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The effect of large wildfires on local labor markets

MAX NIELSEN-PINCUS, AUTUMN ELLISON, AND CASSANDRA MOSELEY

INSTITUTE FOR A SUSTAINABLE ENVIRONMENT

UNIVERSITY OF OREGON

About the authors

Max Nielsen-Pincus is a faculty research associate at the Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon.

Autumn Ellison is a faculty research assistant at the Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon.

Cassandra Moseley is the director of the Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon.

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Maps: Branden Rishel—Ecosystem Workforce Program.

Contact information
Ecosystem Workforce Program
Institute for a Sustainable Environment
5247 University of Oregon
Eugene OR 97403-5247
541-346-4545
ewp@uoregon.edu
ewp.uoregon.edu

UNIVERSITY OF OREGON

Large wildfires have lasting socioeconomic effects on communities located near the fires. Wildfires can unite and divide communities over fire management and recovery, and magnify or create inequities.[1] The impacts on local economies are complex and likely to be dynamic over time, with shifts in various economic sectors that cycle between positive and negative levels before returning to pre-event growth levels.[2] Wildfires may cause short-term shocks and negative impacts on local labor markets in recreation and tourism, manufacturing, and natural resource-based sectors.[3] In contrast, fire suppression can potentially make short-term contributions to labor and employment in local communities through suppression services or other support activities. Postfire restoration activities can contribute to longer-term labor market support.

Although fire managers, policymakers, and communities are benefiting from better understanding of suppression costs, property losses, and community impacts of large fires,[4] no generalizable empirical research has quantified the specific effect of large wildfires on local employment and wages. As federal spending on wildfire suppression in the United States continues to grow,[5] an understanding of the effects of wildfires on local economies will help natural resource managers, policymakers, and communities better anticipate and make management and policy decisions that support local economies. The purpose of this paper is to illuminate the effect of large wildfires on local employment and wages in the western United States and investigate how those changes varied between different types of counties and different levels of suppression spending.

Approach

We collected fire incident data, suppression spending data, and county-level labor market data for wildfires that occurred in fiscal years 2004 through 2008 in which the USDA Forest Service was the lead protection agency and fire suppression costs exceeded $1 million. Fire incident data from the National Interagency Fire Management Integrated Database included fire ignition location, initial attack date, the date for which suppression objectives were met, and a number of other variables. 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 also collected county-specific quarterly earnings and employment from the Bureau of Labor Statistics' (BLS) Quarterly Census of Employment and Wages (QCEW) for all counties in the 11 western states (n=414).

Although the western United States experienced a region-wide period of growth in the mid-2000s, each of the 11 western states had its own business cycle and economic trends. For this reason, we examined the changes in employment and average wages in fire-affected counties during the quarter(s) in which wildfires were being actively suppressed relative to the respective state-wide employment and wage trends. We controlled for potential innate economic differences between fire and nonfire affected counties by using the set of western U.S. counties in which the Forest Service incurred more than $1 million in suppression expenses as a treatment group, and all other western U.S. counties as a control group.

We built nine statistical models to examine the effect of large wildfires on trends in employment and average wages.[6] We then compared the changes that occurred in metropolitan versus rural counties, in counties with economies dominated by federal or state government, services, and recreation sectors, and in counties that experienced multiple wildfires. Finally, we compared the changes that occurred due to total suppression spending and local suppression spending.

Findings

Counties affected by large wildfires

From fiscal years 2004 to 2008 in the western United States, a total of 346 wildfires incurred more than $1 million in net suppression expenses, where the Forest Service was the lead protection agency (see Figure 1, page 3). These fires affected 124 counties. The mean duration of major suppression efforts was 40 days, with a maximum of 141 days. Seventy-seven percent of the fires burned primarily during the summer quarter (July, August, and September).

The total suppression cost for these fires was $2.41 billion, with an average cost of just under $7 million in Forest Service expenditures. For the sample of 135 large wildfires with transactions coded based on recipient addresses, the amount of local spending varied considerably between fires, from zero to $18.7 million. Local suppression spending accounted for from zero to 39 percent of total suppression spending; on average it was nine percent.

