

Joint Fire Science Program

Progress Report:
Fiscal Year 2022-2023



INTRODUCTION

For the past 25 years, the Joint Fire Science Program (JFSP) has provided funding and science exchange on emerging and long-term wildland fire research needs for the science and management community.

The primary goal of the program is for funded science to inform management and decision support. It is this unique emphasis on joint partnerships between scientists, managers, and practitioners that allows the program to exist and continue playing a pivotal role in the interagency fire community.

Research proposals related to high-priority science needs are solicited in the form of annual funding opportunity announcements. Researchers from federal, state, and local governments, academic institutions, nongovernmental organizations, Tribal entities, and private organizations apply to advance their fire science studies. In addition to funding research, the JFSP also continues to deliver high-value science information through a well-coordinated exchange network, the Fire Science Exchange Network. This report summarizes fiscal year (FY) 2022 and FY 2023 program accomplishments related to funded research, science exchange, workforce development, and more.

BUDGET

Annually, the JFSP Investment Strategy allocates funds to both research programs¹ and science delivery and exchange². From an interagency perspective, the JFSP believes great value is added to all participating agencies from this approach. A small percentage of additional funding covers program management and projects³. Figure 1 illustrates the percent allocated in each of these three areas in FY 2022 and FY 2023. In both years, the JFSP operating budget was \$12.9 million, with funds received from the U.S. Department of the Interior, USDA Forest Service, and the Bipartisan Infrastructure Law/Infrastructure Investment and Jobs Act.

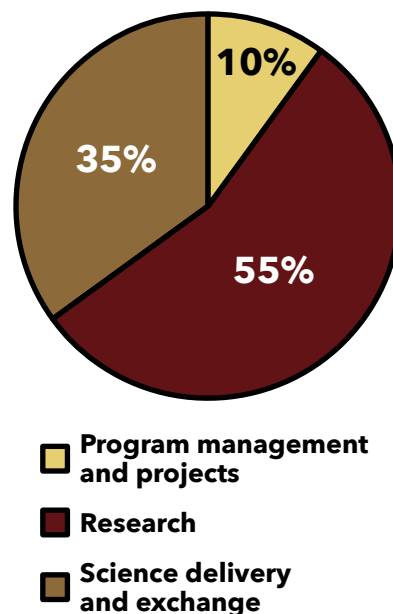


Figure 1. Fiscal years 2022 and 2023 JFSP Investment Strategy breakdown.

- ¹ Research Programs - The JFSP funds research responsive to the emerging needs of fire and fuel managers, sustained research addressing complex management issues, and graduate student research projects that are closely linked to management and policy needs.
- ² Science Delivery and Exchange - Science delivery accelerates the awareness, understanding, and implementation of wildland fire science information. The Fire Science Exchange Network helps identify research needs with input from researchers and managers.
- ³ Program Management and Projects - This category includes program office salaries, travel, program evaluation projects, and archiving data.

SUMMARY OF FY 2022 AND FY 2023 FUNDED RESEARCH

Each year JFSP solicits proposals on emerging and long-term needs identified by the science and management communities.

In FY 2022, JFSP funded 12 projects out of 30 proposals received across 2 primary research tasks:

Task 22-2-01: Social and ecological recovery of communities impacted by wildfire

The objective of this task statement is to inform the development or improvement of strategies, tools, and resources used for post-fire community recovery, such that they facilitate recovery efforts that increase the resilience of social-ecological systems to future wildfires. Of the 11 proposals received, 7 were funded.

Task 22-2-02: Collaborative development of ecosystem mapping products for fire and fuels management

The objective of this task statement is to develop, using a collaborative framework, prototype mapping protocols and products that capture current ecosystem condition, desired condition, and departure from desired condition at spatial and temporal resolutions relevant to fire and fuels management decisions. Of the 19 proposals received, 5 were funded.

In FY 2023, JFSP funded 21 research projects out of 35 proposals received across 4 primary research tasks:

Task 23-2-01: Longevity of fuel treatment effectiveness under climate change

The objectives of this task statement are to (1) understand patterns of fuel accumulation, vegetation change, and potential fire behavior following fuel treatments over time and (2) inform the frequency and type of treatments needed to maintain treatment effectiveness. Of the 14 proposals received, 8 were funded.

Task 23-2-02: Fuels treatment effectiveness across landscapes

The objective of this task statement is to inform planning and implementation of landscape fuel treatment strategies that allow for safe and effective management of wildfire to meet protection and resource management objectives. Of the 13 proposals received, 9 were funded.

Task 23-2-03: Pre-fire management actions for reducing post-fire hazards

The objective of this task statement is to gain better understanding of the factors that lead to successful cross-jurisdictional pre-fire planning aimed at reducing the potential for post-fire hazards, through synthesis and evaluation of existing tools and investigations of enabling conditions that foster successful cross-jurisdictional planning and action. Of the 7 proposals received, 3 were funded.

Task 23-2-04: Social and political factors that influence fire suppression and rehabilitation costs

The objective of this task statement is to evaluate understudied factors that influence costs associated with wildfire suppression and immediate post-fire rehabilitation to inform cost models and performance metrics for efficient use of fire suppression and rehabilitation resources. One proposal was received and funded.

Table 1 provides a summary of FY 2022 and FY 2023 projects funded. Proposals selected for funding hailed from small and large academic institutions, non-profit organizations, and state and federal agencies. Projects are listed by title, principal investigator, and agency/organization affiliation.

Table 1. Proposals selected for JFSP funding in FY 2022 and FY 2023.

