Salt Lake City, UT
- Alaska FSPro Workshop, Virtual attendance
- Payette National Forest Fire Behavior Workshop, McCall, ID
- Personality Styles in the Workplace and Time Management Workshops, Boise, ID

Training

- Fire Management Leadership (FML), Tucson, AZ, March 2012
- S-590 Advanced Fire Behavior Interpretation, Tucson, AZ, March 2012
- Technical Fire Management (TFM) 26, Bothell, WA October 2012
- S-490 Advanced Wildland Fire Behavior, Tucson, AZ, February 2012
- Rx-510 Advanced Fire Effects, Tucson, AZ, February 2012
- Alaska FSPRO Workshop, Virtual, March 2012.
- Fire Effects Monitoring in Kafue National Park, Zambia, Africa, May 2012
- Payette National Forest Fire Behavior Workshop, McCall, ID, April 2012
- WFDSS YouTube Fire Behavior Videos, virtual, Spring 2012
- S-520 Advanced Incident Management, Tucson, AZ, February, 2012

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 COP) Representative Fire Reporting Mobile Application Development Team Representative
- Dashboard WFM RD&A Representative

FY13 Planned Activities

Focus Area 1: Coordinate relevant and timely fire science application

Continue communication, information sharing and dissemination, education, outreach and website maintenance for the WFM RD&A program and relevant partnerships. www.wfmrda.nwcg.gov

- Expand outreach opportunities to define the WFM RD&A and increase awareness.
- Support analysis and review of the Fire Danger Pocket Card evaluation by the Desert Research Institute (DRI)
- Support Alaska Interagency fire behavior webinars.
- Maintain coordination with the Fire Consortia for Advanced Modeling of Meteorology and Smoke (FCAMMS).
- Increase use of the Rocky Mountain Center Products in WFDSS.
- Increase awareness and use of Rocky Mountain Center's products, including the www.fireweather.info website.
- Support an Operational System for Continental---Scale Evaluation and Verification of Fire---Weather Forecasts by the USFS Rocky Mountain Center.
- Increase coordination with the Fire Research and Management Exchange System (FRAMES), including utilization of file sharing, document, data storage, fuels websites and miscellaneous training.
- Participate as a member of the Wildland Fire Science Partnership (WFSP).
- Further collaboration with the Pacific Northwest Research Station's Air Fire program for smoke dispersal models and seek opportunities to further integrate products for field use.
- Coordinate and cooperate with the National Predictive Services and Intelligence groups.
- Provide information as requested regarding use of LANDFIRE data and incident decisions to research partners.
- Stay abreast of the latest risk assessment processes and research. Provide feedback to the various efforts and ensure inclusion in decision support tools.
- Provide support and expertise to the development of performance measures for wildland fire management decision making and risk.
- Establish new and maintain current collaborative activities with universities, fire management groups, and other research projects to review and acquire additional decision support tools and evaluate 2013 operations. Collaborative efforts are underway with the Universities of Idaho and Montana; University of Nevada; Joint Fire Science Program; and Eastern Great Basin, Southwest, and National Interagency Coordination Center Predictive Services Units.
- Provide representative to the JFSP sponsored Northern Rockies Fire Science Network (NRFSN) Consortia.
- Support research for defining the southwest monsoons in terms of fire business being completed by the Desert Research Institute (DRI).

- Support the research to update critical fire weather patterns which is underway with the Desert Research Institute (DRI).
- Collaborate with the USFS Air Resources Management Program (USFS ARM) to perform meteorological and air quality modeling support.
- Pursue further work with the Geospatial Subcommittee to ensure coordination of data and standards to be used in WFDSS and other systems being developed which would include but is not limited to fire origin, ownership, unique fire identification, and fire perimeters.
- Work with IT Roadmap project management team to ensure WFDSS and other science is supported within the IT structure.

Focus Area 2: Develop and support a Wildland Fire Decision Support System (WFDSS)

Development for FY2013 will focus on maintaining system reliability by making adjustments and improvements as funding allows. Evaluation and improvement of this system will continually take place through user feedback and will be addressed as needed.

