

THE JOINT FIRE SCIENCE PROGRAM

20 Years of Innovation and Transformative Contributions
to the Wildland Fire Community

July 2019



IN 1998

In 1998, the Joint Fire Science Program (JFSP) was statutorily authorized as a joint partnership between the U.S. Department of the Interior and the U.S. Department of Agriculture Forest Service. The program provides leadership to the wildland fire science community by identifying high-priority fire science research needs that will enhance the decisionmaking ability of managers to meet their objectives. This publication celebrates and describes the JFSP's contributions to and impact on the wildland fire community over the past 20 years.

The Joint Fire Science Program provides funding and science delivery for scientific studies associated with managing wildland fire, fuel, and fire-impacted ecosystems to respond to emerging needs of managers, practitioners, and policymakers from local to national levels.



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For the past 20 years, the JFSP has distinguished itself as a highly efficient mechanism to connect wildland fire science research to effective management of fire and fire-prone landscapes. Through regular reflection and review of its mission, vision, and growth, the JFSP is a successful model for tackling complex fire management questions and delivering knowledge and tools to land managers. Through use of an open and competitive research process, the JFSP expanded the wildland fire science field by encouraging collaborative research among more than 300 federal, university, state, tribal, industry, and nonprofit organizations. Promoting cooperative research not only spurred innovation and broader engagement within the fire science communities, it also resulted in substantial leveraging of funds and expertise to address the critical wildland fire science and management issues of our time.

"JFSP represents the gold standard in recognizing gaps in knowledge and partnering to meet research needs."

- JFSP 2017 Five-Year Program Review Report

Of the three factors that determine fire behavior—fuels, topography, and weather—fuels are the only one managers can affect. As a result, the JFSP initially was established with a research focus on helping develop a more thorough understanding of fuel loads and conditions as they relate to fire risk, fire regimes, and fire behavior to better protect lives and other values at risk. After initially establishing a solid foundation in fuel management research, the JFSP quickly advanced its capability to support research into all areas posing challenges to wildland fire management. This expanded focus involved fire ecology, fire history, fire effects and postfire recovery, firefighter safety, smoke science, human dimensions of fire, and fire workforce development.

A commitment to internal and external reflection has guided the JFSP into a program capable of answering complex wildland fire science and management questions, facilitating the communication of new understandings, and providing resources and methodologies for putting science into practice. What follows represents just a handful of JFSP-funded areas of work illustrating the clear impact the program has had on the advancement and utilization of wildland fire science.

FUELS AND FUEL TREATMENTS

Today, through JFSP research, the wildland fire community has a better understanding as to how fuel treatments can be effective and what aspects make them most effective at the project scale. The JFSP has guided and funded more than 100 fuels and fuel treatment studies. Studies have characterized conditions of fuels in depth and coupled this information with natural fire occurrence, fire behavior, and fire effects. This work has laid the foundation for designing and implementing effective fuel treatments, prescribed fire operations, and management of wildfire in the multitude of vegetation types across the United States. Because of these studies and the synthesis and integration of their results, the wildland fire community can:

- Design fuel treatments to reduce the severity of fire and unwanted detrimental ecological effects at the project scale.
- Improve wildlife habitat and increase biodiversity using fuel treatments.
- Manage a wildfire to obtain ecological benefits similar to those of a fuel treatment.

For more details about the JFSP and its role in wildland fire science and research during its first 20 years, see the companion document, titled "A Retrospective for the Joint Fire Science Program: 20 Years of Wildland Fire Research Supporting Sound Decisions."





FIRE HISTORY AND FIRE REGIMES

To date, JFSP-supported projects have advanced the understanding of spatial and temporal patterns of fire occurrence in various vegetation types spanning the U.S. The characterization of past fire regimes represents the backbone for determining the effects that changes in management, climate, and land use have on current and future patterns of fire behavior and effects. The Fire and Climate Synthesis Project, with support from the JFSP, compiled existing fire history information from 890 sites representing all major western forest types and analyzed climate-fire relationships back more than 500 years. This project provides the baseline from which to evaluate changes in fire behavior, fire frequency, fire severity, and postfire recovery resulting from fire suppression, land use, and climate across the West. In parts of the Eastern U.S., JFSP investigations provide managers the historical context necessary to promote prescribed fire to sustain their fire-dependent ecosystems.

INTERAGENCY FUELS TREATMENT DECISION SUPPORT SYSTEM

Many useful fuel and fire planning models were developed before and since JFSP inception—so many that their abundance alone was overwhelming. Each model had unique executions, adjustments, and data input requirements, and different organizations and agencies relied on different sets of tools and models.

Discussions with the user community revealed tools were partially redundant, sometimes lacked necessary fuel data inputs, had haphazard technical support, and were incapable of sharing data and outputs. Once the JFSP helped the user community clearly articulate and identify these issues, it moved forward with initial software development and prototype testing of the Interagency Fuels Treatment Decision Support System (IFTDSS), a single platform integrating the capabilities of the many individual systems. IFTDSS increased efficiency across organizations and agencies by requiring users to learn just one interface and allowing researchers to focus on model validation and improvement rather than software development. IFTDSS was turned over to the U.S. Forest Service Wildland Fire Management Research, Development, and Application Program, which is integrating IFTDSS into standard business practices.