Project ID	Title	Principal Investigator	Agency/Organization
22-2-01-16	Resilience to wildfire impacts through adaptation: Support for private lands burning in California	Jesse K. Kreye	Pennsylvania State University
22-2-01-5	Recovery of human communities after wildfire: Building social-ecological resilience	Erin C. Kelly	Humboldt State University
22-2-01-2	Fueling resilience: A risk-based comparison of post-fire programs and recovery outcomes	Miranda H. Mockrin	USDA Forest Service
22-2-01-10	Post-fire social-ecological communities: How social and ecological conditions predict post-fire recovery and state transition	Clare E. Aslan	Northern Arizona University
22-2-01-14	Grow back better: Social and ecological factors shaping wildfire recovery on nonindustrial private forestlands	Heidi R. Huber-Stearns	University of Oregon
22-2-01-11	Persist, adapt, or transform: What drives WUI community recovery after wildfires?	Lisa M. Ellsworth	Oregon State University
22-2-01-9	Developing systematic tools and databases to better support diverse wildfire recovery trajectories	Travis B. Paveglio	University of Idaho
22-2-02-15	EMS4D: multi-scale fuel mapping and decision support system for next generation of fire management	Carlos A. Silva	University of Florida
22-2-02-21	Mapping past, present, and future hydro-ecology, fire, and vegetation for oak ecosystem restoration	Michael C. Stambaugh	University of Missouri-Columbia
22-2-02-14	Co-development of geospatial data products to support treatment planning and monitoring in the upper Rio Grande watershed	Matthew D. Hurteau	University of New Mexico
22-2-02-6	New tools for fire management using ecological site groups, monitoring data, and machine learning	Michael C. Duniway	U.S. Geological Survey
22-2-02-30	Collaborative development of ecosystem mapping products for fire and fuels management: Mapping and quantifying post-wildfire forest conditions	Morris C. Johnson	USDA Forest Service
23-2-01-13	Quantifying fuel-treatment longevity after thinning and prescribed fire	Scott M. Ferrenberg	University of Montana
23-2-01-10	Using landscape features, plot measurements, and remote sensing data to improve predictions of fuels treatment longevity in the Colorado Front Range	Dave M. Barnard	USDA Agricultural Research Service

23-2-01-11	How do bark beetle outbreaks, tree regeneration, and climate determine fuel treatment longevity?	Dominik Kulakowski	Clark University
23-2-01-9	Effectiveness of fuel treatment by prescribed fires in Oklahoma grasslands under climate change	Jia N. Yang	Oklahoma State University
23-2-01-7	Longevity of fuel treatments in eastern Cascades following restoration treatments and wildfire	Brian J. Harvey	University of Washington
23-2-01-3	Forest fuel reduction: Investigating different long-term pathways for fuel development in the Sierra	Scott L. Stephens	University of California-Berkeley
23-2-01-4	Environmental and climate drivers of fuel treatment longevity in California mixed-conifer forests	Jessica R. Miesel	Michigan State University
23-2-01-6	Fuel treatment durability in sagebrush ecosystems in current and future climates	Lisa M. Ellsworth	Oregon State University
23-2-02-17	4D design and assessment of landscape-level fuel treatments in the Sierra Nevada	Birgit E. Peterson	U.S. Geological Survey
23-2-02-15	How can we rapidly and consistently evaluate the effectiveness of fuel treatments on wildfire management and severity?	(Courtney) Alina Cansler	University of Montana
23-2-02-7	Understanding the effects of hazardous fuel treatment reductions on landscape-level patterns of wildfire activity, effects, and suppression operations	Sarah J. Hart	Colorado State University
23-2-02-20	Evaluating optimal placement and timing of fuel treatments across dynamic southern California landscapes	Alexandra D. Syphard	Conservation Biology Institute
23-2-02-14	Optimizing landscape fuel treatment and fire response operations	Jianbang Gan	Texas A&M University
23-2-02-1	Can managed wildfire meet both operational and ecological goals?	Brandon M. Collins	University of California-Berkeley
23-2-02-5	A rare opportunity to evaluate landscape fuel reduction effectiveness in a high-severity fire regime	Brian J. Harvey	University of Washington
23-2-02-11	Developing treatment response groups and optimizing fuel treatment strategies in sagebrush landscapes	Karen C. Short	USDA Forest Service
23-2-02-18	Seasonal and landscape variation in grassland fuels: Mitigating fire risk in grassland landscapes at the wildland urban interface	Katharine N. Suding	University of Colorado Boulder
23-2-03-11	Improving the collection and accessibility of Potential Control Location data for successful cross-jurisdictional pre-fire planning	Madelon F. Case	U.S. Geological Survey
23-2-03-12	Understanding the pre-fire planning tools, methodologies, and governance conditions that facilitate mitigation of post-fire effects in forest ecosystems	Courtney A. Schultz	Colorado State University
23-2-03-2	Pre-fire planning for post-fire hazards: barriers and opportunities across jurisdictions	Catrin M. Edgeley	Northern Arizona University
23-2-04-1	Mapping the socio-political context of fire suppression through multi-institutional collaboration	Christopher Serenari	Texas State University

SUMMARY OF FY 2022 AND FY 2023 COMPLETED PROJECTS

Researchers complete their JFSP-funded research in a 2–3-year time frame. Upon completion, each research team submits a final report that includes project objectives, main findings, discussion,

and next steps. In FY 2022, the JFSP received 40 completion final reports (Table 2); in FY 2023, 23 reports were received (Table 3).

Table 2. JFSP final reports completed in FY 2022.

Project ID	Title	Principal Investigator	Agency/Organization
21-1-01-49	Soil microbiome recovery across a multi-decadal severe wildfire chrono-sequence	Michael J. Wilkins	Colorado State University
20-1-01-9	Quantifying the effects of heat and drought on southwestern tree seedling mortality	Matthew D. Hurteau	University of New Mexico
20-1-01-10	Advancing post-fire tree mortality models to limit fire-induced oak mortality	Jeffrey M. Kane	Humboldt State University
20-1-01-14	Goats, smoke, and oaks: Prescriptive goat browsing and prescribed fire as a means to halt mesophication and promote biodiversity in Ozark hardwood ecosystems	Michael C. Stambaugh	University of Missouri
20-1-01-20	Evaluating canopy fuels across multiple spatial scales for improved fire modeling	Lisa P. Bentley	Sonoma State University
20-1-01-30	Mapping the immediate and prolonged impacts of, and adaptations to, fire in the Kenai River fishery	Jordan W. Smith	Utah State University
20-S-01-1	JFSP Fire Science Exchange Network analysis	Rudy M. Schuster	U.S. Geological Survey
20-S-01-2	Modeling the impact of COVID-19 on wildfire management	Jude Bayham	Colorado State University
19-1-01-5	Incorporating pyrodiversity into wildlife habitat assessments for post-fire management and recovery	Morgan W. Tingley	University of Connecticut
19-1-01-15	Determine the impacts of wildfire occurrence and use of prescribed fire on invasive species presence	Robert K. Grala	Mississippi State University
19-1-01-16	The race between fuels and fruits: serotinous forest resilience to short-interval severe reburns	Brian J. Harvey	University of Washington
19-1-01-27	Potential mechanisms of population decline: Anuran responses to prescribed fire	Pedro Quintana-Ascencio	University of Central Florida
19-1-01-40	Comparing the costs of an operational prescribed burning program to those of unplanned wildfires	Fernando Garcia Menendez	North Carolina State University
19-1-01-43	Evaluating flammability of reburns in the boreal forests of Interior Alaska	Brian J. Buma	University of Colorado Denver
19-1-01-44	Scale-dependent effects of landscape context on post-fire forest regeneration in the Northern Rockies	Erica A. Smithwick	Pennsylvania State University
19-1-01-51	Effects of different fire intensities on Pinus ponderosa sapling physiology and mortality	Alistair M. Smith	University of Idaho
19-1-01-52	Evaluating effectiveness of pre-fire silvicultural and fuel reduction treatments on post-fire forest stand resilience	John L. Koprowski	University of Arizona