- Improvement of map display on mobile devices.
- Evaluate new user roles to aid oversight capabilities.
- Increase risk assessment and management inputs to decisions.
- Maintain improved system help topics and content with overview information on landing pages and descriptions of available features and functions.
- Implementation of Unique Fire Identifiers for future integration into other fire management applications which will improve interoperability of systems.
- Test fire behavior analysis improvements such as ensemble Near Term analysis.
- Capitalize on after action reviews (AARs) of WFDSS with field and Geographic Area Editors.
- Coordinate monthly GA Editors conference calls to disseminate information to field and enlist user feedback.
- Incorporate updates from national data layers and LANDFIRE data as necessary.
- Increase use of web services for acquiring data from and sharing data with other applications.
- Work with the Enterprise Geospatial Portal development to ensure connectivity with WFDSS prepare for future ingestion of data.
- Continue work on spatial fire management planning efforts in WFDSS to ensure coordination and implementation with the field and the Interagency Fire Planning Committee's work. Ensure common messages are distributed regarding this effort.
- Roll out spatial fire management planning effort and training in a timely manner to ensure field adoption as is feasible.
- Support the migration of IBM Help Desk and provide training as necessary.
- Continue to work with FAM IT to maintain collaborative efforts with other software architectures, migration of systems, and compliance with security requirements within WFDSS.
- Collaborate with the dispatching community to provide information for the ICS 209 to reduce redundant field entry and improve accuracy of information.
- Maintain partnership with the IRWIN project to ensure data sharing capabilities and where feasible reduce data entry for the field.
- Consolidate wind and weather tables and provide a more detailed weather summary in the Short Term Fire Behavior model.

- Continue researching, studying and testing gridded weather products for use in the WFDSS fire behavior models.
- Incorporate maps, visual cues, logic rules and validation to assist users in creating more accurate fire locations and Unit ID's.
- Update the WindNinja software in WFDSS and provide a gridded wind option with Near Term Fire Behavior.
- Coordinate with the Cadastral Data Subcommittee to ensure longevity of the project and ease of incorporation in to WFDSS.
- Provide critical information and expertise for the development of the "Dashboard" for national level risk management and decision information. This will include automated analysis, development of the "star chart" as an overview of fires, implementation of and early warning system for emerging fires and other analytics.
- Run automated-NTFB analysis on every fire in 2013 to improve the model outputs and input defaults.
- Test avenues to obtain computing resources such as Amazon Web Services or other.

Focus Area 3: Coordinate technology and development efforts for hazardous fuels and vegetation management and support interagency training in this area

FY 2013 will focus on a long term plan for the WFM RD&A's involvement in fuels planning and development of fuels planning curricula and tools.

- Migrate various supported tools to Arc 10.1.
- Revise LANDFIRE Online Course.
- Update WFAT Tools 2.3.0 for ArcMap 10 which will add a report writer and incorporate FOFEM 6.0.
- Through contracting and collaboration with the Fire Modeling Institute, further develop Fuelcalc 1.1 to include a data import utility for FIREMON as well as incorporating Torching and Crowning Indices.
- Develop the LANDFIRE S-Class (Succession Class) mapping tool. This tool will aid in the mapping of the Succession Classes (SCLASS) layer of LANDFIRE data which characterizes current vegetation conditions with respect to the vegetation species composition, cover, and height ranges of successional states that occur within each biophysical setting.
- Develop FOFEM 6.0 to include the latest Fuel Characteristic and Class System (FCCS) data and upgrade to be compatible with Windows 7.
- Continue to provide FRCC instruction for the Washington Institute's Technical Fire Management Program.
- Conduct interagency workshops on FRCC and related planning tools including the Wildland Fire Assessment Tool (WFAT).
- Develop an FRCC user survey to gain understanding of user base, field needs and future development.
- Develop a methodology and training outline to guide fuels managers in the development of fuels treatments that are effective based on clearly articulated objectives.
- Finalize "A Guide to Creating Wind, Weather and Fuel Moisture Files" for use in Fuels Management planning and fire behavior analysis.
- Produce a publication of case studies outlining the use of The Landfire Total Fuel Change Tool as it applies to landscape level fuels management planning.
- Develop an online course for the Weather Information Management System (WIMS).