Although the 124 affected counties all experienced at least one large wildfire, the affected economies were not all the same. Eighty-two percent of the counties had populations less than 250,000. Twenty-four percent had economies that relied on federal or state government, 22 percent had service-based economies, and 38 percent were reliant on recreation-related industries[7] (see Figure 2, page 3). In addition, some of the counties experienced fires more frequently than others. Forty-eight percent experienced only one fire during the study period, 16 percent experienced two fires, and 36 percent experienced three or more fires, with a maximum of 21 wildfires occurring over the five-year period in Siskiyou County, California.

Figure 1 Large fires

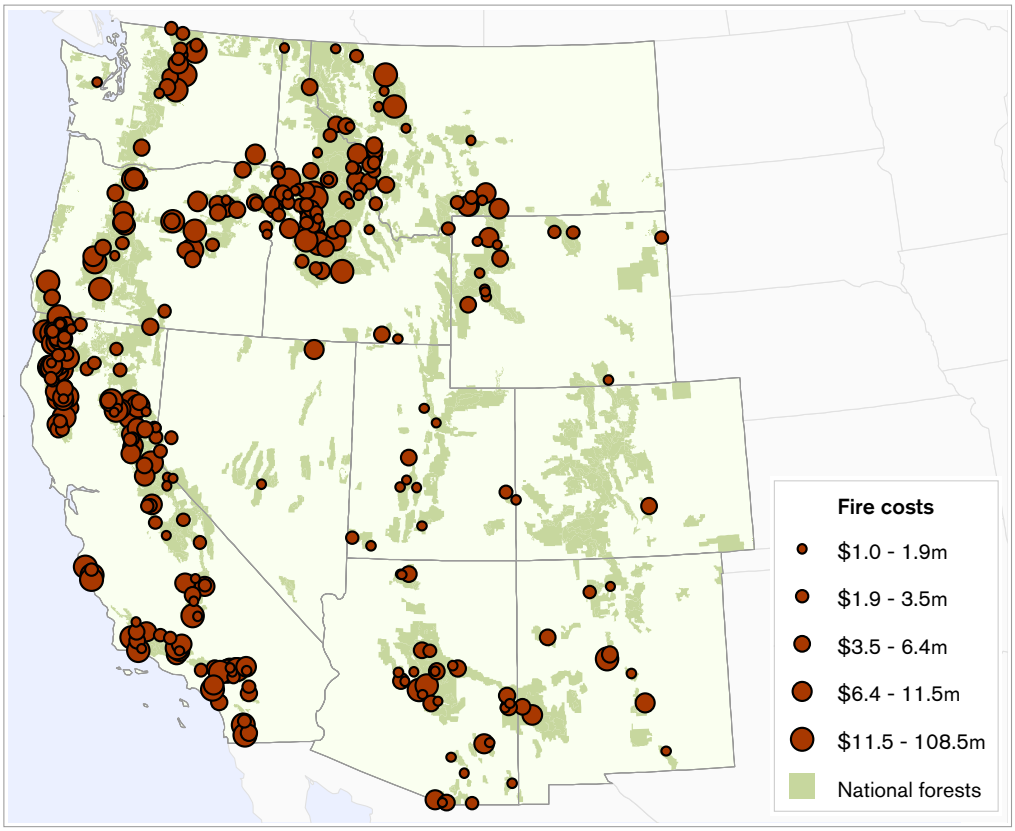

Figure 2 Large fire location and types of counties

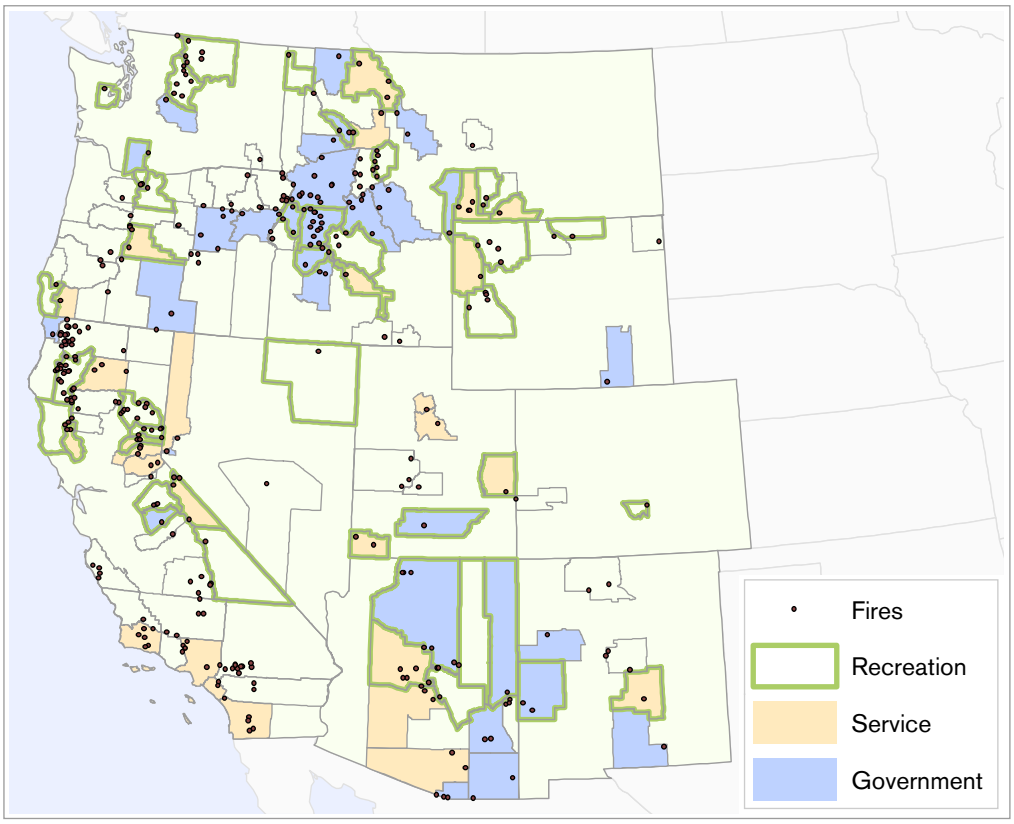

Table 1 Employment effects of large wildfires

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Percent increase or decrease in employment								
Summer	-0.158	-0.160	-0.160	-0.160	-0.175	-0.172	-0.160	-0.160	-0.162
Fire in the county	1.535***	1.790***	1.137**	1.881***	0.315	-0.082	0.785	1.185**	1.383***
Fire in a neighboring county	0.327	0.312	0.330	0.326	0.315	0.355	0.308	0.307	0.314
County where fire is occurring is metro		-0.768							
County where fire is occurring is government dependent			1.752*						
County where fire is occurring is service dependent				-1.441					
County where fire is occurring is a recreation county					4.109***				
