The Economic Effects of Large Wildfires

Final Report: JFSP Project Number 09-1-10-3
Project website: http://ewp.uoregon.edu/largefires/context

Principal Investigator:
Dr. Cassandra Moseley, Director, Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon, 5246 University of Oregon, Eugene, OR 97403.
Phone: (541)346-4545. Email: cmoseley@uoregon.edu.

Co- investigators:
Krista Gebert, Forest Service Rocky Mountain Research Station, Missoula, MT
Dr. Pamela Jakes, Forest Service Northern Research Station, St. Paul, MN
Dr. Laura Leete, University or Oregon, Eugene, OR
Dr. Max Nielsen-Pincus, University of Oregon, Eugene, OR

Research Associates and Assistants
Dr. Emily Jane Davis, Autumn Ellison, Cody Evers, Branden Rishel, and Shiloh Sundstrom
University of Oregon, Eugene, OR

Students Assistants:
Katie Conaghan, Aleta Katra, Liz Podowski, and Nina Rinaldi
University of Oregon, Eugene, OR

This research was sponsored in part by the Joint Fire Sciene Program.
For further information go to www.firescience.gov.

Ecosystem Workforce Program

UNIVERSITY OF OREGON

INSTITUTE FOR A SUSTAINABLE ENVIRONMENT
5247 University of Oregon
Eugene OR 97403-5247
T 541-346-4545 F 541-346-2040
ewp@uoregon.edu • ewp.uoregon.edu

I. Abstract

Large wildfires disrupt the lives of workers, families, and employers. However, fire suppression and recovery efforts may provide economic opportunities. Unlike with other natural hazards, there has been little research about how wildfires affect local economies. The purpose of this project was to analyze the effects of large wildfires on labor markets and examine how fire suppression spending may mediate these effects.

Main findings from this research suggest that (1) in the short term, labor market impacts from large wildfires are positive during the course of a fire, (2) in the long-term, large wildfires lead to greater economic instability by amplifying seasonal variation in employment, (3) local capture of suppression spending helps mediate negative labor market impacts, and (4) local business capacity to capture suppression contracts varies and can be measured by the number of suppression-related vendors active in the county.

II. Background and purpose

Large wildfires disrupt communities and often have lasting socioeconomic effects (Burchfield 2007, Carroll et al. 2005). However, the input of money from fire suppression and recovery efforts may also provide economic opportunities. The cost of suppressing large wildfires has been increasing continually since records of expenses began in the 1970s, with annual expenses reaching well over $1 billion annually in the past decade. Unlike with other natural hazards, there has been little research about how large wildfires and the associated spending affect local economies. Prior to this project, no generalizable empirical research had quantified the specific effect of large wildfires on local employment and wages.

The purpose of this project was to fill this gap in knowledge in order to help land managers, policy makers, and community leaders better understand, anticipate, and plan for the local economic effects of wildfires. The specific knowledge objectives of this study were to (1) produce and provide information to decision-makers that will assist them in making management and policy decisions that support local economies by minimizing potential negative economic effects of wildfire and maximizing potential positive effects, and (2) provide fire social scientists and economists with knowledge about the effects of wildfires on local economic patters and economic development efforts.

These were accomplished through two interconnected research objectives:

(1) An in-depth study of the social and economic effects of the 2008 fire season in Trinity County, California. This objective examined both the community response to and social impacts of the extreme wildfire season as well as the economic impacts of the fires across different sectors in the county.

(2) A generalizable investigation of the relationship between fire suppression and local labor markets in the west. This objective used county-level labor market data to examine changes in local employment and wage rates that occurred during and after large wildfires from 2004-2008. It also examined how differing levels of local suppression spending affected changes in rates, and factors of local business capacity that influence greater local capture rates.

III. Study description and location

The project examined local community and economic impacts from large wildfires through a dual-methods approach, using an in-depth case study and a larger west-wide labor markets analysis to address each objective.

The first objective focused on Trinity County, CA, where our goal was to develop a mixed-methods case study of the social and economic impacts of large wildfires. This focused approach allowed us to delve deeply into qualitative as well as qualitative evidence of wildfire experiences in rural communities in fire-prone ecosystems.

Trinity County is a remote, mountainous area with more than 80 percent public lands and historic reliance on the forest industry. Nearly the entire county is classified as fire regime condition class three, and has population of approximately 13,500 with poverty rates well above the national average. Residents of this county face isolation, poverty, and a challenging business environment. A number of small recreation-based communities lie along the Trinity River. Weaverville, the county seat, has a service-based economy and is home to the county's one remaining sawmill. Marijuana cultivation has become a primary source of income for many residents. Trinity County also has strong community efforts to reduce hazardous fuels and build a local biomass utilization industry. In 2008, numerous wildfires burned in this county; 13 of these fires cost more than $1 million in suppression. Total suppression costs in that year were over $150 million, and the county experienced damages to over $2 million of private timber as well as road and forest closures that affect recreation and natural resource-based businesses.