- Develop an Introduction to Vegetation Dynamics online course for use in the Vegetation Dynamics Learning Pathway.
- Develop LANDFIRE Total Fuel Change Tool Online Course.
- Continue partnership with the University of Idaho in developing training materials (online courses, videos, webinars, posters, etc.), developing marketing materials, monitoring the effectiveness of online courses, and providing workshop instructors.
- Collaborate on technology transfer of LANDFIRE products with The Nature Conservancy.
- Continue supporting websites and a helpdesk for tools and curricula, FRCC, and LANDFIRE.
- Support the Interagency Fuels Treatment Decision -- Support System (IFT--DSS) by assisting the contractor to evaluate the system through a series of user workshops.
- Continue to participate in the development of the Cohesive Strategy as requested.
- Coordinate with LANDFIRE as needed, (fuel Model Transition project, calibrations, user feedback, data refresh and updates).

Focus Area 4: Develop applications, disseminate information, and conduct training for existing and emergent research priorities

The WFM RD&A focuses on developing applications and disseminating information that will provide assistance with decision support. This is completed through training in both wildland fire decision and long term fuels planning.

- Participate in the FS CIO and Fire and Aviation Management's Mobile Technologies Integration testing phases of tablets and smart phones to improve information and applications for fire management.
- Continued development of WFDSS curriculum for NWCG and other courses and regional workshops (\$495- Geospatial Fire Analysis, Interpretation, and Application, \$590 – Advance Fire Behavior Interpretation, Technical Fire Management (TFM), Regional FB workshops and \$490), as it relates fire behavior, decision support, and risk analysis.
- Continue to expand and revise current WFDSS online training curriculum, videos, and presentation media.
- Continue presentations at conferences, workshops, and other venues appropriate for the subject area.
- Continue FSPro and Near Term Fire Behavior Validation to provide feedback to researchers on model revisions and automation.
- Provide representation and collaboration to the RMRS Science Application and Integration (SA&I) peer network.
- Support LANDFIRE Fuel Model Transition project.
- WFDSS training materials will be evaluated and improved as needed; and will include an exercise on an Introduction to WFDSS.
- Add WFM RD&A employees as cadre and steering committee members to national and regional training courses pertaining to decision support analysis, risk assessment, and incident management. Develop and prepare materials for training delivery in FY2013.
- Work with Department of Interior Office of Wildland fire to evaluate a wildland fire cost benefit analysis.

Focus Area 5: Participate in and manage the National Fire Decision Support Center (NFDSC)

The WFM RD&A will support the field with analysis and decision support while also providing feedback to research on analytical tool use and improvements.

- Continue to expand detailer opportunities to emphasize training to field analysts and knowledge of WFDSS and the WFM RD&A
- Support interagency fire requests for fire behavior analysis and decision publication.
- Manage Geographic Area Editor conference calls to aid in information dissemination and to seek field and user input.
- Coordinate and collaborate with other NFDSC members: Fire Spread Research, Fire Economics Research, Human Factors and Risk Management RDA, and Fire and Aviation Management.
- Conduct evaluation of 2013 fire season activities, review procedures and develop improvements as appropriate, develop 2013 accomplishments and input for annual reports.
- Maintain an FBAN/LTAN/technical specialist list for use by the NFDSC, Geographic Area Editors and Geographic areas for determining support and training opportunities.
- Continue to assist with training and refresher information for future and current analysts from IMTs, field units, GACCs, etc. through detail assignments, direct field support, and other means as appropriate.
- Evaluate field use, output, and performance of decision support analysis tools. Provide appropriate feedback to research and the field.
- Develop stronger SOPs for use of Decision Support Centers in Geographic Areas.
- Finalize the Line Officer's Reference Guide in cooperation with the Line Officer's Committee.
- Develop a survey to obtain Line Officer feedback on the decision support provided to them and their staffs as well as on the WFDSS.
- Support development of the Line Officer's Guide for the Department of Interior.
- In cooperation with the Fire Use Subcommittee finalize the Decision Making for Wildfire Incidents: A Reference Guide for Applying the Risk Management Process at the Incident Level.
- Assist with development and testing of the "Dashboard", working with other NFDSC research areas.