County where fire occurs has frequent fires						2.337**			
Number of fires occurring at the same time							0.515		
Total amount of spending on the fire ($1 millions)								0.030	
Total amount of suppression spending on a fire in neighboring county ($1 millions)								0.010	
Total amount of suppression from fire occurring within the county ($1 millions)									0.920***

* significant at p<.10 ** significant at p<.05 *** significant at p<.01

Table 2 Wage rate effects of large wildfires

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	Percent increase or decrease in county wages								
Summer	-0.145	-0.149	-0.150	-0.146	-0.146	-0.156	-0.147	-0.156	-0.144
Fire in the county	0.896**	0.958**	0.151	0.947**	0.682	0.971	0.301	0.769*	0.982***
Fire in a neighboring county	0.430**	0.445**	0.433**	0.431**	0.428**	0.452**	0.416**	0.257	0.439**
County where fire is occurring is metro		-0.180							
County where fire is occurring is government dependent			3.274***						
County where fire is occurring is service dependent				-2.101					
County where fire is occurring is a recreation county					0.488				
County where fire occurs has frequent fires						0.037			
Number of fires occurring at the same time							0.409		
Total amount of spending on the fire ($1 millions)								0.001	
Total amount of suppression spending on a fire in neighboring county ($1 millions)								0.010	
Total amount of suppression from fire occurring within the county ($1 millions)									-0.520**