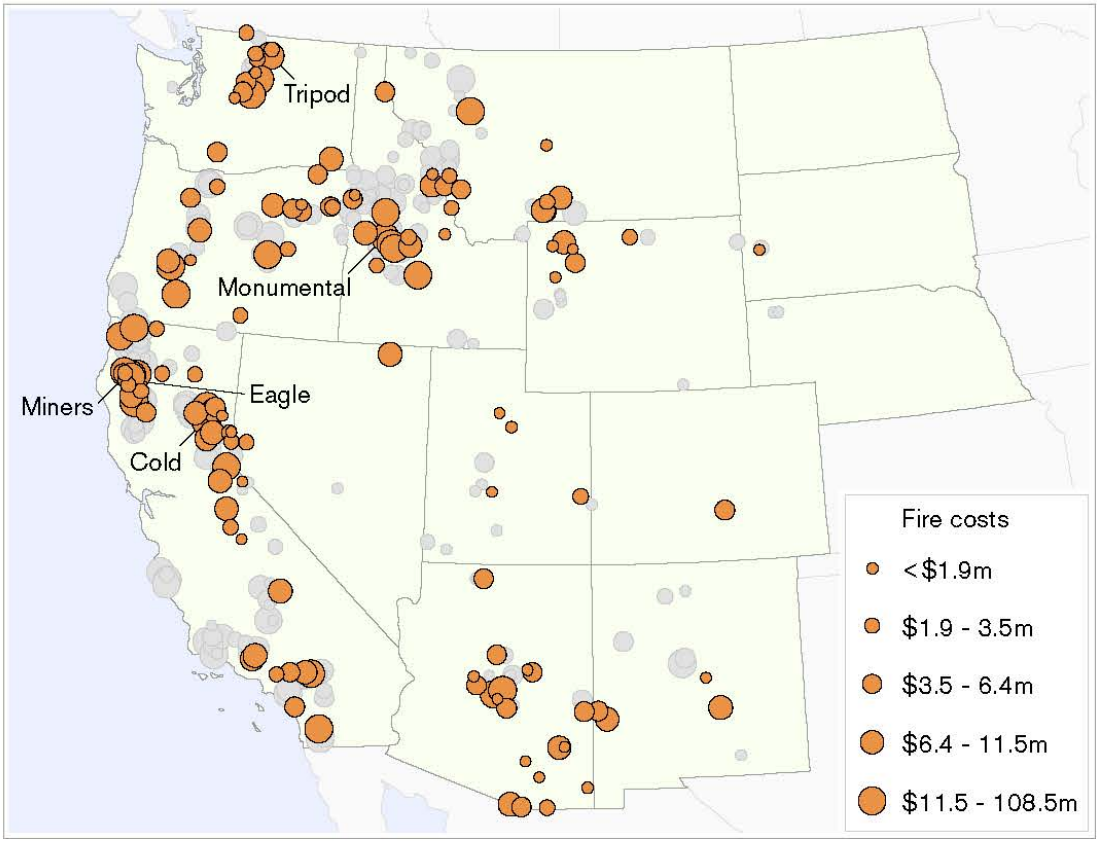
Prior to this fire season, researchers from another JFSP-funded project had examined the successes and challenges to developing biomass utilization capacity to facilitate fire hazard reduction and local economic development. This made Trinity County an ideal case to return to for both re-measurement and assessment of new objectives around the economic impacts of large wildfires.

To understand the effects of the 2008 wildfires in this case, we first examined Forest Service financial transaction information to analyze patterns of suppression spending, and Bureau of Labor Statistics labor market data to document employment and wage rates before, during, and after the fire season. For the labor market analysis, we used a statistical regression model to predict average employment and wage rate growth per quarter by controlling for past growth, state-level growth, economic volatility, and the effect of a wildfire. We applied the model to Trinity County's overall labor market and to specific economic sectors. Second, we reviewed newspapers and agency reports about the 2008 wildfires, and then conducted in-person semi-structured interviews in May 2010. We used open-ended questions about the local effects of the fires in order to capture consistent data while retaining the flexibility to explore unanticipated topics (Schoenberger 1991). We interviewed twenty-one individuals, including citizens, business owners, elected officials and government employees, nonprofit organization staff members, and Forest Service staff members. After transcription, coding, and analysis, we integrated the interview data with suppression spending and labor market data to produce a comprehensive account of

impacts (Bryman 2006). This mixed-methods case study approach allowed us to show how large fires may have extensive, interrelated effects on several economic sectors at local levels.

The second objective of the study sought to generalize the labor market findings found in the Trinity County research (Objective 1). For this we examined the effects of large wildfires on county-level employment and wages across the West. Large wildfires were defined as those with total suppression costs greater than $1 million. In the 11 western states, 346 large wildfires for which the Forest Service was the lead suppression agent burned in 124 counties from 2004-2008 (see figure 1).

Figure 1. Large wildfires and costs, 2004-2008. The 135 wildfires in the spending breakdown sample are shown in orange.



Using the same methods of labor market analysis as for Trinity County, we used statistical regression models to quantify local employment and wage shifts in counties when large wildfires occurred. In addition, to determine the effect of local suppression spending, we requested transaction level financial information from the Forest Service's Foundation Financial Information System for a sample of 135 of the large wildfires stratified for Forest Service region and metropolitan or rural status. We coded each transaction for each wildfire based on the county of the recipient's address. We defined local transactions as those where the recipient was located in the

same county as the wildfire. We analyzed these data to identify where and how fire suppression funds were spent.

Finally, we analyzed how the number of federal contractors in a county prior to a wildfire and county economic specialization predicted local business suppression capacity and influenced local capture when large wildfires occurred. Together, these analyses revealed findings regarding the impacts of large wildfires on 1) local labor markets across the west; 2) how the Forest Service spends suppression dollars and how local spending affects local economies, and 3) factors that influence local business capacity for performing and capturing suppression contracts.

IV. Key Findings

The findings addressed below represent some of the main findings from this research project. These findings are addressed only in brief here. More in-depth findings and discussion can be found in in the working papers (#s 30, 31, 41, 42, and 43) and briefing papers (EWP BPs # 44-48) for the project, which can be found on the project website at http://ewp.uoregon.edu/largefires/context.

A. Impacts in Trinity County, California

The initial case study in Trinity County, CA utilized qualitative interviews and quantitative labor market data to examine the social and economic impacts of the 2008 fire season in the county. The case study provided a close look at large wildfire impacts on a community level, and yielded initial findings and established methods to measure labor market impacts on a larger scale across the west in the rest of the project.

Large wildfires in Trinity County, California, in 2008 caused dynamic varied economic impacts including short-term suppression spending that helped some local businesses avoid closing; but natural resource wages and employment declined following the fires. In the Trinity County case study, combined qualitative analysis with suppression spending and labor market data showed a nuanced range of impacts from large wildfires. Trinity County businesses captured $7.8 million or 6 percent of the $150 million spent on suppression of the 2008 wildfires. Interviews showed that many local residents perceived a lack of local opportunities to perform this work; however, for those who did participate in the suppression effort, several businesses avoided bankruptcy and were able to "pull out" of crisis. Labor market data showed that overall county employment and wages increased during the wildfires, but natural resource and hospitality sectors experienced decreases in the longer-term. Trinity County residents considered the fires a severe economic blow that intersected with existing conditions such as a depressed economy and limited management activity on local forests.