Development of IFTDSS allows fuel specialists and fire planners across agencies and land ownership boundaries to speak a single language by using the same inputs to ask modeling questions and the same outputs to discuss management options.

FIREFIGHTER SAFETY

Firefighter safety zones are identified regions that offer refuge from approaching fires. They are identified by calculating the safe separation distance between the fire and firefighters. Safety zones are not static and are updated as fire direction and fire conditions change. Accurate identification and placement of these zones and their associated escape routes are critical to firefighter safety. The safety zone concept was first proposed after the 1956 Inaja fire in California killed 11 firefighters. Original fire zones were calculated with the assumption that fires were burning across flat terrain without any wind. These calculations were not revisited until 2014, meaning firefighters were operating with guidelines that were much too simplistic. JFSP-funded research prompted potentially life-saving adjustments to the safety zone calculations by incorporating wind speed and terrain factors. These adjustments resulted, in some cases, in major increases in distances between the fire and the interior of the safety zone.

WILDLAND FIRE SMOKE SCIENCE

For more than 10 years, the JFSP coordinated and funded an all-encompassing look at the social and physical aspects of smoke science. Based on land manager requests, this resulted in research into smoke emissions, plume development and movement, impacts on communities, and potential climate change relationships. This research investment shows:

- That the concentration and chemistry of particulate matter in smoke differ by fire location, fuel type, and smoke age.
- That smoke particulates are essential to assessing health impacts and estimating visibility impairment.
- How fuel loads, fuel moisture content, smoldering, and smoke production are related.
- How to schedule prescribed fire operations when fuel amounts and moisture levels will produce lower levels of smoldering and smoke.
- How to efficiently leverage dollars, expertise, and capacities among diverse partnerships to improve fire and smoke modeling systems that link fuels, weather, fire behavior, plume dynamics, smoke composition, and smoke movement to produce accurate and timely predictions about on-the-ground smoke conditions.

SAGEBRUSH STEPPE TREATMENT EVALUATION PROJECT (SageSTEP)

Sagebrush (*Artemisia* spp.) ecosystems occupy extensive areas of the Interior West and are crucial to the western way of life. They are also one of North America's most threatened ecosystems because of too much fire fueled by nonnative grasses in some regions and too little fire supporting transition to woodlands in other regions. The JFSP supported long-term, multidisciplinary, regional-scale research into this problem. SageSTEP set up and analyzed various land management treatment effects on and relationships with soils, wildlife, economics, human perspectives, and weather. The monitoring of these treatments by land management agencies has continued for more than 10 years. More than 90 scientific publications that include SageSTEP data and findings have been used to create tools and resources for development and prioritization of sagebrush management strategies (Figure 1).

Information gathered and synthesized from SageSTEP has removed much of the guesswork associated with vegetation treatments, provided the knowledge to weigh treatment options, and allowed for more educated evaluation of tradeoffs in sagebrush management.



Figure 1. A sample of the science from SageSTEP appearing in planning and policy documents and tools. Groups and teams using these guides include, but are not limited to, the following: Fire and Invasive Species Assessment Teams to develop strategies to reduce the impacts of annual grasses and frequent fire; Agricultural Research Service and its private landowner customers to model and predict erosion potential; and U.S. Forest Service to develop risk assessments to protect sagebrush sites free of nonnative grasses.



SCIENCE SYNTHESIS

The synthesis of related research is critical to fire, fuel, natural resource, and land manager understanding of relevant and actionable science. Managers and practitioners with little time to devote to accessing and reviewing scientific literature rely on high-quality syntheses to elucidate important patterns and trends. The JFSP has directly funded production of more than 25 comprehensive syntheses and indirectly contributed to the development of countless others. The JFSP syntheses on fire effects, fire behavior, fuels, fuel treatments, and postfire treatments represent the go-to resources for managers. The value of a scientific synthesis is unmistakable when considered in the light of JFSP-funded research in postfire assessments, treatments, and risks. Before the JFSP funded the synthesis of postfire science, multimillion-dollar management decisions relied heavily on personal experience. Today, decisionmaking follows a stepwise process that incorporates site assessments, treatment options, and economic considerations. Agencies now direct spending on values at risk, target prioritized treatment areas, and apply only those treatments with demonstrated success.

HUMAN DIMENSIONS OF FIRE

In external reviews, managers and scientists highlighted the need to garner the support of stakeholders, policymakers, and the public for tree removal, prescribed fire, and household risk-reduction practices. Addressing the social, health, and economic impacts of fuel and fire management, however, required an improved understanding of human social, psychological, and communication factors. The importance of investing in and appreciating the human linkage and intersection with fire and fuel management prompted the JFSP to support more than 40 social science or economics-related projects. This investment provides land managers with several tools and resources to better understand and address constituent concerns and barriers to effective communication.