* significant at p<.10 ** significant at p<.05 *** significant at p<.01

The effect of large wildfires on local labor markets

To better understand the impacts that large wildfires had on local labor markets, we examined the average employment and wages in counties during the quarters when large wildfires were burning in comparison to average statewide employment and average wages for that month. In general, there was no significant difference in labor market trends between fire and nonfire affected counties. However, in quarters when a county had a wildfire, the employment and the average wage increased. Employment in the county increased 1.54 percent over the statewide average rate, and the average wage increased by 0.90 percent (see Table 1, page 4, and Table 2, page 5). These increases suggest that, in the short term, the local economic impacts of large wildfires were positive as employment and wages tended to grow faster than expected given statewide trends.

Large wildfires also affect adjacent counties, which experienced a 0.43 percent increase in the average wage. The employment rate in adjacent counties showed no difference from statewide trends. Taken together, we would expect an average wage increase of 1.33 percent when large wildfires burned in the county and two adjacent counties in the same quarter.

More than three-quarters of the large wildfires from 2004 to 2008 burned primarily during the summer quarter. To determine whether the summer season was responsible for any of the observed changes in employment and wages, we also examined employment and wage growth during the summer quarter. We found that the effect of large wildfires on local labor markets remained significant even after controlling for summer seasonal trends.

The economic geography of the impacts of large wildfires

To better understand how local labor market changes were connected with different types of local economies, we examined the changes that occurred in metropolitan compared to nonmetropolitan counties, in government-dominated, service-dominated, and nonmetro recreation counties, and in counties where multiple wildfire events occurred over time. We found that increases in employment and wages were similar to the overall average for both metropolitan and rural counties, with no significant differences.

However, we found that counties that were economically reliant on different economic sectors did experience different employment and wage growth when large wildfires occurred. Both government-dependent and nonmetro recreation counties[8] experienced greater-than-average increases in quarterly employment when large wildfires occurred in the county, but only government-dependent counties also experienced an increase in the average wage. Employment and wage increases in service-dependent economies did not differ from statewide trends. Among these three classifications, nonmetro recreation counties experienced the greatest growth in employment, with a 4.11 percent increase during the quarter of large wildfires. The average wage in recreation counties during wildfire quarters, however, did not differ from statewide trends. In government-dependent counties, employment increased 1.75 percent, and the average wage grew 3.27 percent during the quarter of a large wildfire—a greater increase in wages than for any other type of county.

Counties with frequent wildfires also experienced employment increases, but had wages that were similar to statewide trends. In these counties, separate wildfires burned at different times. During the quarters that wildfires burned in these counties, the employment rate increased 2.34 percent, on average. In counties that experienced multiple wildfires during the same quarter, however, there was no additional increase in either employment or wages. This suggests that the commonality of wildfires in a county has a strong impact on employment increases, while one season with multiple fires may be less important.

The increase in wages that occurred in counties adjacent to a large wildfire remained consistent across county classifications. A fire in an adjacent county contributed an average wage increase of 0.43–0.45 percent regardless of metropolitan or rural status,

economic classifications, or commonality of fire in the county. Akin to the absent impact of large wildfires on adjacent county employment rates overall, a fire in an adjacent county did not significantly impact the employment rate in any type of county.

The impact of suppression spending

To understand how different levels of suppression spending affected local labor markets, we examined the effect of total suppression spending and local suppression spending on employment and average wage growth. Total suppression spending included all federal expenditures on large wildfire suppression in the county plus adjacent counties. Local suppression spending considered the total amount of money that was awarded to vendors in the same county as the wildfire.

As total suppression spending increased, there was a small increase in the average wage (a 0.01 percent increase in wages per $1 million spent), but no change to employment during the quarter. The small increase in the average wage was correlated with spending in adjacent counties, and not with spending in the county itself.

The amount of suppression money that was spent locally was correlated with a larger impact on local employment and wage rates. For every $1 million spent locally, the employment growth rate in the county for the quarter increased 0.92 percent. For every $1 million that was spent locally, the average wage decreased 0.52 percent. As local suppression spending on wildfires increased, therefore, the wage rate in the county decreased while the number of jobs increased.