19-S-01-2	Effectiveness of fuel treatments at the landscape scale: State of understanding and key research gaps	Theresa (Terrie) B. Jain	USDA Forest Service
18-1-01-44	What prescribed fire conditions best replicate active fire regime effects on understory diversity?	Malcolm P. North	USDA Forest Service
18-1-01-53	Impacts of burn severity, microclimate, and soil properties on initial post-fire tree regeneration	Philip E. Higuera	University of Montana
17-1-01-4	Can landscape fuel treatments enhance both protection and resource management objectives?	Carol L. Miller	USDA Forest Service
17-1-01-9	Landscape fuel treatments and wildland fire management strategies within recent large fire events	Susan J. Prichard	University of Washington
17-1-02-3	Effects of changing wildfire management strategies	Jose M. Iniguez	USDA Forest Service
17-1-03-10	Post-fire recovery of Great Basin sagebrush habitat using seed coating technology and herbicides to overcome abiotic and biotic limitations to native plant establishment	Sam B. St. Clair	Brigham Young University
17-1-04-17	Joining laboratory, greenhouse, and field approaches to improve our understanding of fire effects on seed germination in Great Basin, Colorado Plateau, and Sonoran deserts	Sasha C. Reed	USGS-Geological Survey
17-1-05-2	Evaluating thunderstorm outflow boundaries in WRF-Fire	Katja K. Friedrich	University of Colorado-Boulder
17-1-06-6	Co-managing risk or parallel play? Examining connectivity across wildfire risk mitigation and fire response in the Intermountain West	Emily Jane Davis	Oregon State University
17-1-06-14	Effective network governance for co-management: The role of cognitive alignment in risk perception and value orientation toward collaboration	Branda L. Nowell	North Carolina State University
17-C-01-1	JFSP social media writer	Anthony L. Small	FedWriters, Inc.
17-C-01-2	Facilitation for JFSP meetings and conference calls	Diane Williams	Management and Engineering Technologies
17-S-01-2	Student travel assistance	Annie L. Oxarart	Association for Fire Ecology
16-1-02-10	Fighting wildfire with prescribed burning in the Southern Great Plains	Urs P. Kreuter	Texas A&M University
16-1-04-9	Modeling fire-induced tree mortality for eastern hardwood forests	Daniel C. Dey	USDA Forest Service
16-3-01-14	Resilient landscapes and fire regimes: Meaning, metrics, and management	Sharon M. Hood	USDA Forest Service
16-3-01-24	Identifying ecological and social resilience in fire-prone landscapes	Philip E. Higuera	University of Montana
15-1-02-2	AIRPACT-Fire for enhanced communication of human health risk with improved wildfire smoke modeling	Joseph K. Vaughan	Washington State University
15-1-06-8	Fire modeling and social science analysis of fire managers' use of fire weather data across the US	Eric L. Toman	Ohio State University
15-S-01-01	Fire and smoke model evaluation experiment (FASMEE) Phase 1	Roger D. Ottmar	USDA Forest Service
14-4-01-1	North Atlantic Fire Science Exchange	Nicholas S. Skowronski	USDA Forest Service

Table 3. JFSP final reports completed in FY 2023.

Project ID	Title	Principal Investigator	Agency/Organization
21-1-01-26	Does high-severity patch structure scale consistently with fire size across the Northwest US?	Brian J. Harvey	University of Washington
21-1-01-43	Low-cost UAS platforms to quantify and predict post-fire recovery in arid shrublands	Trevor T. Caughlin	Boise State University
20-1-01-6	Less fuel for the fire: How will drought amplify effects of short-interval fire?	Monica G. Turner	University of Wisconsin-Madison
20-1-01-19	Demand for prescribed fire on private lands in the Mid-Atlantic United States	Melissa M. Kreye	Pennsylvania State University
20-1-01-24	Impacts of historical disturbance regimes on avian conservation in eastern tallgrass prairies	Holly Jones	Northern Illinois University
20-1-01-26	Prescribed fire effects on soil hydraulic properties and ecohydrological function	Kevan B. Moffett	Washington State University-Pullman
20-3-01-1	The Alaska Fire Science Consortium: Meeting the needs and challenges of wildfire managers in Alaska	Sarah F. Trainor	University of Alaska-Fairbanks
20-3-01-2	Great Basin Fire Science Exchange	Mark W. Brunson	Utah State University
20-3-01-5	The Pacific Fire Exchange: Linking fire science and fire management in Hawaii and the US-Affiliated Pacific Islands	Parker C. Trauernicht	University of Hawaii-Manoa
19-1-01-11	Accelerating post-fire restoration with a novel fungicide and abscisic acid seed coating formulation	Matthew D. Madsen	Brigham Young University
19-1-01-30	Fire-herbivore-climate dynamics in the Northern Great Plains	David B. McWethy	Montana State University
19-2-01-1	Fuel break systems: Contrasting metrics and evaluative criteria for northern and southern California	Scott L. Stephens	University of California-Berkeley
19-3-01-2	Great Plains Fire Science Exchange	Carol E. Baldwin	Kansas State University
19-3-01-11	Southern Rockies Fire Science Network	Tony S. Cheng	Colorado State University
17-1-04-7	Pyrogenic controls on grass-shrub persistence in the Great Plains	William E. Rogers	Texas A&M University
15-1-07-2	Long-term SUCCESS: Succession and ecosystem dynamics in the sagebrush steppe following wildfires	Jonathan D. Bakker	University of Washington
11-S-2-5	JFSP data management plan	Dave J. Rugg	USDA Forest Service
11-S-3-2	Northern Rockies Fire Science Network	Vita X. Wright	USDA Forest Service
11-S-3-4	Oak Woodlands Fire Science Exchange	Michael C. Stambaugh	University of Missouri-Columbia
11-S-3-8	Northwest Fire Science Exchange	Becky K. Kerns	USDA Forest Service
09-S-04-9	The Southern Exchange: Putting fire science on the ground	Raelene Crandall	University of Florida
09-S-04-13	Developing a Southwest Fire Science Consortium	Andrea E. Thode	Northern Arizona University
09-S-04-15	Consortium of Appalachian Fire Managers and Scientists	Todd F. Hutchinson	USDA Forest Service