B. Labor market impacts from large wildfires across the West.

Following from the findings on labor market impacts realized in Trinity County, the project expanded in scope to include wildfire-affected counties across the American

West. Analysis of county-level labor market data for all counties that either experienced a large wildfire or where adjacent to a county experiencing a large wildfire during the study period yielded the following findings:

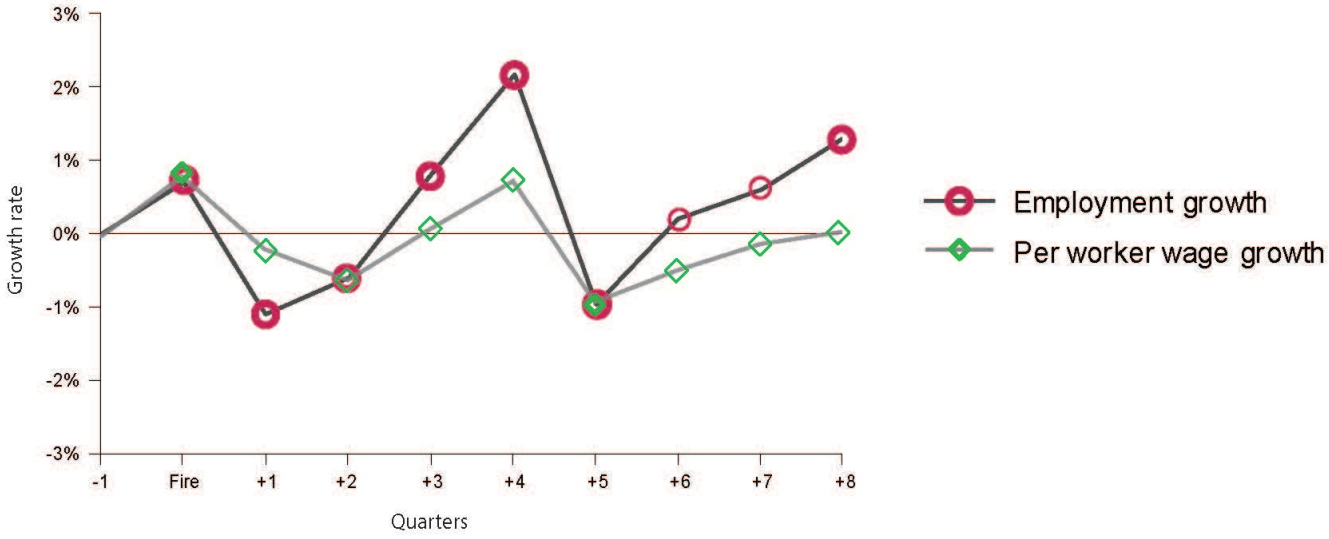
Large wildfires tended to have positive effects on local labor markets during the quarter of the fire. Both local employment and average wages in affected counties increased when large wildfires occurred. Although the roughly one percent increase in employment and wages may appear marginal, it's enough to make a difference in local unemployment rates. These increases suggest that, in the short term, the local economic impacts of large wildfires are positive as employment and wages tended to grow faster than expected given seasonal trends and statewide business cycles. The effect spilled into neighboring economies too. Counties that were not directly hit by wildfire, but were adjacent to wildfires experienced modest increases in both average wages and employment.

The labor market impacts from large wildfire events varied between different types of counties. Counties with economies that were dominated by recreation, service, or government sectors experienced impacts that were significantly different than the overall average. Greater increases in employment occurred in counties that were economically reliant on recreation and government sectors while employment was negatively affected in counties reliant on traditional service sector jobs. Average wages also increased over 2.7 percent during periods of wildfire in counties with a large share of federal and state government employment. The results suggest that employment added during large wildfires may pay differently depending on the sector where it is added. Wages for fire-associated jobs in government sectors, for instance, may grow, reflecting hazard and overtime pay that may not exist in other sectors.

The amount of money that is spent locally during wildfire suppression had a significant effect on the labor market changes that occurred during the wildfire. Local labor markets were affected by how suppression money was distributed geographically. Local economic growth was significantly influenced by the amount of suppression expenses spent in the county of the fire. On average, for every million spent locally, local employment increased one percent. In contrast the total cost of the fire had no effect on the local economy, suggesting that local suppression spending is a better indicator for estimating local economic impacts.

Large wildfires had persistent effects on local economies. Although the short-term effects of wildfires on local economies were generally positive, in the medium to longer-term, local economies experienced increased volatility in employment and average wages (see figure2). Wildfires tended to amplify existing seasonal economic patterns, reducing local economic stability in communities for a year or two after the fire. Similar to findings form other natural disasters, the large wildfires created more drastic seasonal patterns in the years following the event. Although increased employment and wages during wildfires will not likely negate these longer-term impacts, they may indicate increased local capacity to contribute to suppression activities and adapt to growing wildfire risk.

Figure 2. Percent change in average employment and per-worker wage growth rates during and after large wildfires



Large wildfires affected county level employment growth differentially by sector. Some sectors naturally grew in response to suppression and recovery efforts while other sectors contracted as the demand for other goods and services declined until the uncertainty of the impact of the wildfire was over. Although overall employment growth was positive, large fires had a negative effect on employment growth in several sectors, while other sectors exhibited strong growth in months when large wildfires were burning. Natural resources, trades, information, and finance sectors exhibited positive employment growth during large wildfires. Construction, manufacturing, professional services, education and health, and leisure and hospitality sectors exhibited less than expected employment growth during large wildfires. Government employment remained stable during large wildfires, although county labor market data showed that counties with large proportions of government employees experienced significant growth in wages during large wildfires.