Summary

To better understand the impacts of large wildfires on local economies, first we examined employment and wage data for the 124 counties in the 11 western states that experienced 346 large wildfires from 2004 to 2008. We found that overall, both employment and average wages increased beyond the statewide average in counties during quarters when large wildfires were active. An increase in wages, but not employment, also occurred in counties adjacent to large wildfires.

Second, we explored the employment and wage impacts between different types of counties. We found additional increases in the employment rate in counties that were economically reliant on government or recreation sectors, and in counties that experienced wildfires in multiple quarters of the study period. The changes in average wages between these types of counties varied. For example, government-dependent counties also experienced greater increases in wages during quarters with wildfires. In recreation counties and counties in which wildfires were common, however, wages did not differ significantly from statewide trends. Although our data do not isolate the added employment with associated wages, they suggest that employment added during large wildfires may pay differently depending on the type of county where it is added. Jobs added in government counties paid greater wages than jobs added in other types of counties. Wages for fire-associated jobs in government sectors, for instance, may increase to include hazard and overtime pay, while similar pay schedules may not exist for employment in other sectors. However, it is important to note that the added jobs in these government-dependent counties may not have occurred in government sectors. Likewise, added employment in recreation counties did not necessarily occur in recreation sectors. In fact, previous research suggests that recreation-related employment and wages may decline during larger wildfires.[9]

Third, we examined the impact of suppression spending on local employment and wages. We found that increasing total suppression costs for wildfires had minimal impact on local employment and wages, but increasing local suppression spending had a great impact on local employment and wages. This suggests that the overall cost of fires had little impact on local economies, whereas the overall amount that was spent in the county had a great impact, regardless of the proportion of spending that it represented. On average, for every $1 million of suppression spending in the county of the fire, employment increased nearly one percent and average wages decreased one half of a percent.

In contrast to government-dependent counties, recreation counties, and counties commonly af-

fected by wildfires, counties with increased local spending did not experience increasing or steady wages as employment rates increased. Instead, the employment growth observed as local suppression spending increased was accompanied by decreasing average wages. This suggests again that the range of employment required in wildfire suppression spans a variety of pay scales, and that overall, the increased employment observed with increased local spending included jobs that either paid less than the average wage or were of limited duration across the quarter.

Conclusion

Large wildfires require a multitude of direct suppression and suppression support services. Although the overall impacts of large wildfires on local economies are complex and dynamic over time, the increased activity during suppression can affect local economies during the wildfire. This research demonstrates that the initial impacts—those occurring during the same quarter as the fire—are often positive as, in general, both employment and wages increased in counties when large wildfires were burning. The impacts on all counties are not likely equal, however. Based on our results, we would expect government-dependent, recreation counties, and counties with frequent wildfires to experience the greatest increases in employment, and we would expect government-dependent counties to experience the greatest average wage rate increases. Additional investigation is required to determine how long these employment and wage impacts persist; they may well dissipate quickly and even reverse in subsequent quarters.

Furthermore, we would expect the employment and wage impacts to vary depending on how much suppression spending occurred in the county of the wildfire. The people, equipment, and skills involved in suppression and suppression support services may come from nearby communities or from locations much farther away. Our results suggest that, as local suppression spending on wildfires increases, employment in the county increases while the average wage decreases. Given the current decade-long trend of growing suppression costs and projections for further increases in the future, we might expect the distribution of suppression spending to play an increasingly important role in our understanding of the impacts of wildfires on local economies.

Endotes

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6 A detailed description of methodology is presented in a forthcoming peer-reviewed article. For detailed information on model factors, construction, and operation, please contact the authors of this working paper.

7 County classifications based on USDA Economic Research Service county economic types, www.ers.usda.gov/data-products/county-typology-codes/descriptions-and-maps.aspx#nonrec.

8 Note that the economic classification of "government-dependent" and "service-dependent" are mutually exclusive whereas "nonmetro recreation counties" can also be government or service dependent.

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