IMPORTANT JFSP-FUNDED RESEARCH FINDINGS

Effectiveness of Fuel Treatments at the Landscape Scale

In FY 2022, Terrie Jain (USDA Forest Service) and team conducted an extensive analysis of landscape-scale fuel treatment effectiveness in North America. The team analyzed 127 fuel treatment effectiveness studies in three categories (simulation, empirical, and case studies). They found that generally, fuel treatments reduced negative outcomes of wildfire. In some cases, fuel treatments promoted beneficial wildfire outcomes, although the effects diminished over time following treatment and were influenced by factors such as weather conditions at the time of the fire. The three types of effectiveness study categories all emphasized the need to treat multiple strata in a landscape to reduce fuels contributing to fire spread and severity. The research team concluded that additional research is needed to better understand the cost versus benefit; fuel treatment longevity; and interactions among fuel, topography, and climate. There is also a need for empirical studies to examine: (1) fuel treatments beyond the treatment boundaries, and (2) simulation studies to look at conditions under a changing climate and case studies that document firsthand management experience of the effectiveness of fuel treatments.

Theme	Question
Location	Where was the case study located? What are defining characteristics of the affected landscapes?
Treatment types	Which of the treatment types were implemented? What was the stated rationale behind treatment placement/design?
Indicators	Which indicators were evaluated to assess treatment effectiveness?
Effectiveness	How effective were fuel treatments (fire spread, fire intensity, fire effects, and suppression tactics)?
Interacting factors	What factors influenced treatment effectiveness?
Management	What barriers exist when implementing fuel treatments? What were identified as lessons learned?
Inference	What research needs were identified? What limitations might affect inference from case studies?

Figure 2. Themes and list of questions used to extract information from each case study.

Jain and the team’s JFSP-funded research resulted in numerous publications, including:

- Urza, A.K., B.B. Hanberry, and T.B. Jain. 2023. Landscape-scale fuel treatment effectiveness: Lessons learned from wildland fire case studies in forests of the western United States and Great Lakes region. *Fire Ecology* 19 (1): 1.
- Ott, J.E., F.F. Kilkenny, and T.B. Jain. 2023. Fuel treatment effectiveness at the landscape scale: A systematic review of simulation studies comparing treatment scenarios in North America. *Fire Ecology* 19 (1): 10.
- Jain, T., S. Hood, S. McKinney, J. Ott, A. Urza, M. Varner, I. Abrahamson, N. Anderson, M. Battaglia, J. Chambers, B. Hanberry, F. Kilkenny, and J. O’Brien. 2023. Can fuel treatments change how a wildfire burns across a landscape? *Science You Can Use Bulletin*, Issue 59. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Co-Managing Wildfire Risk

In FY 2017, the JFSP solicited proposals to investigate the social dimensions of co-managing wildfire risk across jurisdictional boundaries. Two interdisciplinary teams released well-researched findings on the concept of co-management of risk in December 2021.

Emily Jane Davis and team examined the concept of co-managing risk, in particular, connectivity across wildfire risk mitigation and fire response in the Intermountain West. Given various administrative challenges and views on wildfire suppression, there is a need for a more cohesive approach to managing wildfire risk in the Western United States.

The team’s findings included:

1. Collective action to reduce wildfire risk is challenged by multiple types of boundaries, as well as a fluidity of framings of wildfire risk across social domains and boundary

objects, creating some disconnection between how risks are defined and their potential solutions.

2. Multiple forms of boundary spanning actors, functions, and features are needed to overcome these boundaries and disconnects. Community-based and collaborative coalitions are key boundary-spanning organizations that can unite actors across organizational boundaries.
3. The practices of prescribed fire and managing wildfire for natural resource objectives help span the boundaries between the functional realms of mitigation and fire response.
4. Research suggests the need for further investment in boundary spanning actors and functions at local scales, coordinated with efforts to align risk paradigms in broader-level venues; and future applied social science that can continue to identify strategic boundary-spanning approaches in varying contexts.