C. Forest Service spending

How and where the Forest Service spends suppression money can have a significant impact on the local communities and economies located near wildfires. The transaction-by-transaction breakdown from the 135 large wildfires in our spending sample yielded the following findings about Forest Service spending on large wildfire suppression:

The amount of local spending during large wildfires varied greatly between fires. The people, equipment, and skills involved in suppression work came from both nearby communities and from locations much farther away. Overall, just nine

percent of all suppression spending in our sample of 135 wildfires was spent in the county of the fire. Between fires, local spending varied from zero to 39 percent of the total fire cost. While the large majority of fires had less than five percent local spending, a handful had more than twenty percent.

The Forest Service spent more money on contracted services than any other suppression expenditure category. During wildfires the Forest Service uses its own workforce, contracts with outside businesses, and enters into agreements with other government entities to perform services. Because suppression contracts are made with private vendors, they represent a central avenue for local businesses to provide services during wildfires and capture spending locally. Contracts for services with private firms made up 39 percent of the total federal suppression spending we analyzed, a greater proportion of spending than wages for federal personnel and governmental agreements combined.

The proportion of each large wildfire that went to contracted services varied between fires, and was significantly related to the overall cost of the fire, the geography of the fire, and the total cost of all large wildfires occurring at any given time. As the total cost of the fire went up, the proportion of suppression expenditures that were spent on contracted services increased. In addition, fires in the northwestern part of the study area had higher proportions of contract spending than fires in the southeastern part. Finally, as the cost of all wildfires occurring across the west increased, the proportion of the wildfire expenses awarded to private contractors also increased.

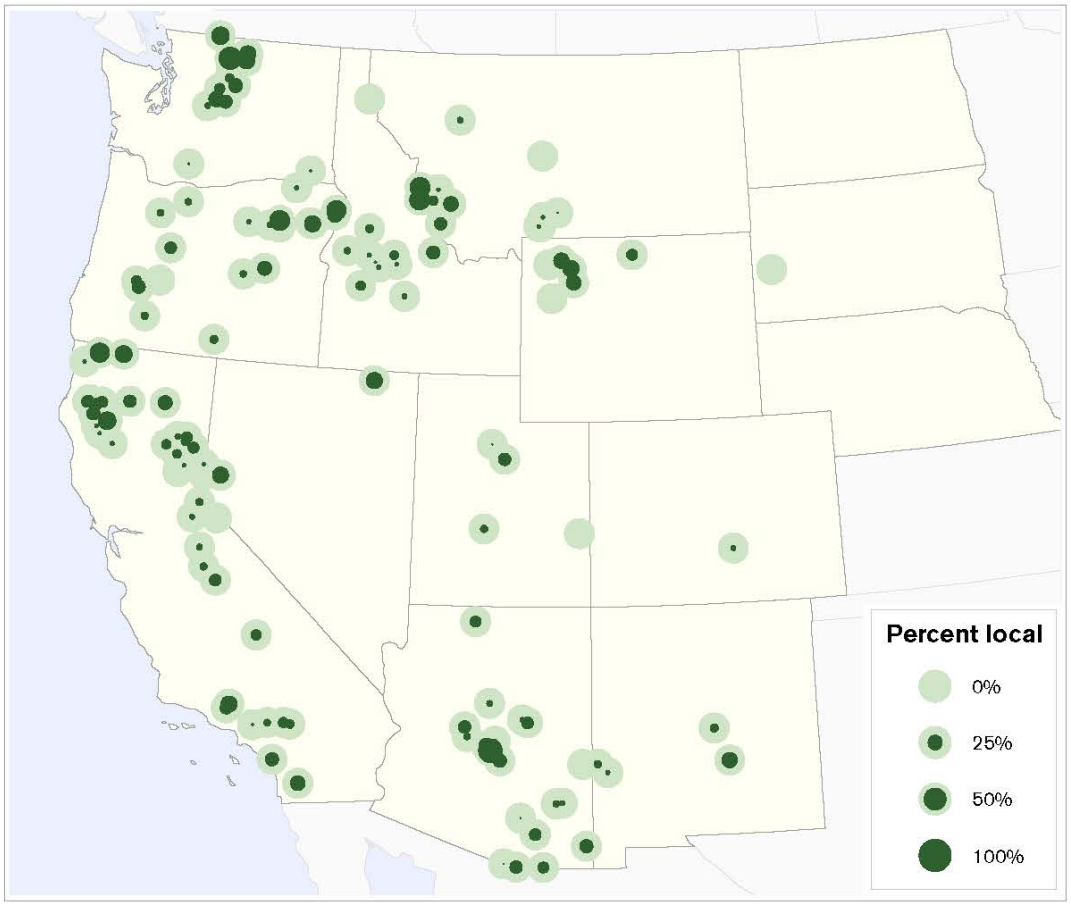
Spending on large wildfire suppression included substantial payments for a large variety of suppression support services in addition to direct suppression work. The highest-paid service vendors in the sample of wildfires provided a wide variety of services. Suppression contracts were made in sectors that varied from traditional natural resource services to housekeeping and utility services. While some of the highest paid vendors in our sample of wildfires provided line crews and suppression equipment, others provided food catering, janitorial and other base-camp set up or support services. Whether a community has the capacity to provide some of these services or whether a community's ability to participate is quickly outpaced may explain whether more suppression spending is awarded locally during some wildfires than others.

In the years following large wildfires, significant increases occurred in recovery and rehabilitation service contracts. Beyond suppression costs, large wildfires incur significant costs for recovery after the fire has been put out. In the year after large wildfire occurrences in counties, service contracts increased for a variety of facility and structure restoration, and natural rehabilitation services. Although this research focused on the impacts of the $1 billion plus spent only on suppressing wildfires each year, additional impacts are implicit in the spending needed to recover from wildfire events.

D. Local business capacity and contract capture.
Because suppression contracts represent a central avenue for local communities to participate in wildfire suppression, the research examined the variability around local spending in terms of differences in local business capacity to provide the types of work needed to engage with suppression efforts. The research examined variability in local contract capture and identified indicators of business capacity correlated with local capture rates.