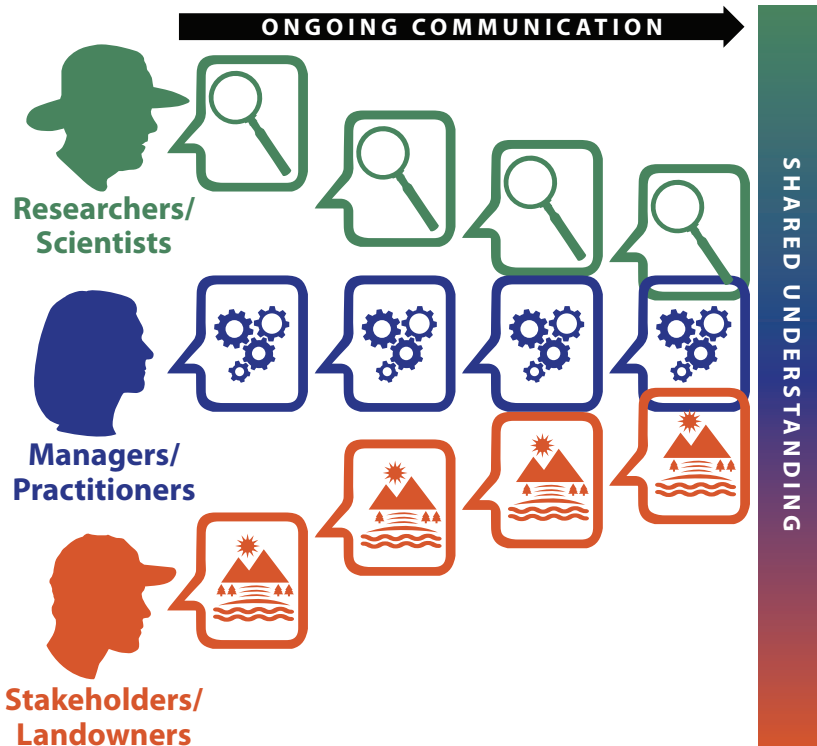
SCIENCE DELIVERY

Investigations into barriers to and factors supporting the translation of science into practice revealed that field personnel mostly relied on informal information networks to keep apprised of new research. The importance of informal networks inspired the JFSP to launch a novel pilot program focused on accelerating the use of wildland fire science in the field. The JFSP created the first eight of what would become 15 regionally focused knowledge exchanges spanning the entire U.S. The JFSP Fire Science Exchange Network (FSEN) is popular with both its regional researcher and manager communities, the majority of which indicate their exchange is necessary to coordinate the sharing of wildland fire science information. The network delivers timely, regular, and ecologically relevant information, tools, and resources to the field. Delivery includes condensed versions of research papers, regular research and event updates, and interpersonal activities, such as webinars, workshops, field tours, and working groups. Perhaps the most valuable FSEN function is its support of interactive communication, which through repeated interactions has tightened the linkage and back-and-forth communication among scientists, managers, and practitioners (Figure 2).

“JFSP funding advanced our understanding of the postfire environment by leaps and bounds, which made a tremendous difference in how we address postfire effects through science-based changes in agency policies and decisionmaking.”

– Pete Robichaud, U.S. Forest Service, Research Engineer

Figure 2. By encouraging repeat interactions among researchers, managers, and end-user communities, communication is increased. This fosters shared understanding of dilemmas, obstacles, and pathways forward, which increases trust and focuses research (adapted from Randi Jandt, University of Alaska, Fairbanks, Fire Ecologist).



"Because of the network, we are seeing managers more engaged in the research process. Their input helps scientists in addressing the right research questions"

- Molly Hunter, University of Arizona,
JFSP Science Advisor

CONCLUSION

Science is not static. Only change is constant. Maintaining the science-manager relationships cultivated and advanced by JFSP-sponsored projects, programs, and products is critical to efficiently advance the understanding of wildland fire science. The JFSP has a proven process to dissect a complex issue into its simplest science components and formulate researchable questions; to synthesize study findings and package them into useable, actionable, and updateable guides, tools, and applications; and to promote the networks and capacities needed to maintain manager, researcher, and stakeholder relationships for science delivery. The JFSP has been and remains an essential component of the wildland fire science enterprise for addressing fire questions that will evolve as climate, land use, and technological capabilities change.

WORKFORCE DEVELOPMENT

The JFSP has long supported educating and training the next generation of fire scientists and managers through curriculum development, training opportunities, and real-life experience exposure. This includes the JFSP's annual Graduate Research Innovation (GRIN) awards, which are designed to provide students a taste of the competitive research process and foster early connections and long-lasting relationships between research and management communities. The experience, knowledge, and relationships that GRIN recipients bring to their professions result in a multiplicative effect for fire learning. In several cases, GRIN recipients have gone on to build university fire programs that not only offer numerous wildland fire courses but have integrated fire science into other disciplines, supported several fire-specialized faculty, and graduated many students with exposure to fire science and management.

"Every year in fire is more complex and difficult than the last. JFSP is the organization prepared to examine and provide operational solutions."

- J. Morgan Varner, U.S. Forest Service,
Research Biological Scientist



Learn more about the JFSP at:

www.firescience.gov

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