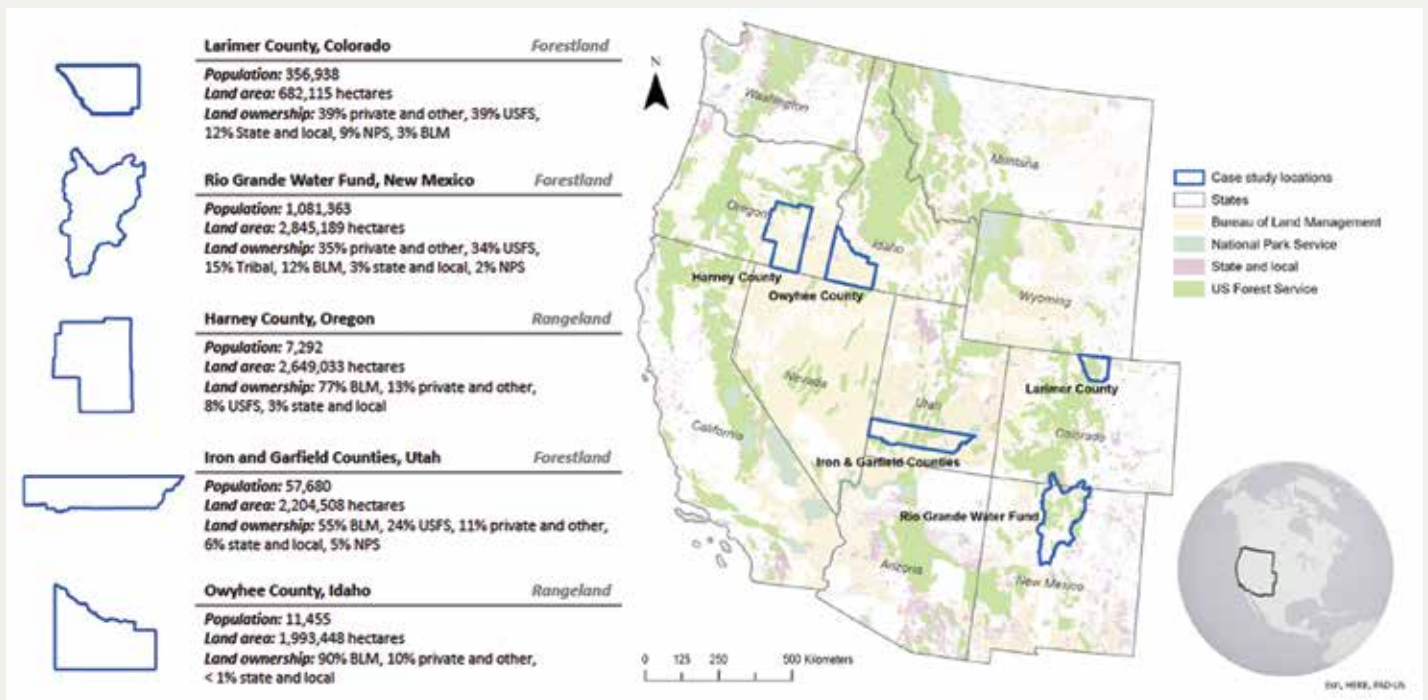


Figure 3. Case studies and key characteristics of the fireheds studied in the Davis research team co-managing risk project.

The Northwest Fire Science Consortium has a webpage dedicated to this research along with numerous factsheets and archived presentations. Of particular note is a well-organized and informative story map detailing many research findings related to tools for collective action to reduce wildfire risk.



Several publications resulting from this work include:

- Davis, E. J., H. Huber-Stearns, M. Caggiano, D. McAvoy, A.S. Cheng, A. Deak, and A. Evans. 2022. Managed wildfire: A strategy facilitated by civil society partnerships and interagency cooperation. *Society & Natural Resources* 35 (8): 914-932.
- Huber-Stearns, H.R., E.J. Davis, A.S. Cheng, and A. Deak. 2022. Collective action for managing wildfire risk across boundaries in forest and range landscapes: Lessons from case studies in the western United States. *International Journal of Wildland Fire* 31 (10): 936-948.
- Jacobson, M., H. Smith, H.R. Huber-Stearns, E.J. Davis, A.S. Cheng, and A. Deak. 2022. Comparing social constructions of wildfire risk across media, government, and participatory discourse in a Colorado fireshed. *Journal of Risk Research* 25 (6): 697-714.
- Davis, E.J., H. Huber-Stearns, A.S. Cheng, and M. Jacobson. 2021. Transcending parallel play: Boundary spanning for collective action in wildfire management. *Fire* 4 (3): 41.

In another co-management study, Branda Nowell (North Carolina State University) and Toddi Steelman (Duke University) released five

noteworthy findings on how to govern and manage across jurisdictionally fragmented landscapes to promote more effective wildfire preparedness and response. Their findings included:

1. Stakeholders varied in the weight they placed on perceptions and management of immediate and tactical risk relative to incident-level potential risks and long-term risks post incident. Minimizing risk in one temporal phase often necessitates accepting greater risk in another phase.
2. Operationally, leaders subscribe to different mental models for undertaking co-management. The implication is that different leaders will enter into conversations about co-management with different expectations, preferences, and assumptions. Making these assumptions more explicit will be important to effectively manage interdependency in interjurisdictional wildfire response.
3. Governance structures for co-managing multiple jurisdictions on wildfires are varied and include ad hoc arrangements, unified command, and delegations of authority. Ad hoc arrangements were most problematic for providing voice in decision making.

New governance arrangements may be needed as fire organizations grow more complex over time with the growth of wildfire size and jurisdictional participation.

- Facilitating better co-management outcomes was possible when two conditions were met: (1) neighboring jurisdictions were involved in decision making and felt they had a voice, and/or (2) neighboring jurisdictions felt confident that the risk

management process was appropriate and took their concerns into account.

- Wildfires in the United States have become more institutionally complex over the past 20 years in at least three ways: (1) larger fire perimeters, (2) greater number of incident days at heightened preparedness levels, and (3) more jurisdictions across more levels of government affected on an average incident.

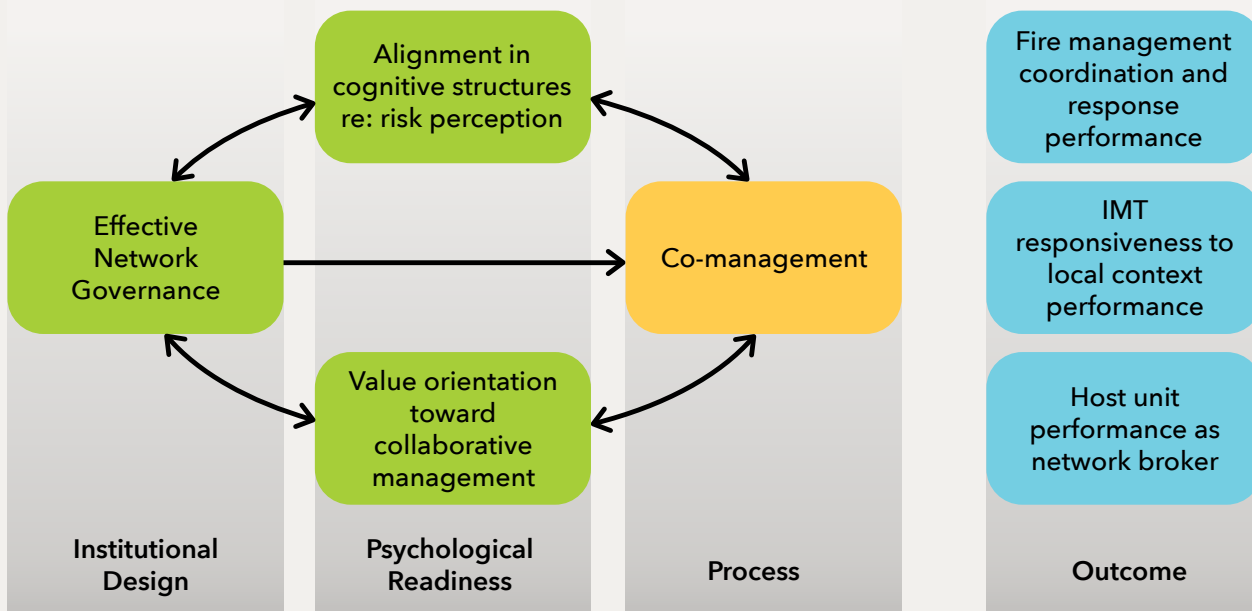


Figure 4. Conceptual model of co-management processes, structures, and outcomes from the Nowell and Steelman findings.