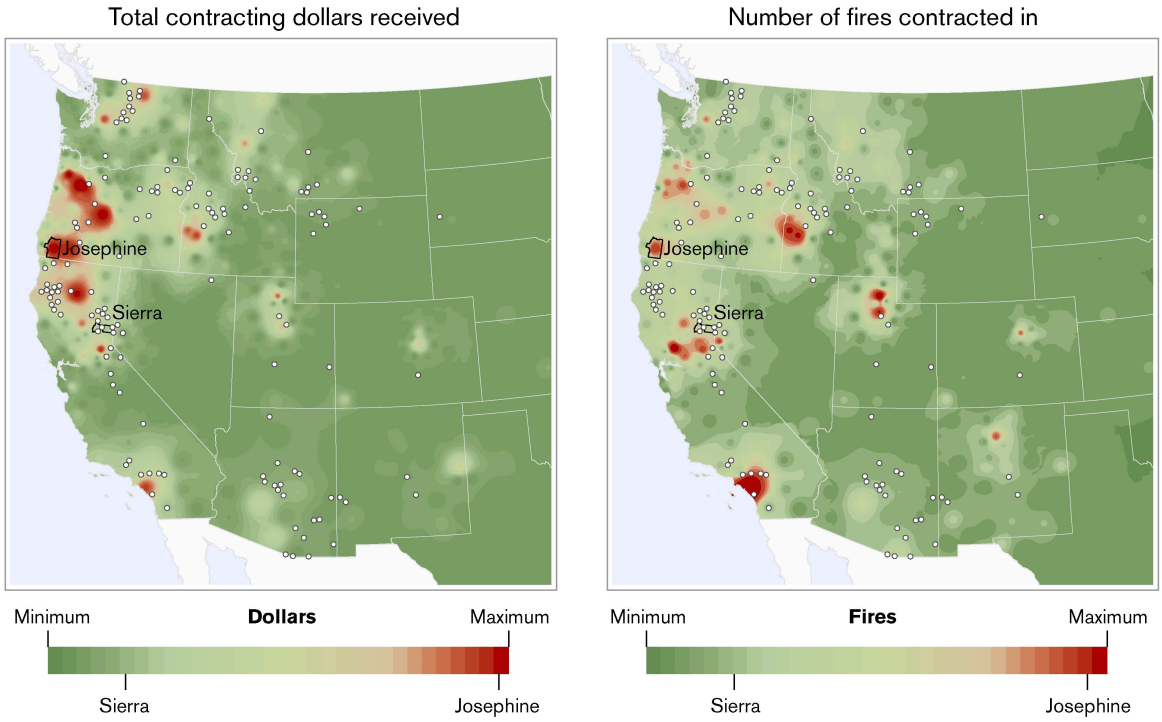
Variability in local capture of suppression contracts was one-and-a-half times as great as the variability in total local spending during large wildfires.
Local contract capture ranged from zero to 62 percent of the total contracted cost per fire (see figure 2), suggesting that some counties are more adept in capturing suppression contracts locally than others. This means that across wildfire events, different scenarios of local suppression contract capture occur, with some counties capturing no contract spending and others capturing the majority of contract spending. With just 12 percent local capture across all fires, the large majority of suppression contract dollars in our study still went to nonlocal vendors.

Figure 3. Percent of contracted suppression costs to local vendors by fire



Capture of fire suppression contracts is concentrated in a few areas in the West. Capture of suppression contracts is not necessarily tied to the places with the most fires. The distribution of contract spending from the sample of wildfires across the West suggests that capacity for local capture is greater in some counties than others (see figure 3). Large wildfire suppression events did not always translate to broad local participation in suppression contracting, suggesting that capacity for local capture does not always coincide with local fire risk. Furthermore, some regions appear to be particularly specialized in capturing suppression contracts, regardless of a fire's location. This apparent specialization could be due to the types of existing businesses in these counties, long-term agreements between contractors and the Forest Service for suppression services in specific counties, or a deliberate business development strategy for wildfire suppression that is not well understood.

Figure 4. Distribution of contract expenditures relative to location of fires



Local business capacity for suppression work can be measured by the number of suppression-related vendors active in the county prior to the fire. Counties with more vendors captured more contract spending locally. In addition, counties with greater number of vendors exhibited greater variability in the amount of suppression contracting captured locally, indicating that the number of vendors is a necessary but not sufficient condition for local capture. The underlying composition of the local economy also affected local capture. Counties with diverse and broad-based economies captured the most contract spending, while counties with more narrow economic specializations, including specializations in services, government, and farming all had lower rates of local capture.

The number of relevant vendors and local economic specialization can be seen as measures of contracting capacity. Local economic specialization influences the types of business present in the county, and counties that have more and diverse suppression-related businesses interfacing with the federal government have more resources for federal suppression work. Together, these two factors accounted for 62 percent of the variance in local capture. Our research suggests that although there are other factors at play, underlying economic structure and the number of vendors interfacing with the federal government are important predictors of how local economies experience large wildfires.

V. Management implications

Taken together, these findings suggest that the details of how wildfires affect communities economically differs based on the particulars of the fire and the local economy. Some sectors, such as tourism and natural resources, are more likely than others to feel the effects of a wildfire. Some of these impacts are simply the result of underlying ecological and economic processes. In most cases, however, fire suppression spending reduces the negative impacts of a large wildfire, by stimulating short-term economic growth. The greater the amount of suppression money spent locally, the greater the short-term economic growth. ***Consequently, agency decisions about how they spend suppression funds influences how a community experiences a wildfire****.*

Clearly, there are complex dynamics in play that drive the complex wildfire response system, not the least of which is the need to ensure that there is adequate natural hazard response capacity available nationally at a moments notice without wasting precious resources developing excess capacity. This paper does *not* suggest that all suppression spending needs to occur locally; rather it suggests that suppression policies, management strategies, and associated spending decisions are not without economic and social costs (and benefits) to communities where wildfires occur.