Several publications have also resulted from this work and can be accessed below:

- Nowell, B., T. Steelman, A.L. Velez, and K. Albrecht. 2022. Co-management during crisis: Insights from jurisdictionally complex wildfires. *International Journal of Wildland Fire* 31 (5): 529-544.
- Stelman, T., B. Nowell, A.L Velez, and R. Scott. 2021. Pathways of representation in network governance: Evidence from multi-jurisdictional disasters. *Journal of Public Administration Research and Theory* 31 (4): 723-739.
- Nowell, B., T. Steelman, A. Velez, K. Albrecht, S. Baines, S. McGovern, H. Minkowitz, E. Nauert, and R. Scott. 2020. Knowing what

we're up against: A profile of jurisdictional complexity of wildfire. *Wildfire Magazine* December 2021.

- Nowell, B., A. Velez, and T. Steelman. 2018. Co-managing wildfire: Conversations you should have right now. *Fire Adapted Communities Learning Network*. July 12, 2018. <https://fireadaptednetwork.org/co-managing-wildfire-conversations-you-need-to-have-right-now/>.

To access the reports highlighted above, please visit <https://www.firescience.gov>, click on the Research tab, then the Completed Research tab, and search by principal investigator name.

Graduate Research Innovation Awards

Every year, the JFSP invites current master’s and doctoral students from U.S. colleges or universities studying wildland fire and related physical, biological, and social sciences to apply for a Graduate Research Innovation (GRIN) award. The purpose of the competitive award program is to enhance the management and policy relevance of current fire-related research and to achieve beneficial outcomes of funded work.

Students are asked to address one of the following topic areas in their proposals:

- Fuels management and fire behavior

- Changing fire environment
- Emissions and air quality
- Fire effects and post-fire recovery
- Relative impacts of prescribed fire versus wildfire
- Human dimensions of fire

The GRIN award program is renowned across the fire science community. It allows graduate students an opportunity to connect and network with scientists and land managers, while also giving them a direct pathway for their research to be applied to on-the-ground decision making. In FY 2022, 11 proposals were received and 7 proposals were selected for funding (Table 4). In FY 2023, 30 proposals were received and 20 were funded (Table 5).

Table 4. 2022 Graduate Research Innovation (GRIN) award recipients.

Project ID	Title	Student Investigator	Agency/Organization
22-1-01-2	Linking understory community functional traits and fire behavior in two fire-dependent forest types	Arthur Lamounier Moura	Auburn University
22-1-01-4	A comparison and development of methods for estimating sagebrush shrub biomass and fuels	Georgia R. Harrison	University of Idaho
22-1-01-6	Classification and high-resolution delineation of the fire-prone wildland-urban Interface	Megan R. Dolman	Boise State University
22-1-01-10	The effects of re-introducing fire in a long-unburned mixed wood forest	Jonathan D. Goode	University of Alabama
22-1-01-12	How fire regime, land use, and climate change affect seed survival in a fire-dependent ecosystem	Angelica Bautista	University of Wisconsin
22-1-01-29	Influence of fuel reduction strategies on soil nitrogen and forage quality in ponderosa pine forests	Emily L. Yurcich	University of Idaho
22-1-01-31	Post-wildfire hydrogeomorphic risk management assessment	Haley Canham	Utah State University

Table 5. 2023 Graduate Research Innovation (GRIN) recipients

Project ID	Title	Student Investigator	Agency/Organization
23-1-01-2	Characterizing a decision-making process to shift fire management paradigms around natural ignition	Scott T. Franz	Northern Arizona University
23-1-01-5	Prescribed fire effects on wetland nutrients, macroinvertebrate production, and insect emergence	Coleson F. Wrege	University of Florida
23-1-01-6	Using NAIP DAP and Landsat time series data to quantify post-fire vegetation recovery	Madeline C. Franz	Washington State University
23-1-01-10	Fire and forest recovery in rugged terrain: Does topographic complexity enhance forest resilience?	Timon T. Keller	University of Wisconsin
23-1-01-11	How can managers mitigate forest type conversion in post-fire and drought-affected landscapes?	Caden P. Chamberlain	University of Washington
23-1-01-12	Evaluating bark beetle use of fuel treatments for better fuel treatment design	Jonas W. Noomah	Northern Arizona University
23-1-01-15	Stand-level drivers and management impacts on trajectories of reburn potential in western Cascadia	Jenna E. Morris	University of Washington
23-1-01-16	Projecting long-term impacts of management actions and climate on boreal forest fuel characteristics	Nicholas T. Link	Northern Arizona University
23-1-01-18	The effect of prescribed fire timing on seed maturation and seedling recruitment in restored prairie	Michelle A. Homann	University of Wisconsin
23-1-01-19	Post-restoration flammability: The effect of time since treatment on understory live fine fuel traits	Ethan M. Taber	University of Arizona
23-1-01-20	A policy implementation analysis of managing wildfire risk in Oregon	Alexandra M. Casey	University of Oregon
23-1-01-21	Evaluating cultural ecosystem service impacts of prescribed burning in San Juan National Forest	Anna L. LoPresti	University of Colorado-Boulder
23-1-01-23	Making it out alive: The story of wildland fire microbial emission factors	Phinehas T. Lampman	University of Idaho
23-1-01-24	To burn or not to burn: UAS mapping of tree-level foliar moisture content	Lauren E. Lad	Colorado State University
23-1-01-27	Effects of wildfire burn severity on pollinator habitat and community composition two decades post-fire	Alaina K. Smith	University of Denver
23-1-01-28	Augmenting pre-fire debris-flow hazard assessments with runout modeling to inform pre-fire management decisions	Alexander N. Gorr	University of Arizona
23-1-01-30	Planning for uncertain fire futures: a model of microclimate and fuel moisture in mesic forests of the northeastern U.S.	Peter J. Breigenzer	University of Maine
23-1-01-31	Do prescribed fires on non-Department of Defense lands in Virginia support habitat for the imperiled Southern Plains Bumblebee (<i>Bombus fraternus</i>)?	Jennifer M. Weber	Virginia Polytechnic Institute and State University
23-1-01-32	Post-fire management practices and Sin Nombre virus: Do re-seeding efforts influence hantavirus prevalence in New Mexico?	Carleen N. Silva	New Mexico State University
23-1-01-38	Impacts of prescribed fire on drought resilience of ponderosa pine and Douglas-fir	Charlotte C. Reed	University of Montana

GRIN PROFILES

Meg Dolman (Boise State University)



Meg Dolman planting sagebrush in Boise, Idaho.

Project: Classification and High-Resolution Delineation of the Fire-Prone Wildland-Urban Interface

What do you hope to accomplish through your research?

Through my research, I aspire to create something valuable for managers tasked with wildfire hazard management and mitigation, that is also applicable beyond southern Idaho. I am excited by the skills that I am acquiring through my research and I hope to continue to strengthen my relationship with my community partner.

Are you interested in a particular fire science career path?

Post-PhD, I am dedicated to pursuing a fire science career path. Ideally, I would like a position that allows me to continue furthering my passion for research, whilst exploring avenues of fire science communication and education. Specifically, I am passionate about initiatives aimed at human-ignition reduction, fire prevention, and enhancing community resilience to fire risk.

Charlotte Reed (University of Montana)

Project: Impacts of prescribed fire on drought resilience of ponderosa pine and Douglas-fir

What do you hope to accomplish through your research?

Prescribed fire and managed wildfire can help reduce forest density, making forests more resilient to future wildfires. It is also often assumed that this reduction in forest density can increase water availability for remaining trees and improve their ability to withstand droughts. Yet, there has not been much research to validate this assumption, which may not hold true if the injuries that trees sustain during fire impair their ability to function normally.

I hope that my research will help to understand to what extent prescribed fire can be used as a tool to increase the drought resilience of forests, as well as to better understand how long it takes trees to fully recover from their fire injuries. I also hope to use this research to better understand how the seasonality of burning (i.e., spring burning or fall burning) influences these effects, and whether prescribed fire may enhance drought resilience for some species more than others.

Are you interested in a particular fire science career path?

My hope is for a career as an agency research scientist, likely with the USDA Forest Service. Doing science that is motivated by land management questions is what excites me, and I hope to continue to do this type of research throughout my career.

Charlotte extracts a tissue sample from a ponderosa pine to understand how tree carbon stores change after prescribed burning.



USGS REPORT ON THE FIRE SCIENCE EXCHANGE NETWORK

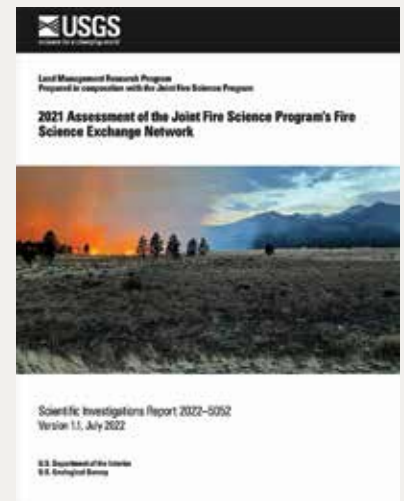
At the request of JFSP, the U.S. Geological Survey (USGS) conducted an evaluation of the Fire Science Exchange Network (FSEN). The study was divided into two phases: the first phase was a literature review and synthesis from materials provided by the JFSP Board. Phase two, informed by the literature review, was an online survey sent to more than 16,000 exchange network users (compiled from electronic mailing lists for each exchange). Respondents indicated that were asked their opinions on the importance, quality, and delivery of information for 16 key fire science topics, the prioritization of FSEN objectives, and from where and to what extent respondents are gathering information on key topics.

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Overall, respondents believed that sharing information and building relationships are the most important objectives of the FSEN. Respondents indicated that the exchange network is successful in delivering information for many of the key science topics (e.g., fire behavior, prescribed fire, firefighter safety,

and incident management). Gaps were identified in scientific resources available for some topics (e.g., economic impacts, social science and human dimensions, and Indigenous knowledge). Most respondents participated in 1-2 unique exchanges and they relied primarily/heavily on the exchange nearest to where they lived and/or worked for information. Respondents also often relied on external sources outside of the exchange network. Regional patterns emerged in information gathering; respondents from exchanges in the Western United States (e.g., Northern Rockies, Southern Rockies, and Northwest) and respondents from exchanges in the Eastern United States (e.g., Southern, Oak Woodlands, and Tallgrass) frequently gathered information from each other.

Access the full report [here](#).



FIRE SCIENCE EXCHANGE NETWORK

The Fire Science Exchange Network is made up of 15 regional exchanges across the country that are focused on delivering wildland fire science information to the science and management community. Created in 2010, this science delivery approach ensures wildland fire science information is relevant to a particular region and can be used and applied by the local research and management community in future projects and decision-making processes. Exchanges engage with their respective subscribers in a variety of manners from online platforms such as webinars, newsletters, and social media, to in-person engagement events such as conferences, webinars, workshops, and trainings.



Highlights from 2022 and 2023

- Produced 487 newsletters
- Published 278 blog posts
- Developed 40 syntheses
- Hosted 213 webinars
- Hosted 186 conferences and workshops
- Developed 102 short courses and continuing education units
- Created 243 video productions

A detailed breakdown of exchange activities is highlighted in the FY 2022 and FY 2023 annual reports found on the Publications Tab of www.firescience.gov.