This study also finds that pre-existing local business capacity is a factor influencing how much contract suppression spending is captured locally during a fire. Local economics that include many of businesses that contract with the federal government for either natural resource or fire-related services prior to a wildfire tend to capture more suppression spending when the large fire comes to that community. ***Business capacity to participate in preparation, mitigation, response, and recovery needs to be considered as one of the components of influencing community resiliency to wildfire.***

Over the past decade, there has been a significant policy emphasis on engaging communities in reducing fire hazards and preparing for wildfire. One central strategy for accomplishing this has been to encourage local community groups and fire departments to develop and implements wildfire protection plans, reduce fire hazard, and increase rural fire department response capacity. This approach, however, has tended to neglect business capacity. ***Communities may want to increase attention on ensuring that relevant local businesses are prepared to participate in federal contracting across all phases of wildfire management and that relevant***

government agencies are structuring contracting opportunities and dispatch practices to foster that local capacity while meeting agency needs*.* This is particularly true in parts of the country where the federal land management agencies make significant use of contractors for wildfire management.

This study also finds that large fires are most likely to occur in communities with significant seasonal variation in employment, and that large wildfires tend to increase this economic volatility. In places with already weak and vulnerable economies, large wildfires can create further instability. In addition, communities that are isolated, lack economically diversity, and have low population tend to fewer businesses available to participate in wildfires and have lower capture rates of suppression contract spending. With this limited pre-existing capacity and local capture, large fires may destabilize already vulnerable local economy.

In isolated communities with significant public lands, low populations, and narrow economic diversity, federal land management agencies and community leaders may need to develop deliberate strategies to increase resiliency. In these communities, it may be productive to develop integrated mitigation, preparation, response, and recovery capacity across the public, non-profit, private sectors to create a mutually reinforcing system for fire and forest management. Building this integrated capacity would likely require attention to the structure of the contracting systems that drive demand for wildfire management services, and the capacity of the organizational of the entities that respond to that demand. Given the limited capacity and risks to resilience in these communities, ***success may require more intensive and deliberate investments in capacity building than in more diverse, affluent, and larger population communities.***

VI. Relationship to other recent findings and ongoing work

This was the first project to examine the economic impacts of wildfires on local labor markets. This inquiry builds onto several bodies of research:

1) Wildfire suppression expenditures

Previous research on wildfire suppression costs, such as Prestemon, Gebert, and others, has focused on the trend of growing costs and increasingly severe fire seasons, often at the national scale. Little attention has been given to local impacts, business capture, and the resulting fire suppression industry that has arisen. Our work adds to this research by better documenting how and where suppression money is spent, in particular how it "reaches the ground" across the West.

2) Economic impacts of natural disasters

While this project was the first to examine the economic impacts of large wildfire events from the community perspective, there is longer tradition of looking at local economic impacts from natural hazards. The project builds onto existing literature that examines labor market shifts from natural disasters such as hurricanes (Belasen and Polachek 2008) and tornados (Ewing et al. 2005), introducing wildfires into the research and literature on local economic impacts during disasters.

3) Local business capacity for natural resource work
Our research explored two dimensions of community capacity in relation to wildfires. First, we contributed new work on local business capacity for performing suppression activities. Although there is existing literature on natural resource management businesses and their ability to capture local work from federal land management agencies (e.g. Moseley and Shankle 2001, Moseley and Toth 2004), this focus had not yet been applied to wildfire-related activities, including the variety of support services that are contracted. Second, we also have contributed to a broader literature on community capacity and wildfire response that Williams and others have recently spearheaded. This work has focused on community wildfire protection planning and the social and institutional dimensions of community preparedness and experiences. Our research adds economic and business considerations to this work, providing a more complete picture of community capacity.

In addition to contributing to the the bodies of research noted above, members of the research team are currently involved in a number of related ongoing projects that build from and supplement the findings from this project:

Managing the market: How procurement practices impact private sector wildfire response capacity
This study looks at how the Forest Service acts as a market manager during wildfire suppression contracting through its processes, partnerships, requirements, and dispatching protocols. It then assesses the business models that suppression contractors use do develop and maintain suppression capacity in ways that are competitive, sustainable, and responsive to government requirements and regulations. This study will help enable respondents to the recent JFSP RFA associated with calculating the costs and benefits of hazardous fuels reduction by providing information on the role and costs of suppression work.

Understanding the Roles of Socioeconomic Vulnerability, Adaptive Capacity, and Mitigation in Determining Economic Impacts of Wildfire
This study examines how socioeconomic status, wildfire planning and adaptive capacity in communities interact and influence community resilience to large wildfires when they occur. The study considers the identified economic impacts in the myriad of large wildfire effects to communities, and considers community capacity for planning by examining 130+ Community Wildfire Protection Plans (CWPPs) across western states. This project also builds onto the 2004-2008 data set of Forest Service suppression spending on large wildfires, extending the set of large wildfires with detailed spending information to 2011.

Community-Based Organizations, Social Networks, and Conservation: Strategies for Rural Economic Development in the West
This project examines natural resource-based economic development in rural communities across the West. In particular, the study investigates the role of non-profit community based organizations in building this capacity and enhancing the

business environment in public lands communities. This includes businesses that perform fire suppression as well as other natural resource management work. Like Williams, Cheng, Jakes, and others, we are interested in the institutions and networks that enable community capacity and business innovation.

Economic Impacts of Forest and Watershed Restoration
We have conducted studies of the economic impacts of restoration in Oregon (Nielsen-Pincus and Moseley 2010) and are currently expanding this project nationally. This has included analysis of federal and state investments in restoration, a profile of the restoration industry, and tools to help practitioners better estimate and understand the economic impacts of their work. Through this large fires study, we have gained valuable knowledge about the impacts of fire suppression work and the connections between suppression and restoration work in sustaining capacity, creating a more complete picture of both the business and community capacity to manage natural resources and wildfires.

Northwest Fire Science Consortium
We are part of the leadership team of the JFSP-funded Northwest Fire Science Consortium that began providing science and knowledge dissemination in 2012. We help bring social and economic research such as this study forward through this venue, ensuring that community capacity and economic development findings are shared with diverse manager and practitioner audiences across this region. In particular, the consortium has provided a channel to better and more broadly communicate the findings of this study with these audiences.

VII. Future work needed

The ongoing research above reflects some of the research team's and other's focus on future needed work. In particular, this research raises questions about (1) fire suppression business capacity; and (2) connections between the markets and business models that connect hazardous fuels reduction/restoration and fire suppression.

First, this study finds that greater local capacity for suppression contracts leads to greater local capture, and greater labor market benefit during large wildfire events. More research is needed to determine what the "right" amount of local capacity is; in other words, the level of local capacity that allows a community to effectively mitigate the economic disruption and instability caused by large wildfires. Further inquiry might also address the level of local capacity that is needed for a community to effectively contribute to the scale of services required during large wildfire events. Additional research is also needed to understand how communities create and sustain capacity, and how policies can promote community capacity. In particular, an understanding of the roles of non-suppression contracting practices, dispatch practices, and local direct federal employment is needed.

Second, this study finds that large fires impact local labor markets for at least a year after a fire. It also finds that pre-existing natural resource contractor capacity influences the amount of local capture of contract suppression spending. Taken

together, these two findings raise intriguing questions about how restoration contracting industry and the suppression contracting industry are connected to each other. Little is known about these relationships. Although this research suggests that managers and policy makers may be able to temper the boom-bust economics of fire suppression by thinking about their hazardous fuels/ecosystem restoration contracting in concert, more research is needed to understand this relationship. In order to create effective policy and management options, we need to know more about how these markets are connected to each other as well as more about the interconnections between local and regional contracting markets.

VIII. Deliverables Cross-Walk Table

Products produced beyond those proposed are noted in green

Proposed	Delivered	Status
Project website	http://ewp.uoregon.edu/largefires/context	Complete, update as needed
Project description 2-pager	Transferred to website description of project, final results briefing paper (BP #48)	Completed
3 academic conferences: 2 with preliminary results 1 with final results	4 conference presentations (see end citations): 2 preliminary results (ISSRM 2010, EMFR 2011) 2 with final results (ISSRM 2012, **FireEco. 2012**)	Completed
Two presentation/poster at manager/ practitioner conferences	HDWF 2012-1 (Capacity) HDWF 2012-2 (Labor Markets)	Completed
1 Trinity County non-referred paper	1) EWP Working Paper # 30 **2) EWP Working Paper # 31**	Completed
1 non-referred report of findings	3 additional EWP Working Papers (#'s 41, **42, 43**). See end citations.	Completed
1 non-referred briefing paper of findings	5 EWP Briefing Papers (#'s 44, **45, 46, 47, 48**) See end citations.	Completed
1 press release announcing findings	On 9/14/12, EWP released a preliminary findings press-release to coincide with the fire season. The release was re-covered by Oregon Public Broadcasting, Science Daily, 2 local news stations, EE news, and others.	Completed
Two referred journal articles submitted	1) Davis et al., submitted to Society and Natural Resources 2) Nielsen-Pincus et al, submitted to Proceedings of the National Academy of Sciences **3) Moseley et al, submitted to International Journal of Wildland Fire** **4) Nielsen-Pincus at al, in prep for Forect Policy and Economics**	1) Under review 2) Under review **3) Under review** **4) In prep**
Washington D.C. briefings for key FS personnel, interest groups, and congressional staff	12/11/12-12/14/12, meetings with key personnel, intereste groups, and congressional staff. Brown bag lunch of research findings with key Forest Service personnel on 12/11/12. Follow up information and data provided the following week upon request.	Completed
	JFSP Cold Springs Field Tour Presentation, 9/12/12	**Additonal presentation completed**
	Webinar on Results via Forest Guild 12/17/12	**Additional dissemination of results completed**
	Ellison et al, Rural Connections article	**Additonal product/ dissemination completed**

IX. Sources Cited

Belasen, A.R., and S.W. Polachek. 2008. How hurricanes affect wages and employment in local labor markets. *American Economic Review: Papers and Proceedings* 98: 49-53

Bryman, A. 2006. Integrating quantitative and qualitative research: how is it done? *Qualitative Research* 6(1): 97-113.

Burchfield, J. 2007. Community impacts of large wildfire events: Consequences of actions after the fire. Pages 124-140 in T.C. Daniel, M.S. Carroll, C. Moseley, C. Raish, eds. *People, Fire, and Forests: A Synthesis of Wildfire Social Science* (Corvallis, Oregon: OSU Press, 2007).

Carroll, M.S., P.J. Cohn, D.N. Seesholtz, and L.L. Higgins. 2005. Fire as a galvanizing and fragmenting influence on communities: The Case of the Rodeo-Chediski Fire. *Society and Natural Resources* 18(4): 301-20.

Ewing, B., J.B. Kruse, and M.A. Thompson. 2005. Twister! Employment responses to the May 3, 1999, Oklahoma City Tornado. *Applied Economics* 41 (6): 691- 702.

Moseley, C., and S. Shankle. 2001. National forest contracting in the Pacific Northwest. *Journal of Forestry* 99(3); 32-37.

Moseley, C., and N. Toth. 2004. Fire hazard reduction and economic opportunity: How are the benefits of the National Fire Plan distributed? *Society and Natural Resources* 17(8):701-716.

Shoenberger, E. 1991. The corporate interview as a research method in economic geography. *The Professional Geographer* 43(2):180-189.

X. Deliverables

Final report:

Moseley, C., K. Gebert, P. Jakes, L. Leete and M. Nielsen-Pincus. 2012. The economic impacts of large wildfires. Final Project Report (JFSP Project Number: 09-1-10-3). December 31, 2012. Eugene, OR.

Website:

The Economic Impacts of Large Wildfires. Research Project Website:
http://ewp.uoregon.edu/largefires/context

Press Release:

Preliminary findings release:
http://uonews.uoregon.edu/archive/news-release/2012/9/uo-study-shows-wildfires-positive-and-negative-economic-impacts

Conference Presentations/ Workshops

M. Nielsen-Pincus, E.J. Davis, C. Moseley, and P. Jakes. The economic impacts of large wildfires: A mixed methods perspective from Trinity County, CA. June 7, 2010. International Symposium on Society and Resource Management. Madison, WI.