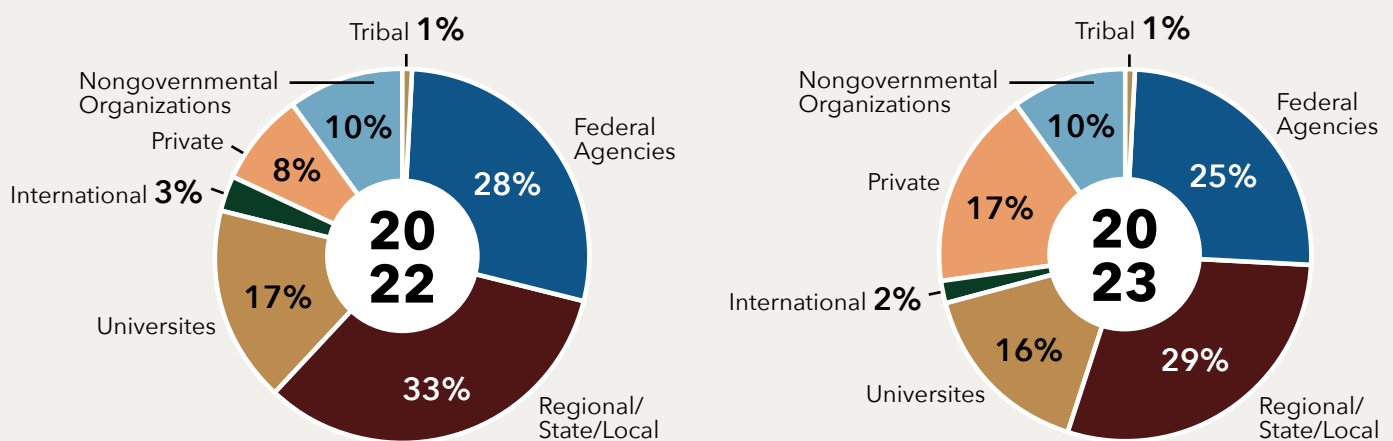


Figure 5. The number of Fire Science Exchange Network participants by group in FY 2022 and FY 2023.

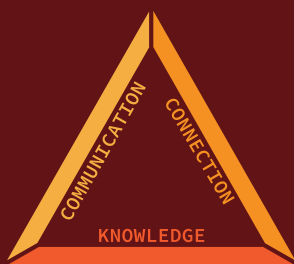
The total number of participants in exchange activities from all organizations (Figure 5) significantly increased from 2022 to 2023, from 19,000 to 23,000 individuals. While the JFSP cannot definitively attribute a rise in participation to one event, we hypothesize the return of in-person engagement events contributed to the increase. In-person events—such as webinars, workshops, conferences, and trainings—result in building strong relationships between scientists and managers and the wildland fire community members at large. Since moving on after the pandemic, exchanges and their subscribers have embraced being back together to learn and teach the latest in wildland fire science, both in research and in management.

There is a notable shift in how exchanges organize around wildland fire science topics. From roughly 2012–2020, exchanges expended time and energy building up their respective regional portfolio, subscribers, and networks. Now with an established network in place, exchanges have shifted to collaborating with each other on workshops, webinars, conferences, trainings, and more. This demonstrates the evolution and maturation of the network and how it has grown to become one of the most successful aspects of the program. For FY 2022–2023, JFSP highlights two network collaborative activities.

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Wildland Firefighter Health Series

Several western exchanges, including the Northern Rockies Fire Science Network, the Northwest Fire Science Consortium, the Great Basin Fire Science Exchange, the Southern Rockies Fire Science Network, and the California Fire Science Consortium, partnered to host a successful 3-day webinar series focused on wildland firefighter health. During this 3-day series of presentations and panel discussions, professionals and agency leaders shared some of the current science, knowledge, and tools available to support wildland firefighter physical and mental health. The [series](#) aimed to bring the latest science to those working in fire management and/or wildland firefighting. This well-attended series is just one of the many examples of how exchanges collaborate and partner on common emerging issues.



Fueling Collaboration

This series was developed by the USDA Forest Service Northern Research Station, the USDA Forest Service Southern Research Station, and the Joint Fire Science Program’s Consortium of Appalachian Fire Managers and Scientists, Lake States Fire Science Consortium, North Atlantic Fire Science Exchange, Oak Woodlands & Forests Fire Consortium, Southern Fire Exchange, and Tallgrass Prairie and Oak Savanna Fire Science Consortium. Fueling Collaboration strives to build connections between land managers and researchers through a series of interactive virtual panel discussions, mainly focused on fire issues in the Eastern U.S. Visit the [website](#) to access future webinar dates and past recordings.

2023 Annual Exchange Meeting

Each year, the 15 exchanges and the Joint Fire Science Program office staff come together for a one week in-person meeting to discuss the program and lessons learned in science delivery. It is also an opportunity for the exchange hosting the meeting to showcase their science delivery activities in the form of presentations and field trips.

In 2023, the Great Plains Fire Science Exchange hosted the All Exchange Meeting in Manhattan, Kansas. The meeting was planned and executed brilliantly with presentations from the local prescribed burn associations, Konza Prairie Biological Station, and hands-on prescribed burning on private lands. Unlike many of the other exchanges, the Great Plains Fire Science Exchange covers less than 2% of federal lands and over 98% private lands. As such, forging strong relationships with private landowners is key to their successful program.



Onsight instruction/ demonstration of drip torch ignition safety at The SAVE Farm, where burning is incorporated into the agricultural training program.

FUTURE JFSP FUNDING INITIATIVES

Firefighter Health and Wellness

Wildland firefighter health and safety has been a longstanding topic of interest to the JFSP, with links going back to the 2010 JFSP Smoke Science Plan. Research conducted through that plan was limited, but smoke impacts have continually been a potential science topic. Overall firefighter health, (smoke impacts included) was approved as an Investment Strategy sustained research topic in 2021. Moving forward, the program will work with numerous organizational partners, including the National Wildfire Coordinating Group's Medical and Public Health Advisory Team, Colorado State University, and USFS Rocky Mountain Research Station to advance this very important science management need. Anticipated product outcomes include a science needs assessment with partners and potential future research projects.

Climate Adaptation Partnership

In response to a rapidly changing fire environment, the JFSP developed a partnership with the U.S. Geological Survey Southwest Climate Adaptation Science Center to jointly fund proposals that develop place-based partnerships between scientists, practitioners, and managers. These proposals focus on implementation of climate-adapted management approaches in response to changing fire regimes. The long-term goal of this project is to create and sustain partnerships throughout the country, with a strong emphasis on identifying and implementing management strategies as the fire environment changes. This plan will be implemented in steps beginning with partnerships in California and the Southwest United States. More about this long-term science plan is found in the following publication: Hunter, M.E., E. Brunson, K. Dante-Wood, C. Enquist, K. Hiers, and S. Goodrick. 2022. An emerging framework for adapting to changing fire regimes: Reimagining science, management, and culture. *Wildfire Q3 2022*.



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