Nielsen-Pincus, M., C. Moseley, E.J. Davis, P. Jakes, and L. Leete. The economic impacts of large wildfires. November 16, 2011. Exploring the Mega-fire Reality: A Forest Ecology and Management Conference. Tallahassee, FL.

Moseley, C., C. Evers, and M. Nielsen-Pincus. Community Business Capacity to Participate in Wildland Fire Operations. April 18, 2012. Third Conference on the Human Dimension of Wildland Fire, International Association of Wildland Fire. Seattle, WA.

Nielsen-Pincus, M., C. Moseley, E.J. Davis, L. Leete, and P. Jakes. The effect of large wildfires on local labor markets. April 18, 2012. Third Conference on the Human Dimension of Wildland Fire, International Association of Wildland Fire. Seattle, WA.

Nielsen-Pincus, M., L. Leete, E. Jane Davis, P. Jakes, C. Moseley. The effect of large wildfires on local labor markets: A mixed methods perspective from the western US and Trinity County, California. June 17, 2012. International Symposium on Society and Natural Resource Management. Edmonton, Alberta.

Moseley, C., M. Nielsen-Pincus, E.J. Davis, A. Ellison, and C. Evers. Local Contracting Capacity and Economic Impacts of Large Wildfires. Paper presented at the 5th Association of Fire Ecology Conference, Portland, Oregon, December 3-7, 2012.

Invited Papers/ Presentations

Moseley, C. and M. Nielsen-Pincus. Local Economic Effects of Large Wildfires. Webinar on December 17, 2012 at 11 AM PST. Hosted by the Forest Guild. Link to audio: https://forestguild.mitel-nhwc.com/join/bkcpphh

Washington, DC presentations:
PI, Cassandra Moseley, traveled to Washington, D.C. the week of December 15th to present findings to managers and policy makers. She had 15 meetings with Forest Service, Office of Management and Budget, USDA, and Hill staff. Forest Service meetings included a seminar presentation to approximately 12 people as well as briefings with the Associate Chief, Deputy Chief for State and Private Forestry, and Director of Fire and Aviation Management. She me with congressional staff from the Oregon delegation, as well as the House and Senate resource committees.

JFSP Cold Springs field tour:
PI, Cassandra Moseley presented preliminary research findings linked to the economic impacts of the Cold Springs Fire in particular, during the JFSP Cold Springs Field Tour on September 12, 2012. A briefing paper of findings for the research and the fire was created for distribution (see briefing paper citation below).

Publications in Print/ in Press

Working papers:

M. Nielsen-Pincus, Evers, C., A. Ellison, and C. Moseley. 2012. Wildfire Suppression Contracting: The Effect of Local Business Capacity during Large Wildfire Events. Ecosystem Workforce Program Working Paper 43. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/working/.

Nielsen-Pincus, M., A. Ellison, and C. Moseley. The Effect of Large Wildfire on Local Labor Markets. Ecosystem Workforce Program Working Paper 42. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/working/.

Ellison, A., C. Moseley, C. Evers, and M. Nielsen-Pincus. 2012. Forest Service Spending on Large Wildfires in the West. Ecosystem Workforce Program Working Paper 41. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/working/.

Nielsen-Pincus, M., C. Moseley, and E.J. Davis. 2011. Fire suppression costs and impacts of the 2008 wildfires in Trinity County, California. Ecosystem Workforce Program Working Paper 31. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/working/.

Davis, E.J., C. Moseley, P. Jakes, and M. Nielsen-Pincus. 2011. The Lost Summer: Community experiences of large wildfires in Trinity County, California. Ecosystem Workforce Program Working Paper 30. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/working/.

Briefing papers:

Moseley, C., M. Nielsen-Pincus, E.J. Davis, C. Evers, and A. Ellison. 2012. Economic Effects of Large Fires: Main Findings. Ecosystem Workforce Program Briefing Paper 48. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/briefing/

Ellison, A., C. Moseley, M. Nielsen-Pincus and C. Evers. 2012. Wildfire Suppression Contracting: The Effect of Local Business Capacity during Large Wildfire Events. Ecosystem Workforce Program Briefing Paper 47. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/briefing/

Ellison, A., C. Moseley, M. Nielsen-Pincus and E.J. Davis. 2012. The Effect of Large Wildfires on Local Labor Markets. Ecosystem Workforce Program Briefing Paper 46. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/briefing/

Ellison, A., C. Moseley, C. Evers, and M. Nielsen-Pincus. 2012. Forest Service Spending on Large Wildfires in the American West. Ecosystem Workforce Program Briefing Paper 45. University of Oregon. Eugene, OR. Available Online [URL]:

http://ewp.uoregon.edu/publications/briefing/

Moseley, C., M. Nielsen-Pincus, and B. Rishel. 2012. Economic Effects of Large Fires: Application to the Cold Springs Fire. Ecosystem Workforce Program Briefing Paper 44. University of Oregon. Eugene, OR. Available Online [URL]: http://ewp.uoregon.edu/publications/briefing/

Other:
Ellison, A., M. Nielsen-Pincus, E.J. Davis, C. Evers, and C. Moseley. The Economic Impacts of Large Wildfires. Rural Connections magazine.

Publications under Review (refereed)

Davis, E.J., M. Nielsen-Pincus, C. Moseley, and P. Jakes. The community economic impacts of large wildfires: A case study from Trinity County, CA. Submitted to *Society and Natural Resources* on October 15, 2012.

Nielsen-Pincus, M., C. Moseley, K. Gebert. The effect of large wildfires on economic growth and volatility in the western United States. Submitted to *Proceedings of the National Academy of Sciences* on November 16, 2012.

Evers, C., C. Moseley, and M. Nielsen-Pincus. Predicting local business participation in wildfire suppression contracting in the Western United States. Submitted to *International Journal of Wildland Fire* on December 30, 2012.

Publications in Preparation (refereed)

Nielsen-Pincus, M., C. Moseley, and K. Gebert. The impact of large wildland fires on local labor markets. In preparation for *Forest Policy and Economics*.