The Full Cost of New Mexico Wildfires

January 24, 2013

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TABLE OF CONTENTS

I. INTRODUCTION

The purpose of this analysis was to estimate the full impact of wildfires in New Mexico both during and after the wildfire occurs. This analysis was prepared by Impact DataSource, an Austin, TX economic consulting, research and analysis firm and provides information on the cost of recent wildfires in New Mexico.

The costs for wildfire suppression, number of acres burned and number of structures destroyed is documented fairly consistently at the national level. However, additional environmental, societal, economic and fiscal impacts are typically not tracked by any federal, state or local government or organization making the full impact of wildfires difficult to quantify.

This analysis draws on prior case-study research to estimate the full cost of wildfires. Through this research the following facts are clear:

- The full costs of wildfires far exceed suppression costs, often including:
  - Damage to private homes and other structures,
  - Damage to soil, timber, wildlife and watersheds,
  - Evacuation, tourism and transportation costs, and
  - Increased public health and individual healthcare costs.
- Wildfire costs vary significantly based on a number of factors, including:
  - Weather,
  - Population density of the burned area,
  - Burn severity, and
  - Geography of the area.
- Direct and indirect wildfire costs are incurred by individuals and private businesses as well as federal, state and local governments.

This analysis includes the following sections:

- An executive summary of the results of this analysis,
- A literature review and discussion of the types wildfire costs,
- Cost data from recent comprehensive wildfire case studies,
- Range estimates for the full cost of recent fires in New Mexico, and
- Information about Impact DataSource.

II. EXECUTIVE SUMMARY

From 2009 to 2012, wildfires affected over 2 million acres of land in New Mexico. The following table summarizes the wildland and prescribed fire incidences from 2009 to 2012.

	New Mexico Wildfire History 2009-2012			
	Wildland		Prescribed	
	# of Fires	# of Acres	# of Fires	# of Acres
2012*	1,028	372,497	58	29,950
2011	1,873	1,089,769	62	80,176
2010	998	233,056	63	61,403
2009	1,278	421,481	76	99,132
Total	**5,177**	**2,116,803**	**259**	**270,661**

Source: National Interagency Fire Center **As of December 20, 2012*

The above table demonstrates the difficulty in predicting the quantity and magnitude of wildfires, even when comparing on a year to year to basis. As the table shows, 2010 was a relatively mild year for wildfires, while 2011 saw a dramatic increase in activity. Due to the amount of variables and range of effects, predicting the true cost of an individual wildfire is equally as difficult. Lack of tracked and available of data and the case-specific nature of each wildfire provides many challenges in overall cost estimation. However, a report including six wildfire case studies from the western United States by the Western Forestry Leadership Coalition estimated the true cost of a wildfire as compared to the suppression cost. These ratios of total cost to suppression cost from the study have been applied to tracked suppression costs of the larger wildfires (fires affecting more than 40,000 acres) in New Mexico over the last four years to develop a range of possible costs of these wildfires. As summarized in the table below, the potential full cost of these wildfires has a midpoint estimate of $1.5 billion.

New Mexico Wildfire Full Cost Estimates: 2009-2012					
			Total Costs / Suppression Cost Estimate Factors		
			Low	Mid	High
Fire	**Year**	**Suppression Costs ($)**	**1.9**	**12.7**	**29.0**
Whitewater - Baldy	2012	$23,000,000	$43,700,000	$292,100,000	$667,000,000
Little Bear	2012	$19,400,000	$36,860,000	$246,380,000	$562,600,000
Las Conchas	2011	$48,385,000	$91,931,500	$614,489,500	$1,403,165,000
Miller	2011	$18,100,000	$34,390,000	$229,870,000	$524,900,000
Donaldson	2011	$5,700,000	$10,830,000	$72,390,000	$165,300,000
Last Chance	2011	$2,062,400	$3,918,560	$26,192,480	$59,809,600
Enterprise	2011	$37,000	$70,300	$469,900	$1,073,000
Cato	2009	$460,000	$874,000	$5,842,000	$13,340,000
Pasco	2009	$450,000	$855,000	$5,715,000	$13,050,000
Totals		**$117,594,400**	**$223,429,360**	**$1,493,448,880**	**$3,410,237,600**

III. ACCOUNTING FOR THE FULL COST OF WILDFIRE

Suppression Costs and More: Costs Resulting from Wildfires

The cost of a wildfire is often expressed in terms of the suppression costs – the dollars spent on firefighters and equipment to extinguish the fire. Although the value of suppression cost is often readily available and may indicate the severity and scale of the fire, suppression costs represent a subset of the full cost of a wildfire. A more complete accounting of the full cost of a wildfire is needed to understand the true impact to allow for appropriate understanding and planning by state and local governments.

Wildfire impact information is summarized at the national level by the number of fires, acres burned, number of structures burned and cost of fire suppression. Other costs that are more difficult to track and quantify often go uncollected. These other wildfire costs include[1]:

- Alteration of wildlife habitat
- Damage to watersheds and water supply
- Damage to public recreation facilities
- Evacuation of adjacent communities
- Tourism impacts
- Damage to timber resources
- Destruction of cultural and archaeological sites
- Costs of rehabilitation and restoration
- Public health impacts
- Transportation Impacts

The comprehensive study conducted by Yale University researchers (Morton, Roessing, Camp & Tyrrell, 2003) investigates the availability of data from federal, state and local sources to assess what additional data collection procedures are needed. Based on a survey of 10 large wildfires nationwide, the authors demonstrate the type of impacts and costs that are not collected or calculated by the federal, state or local governments. The case studies presented reveal that widely collected and available data represent a fraction of the full impact and costs. In addition, the documented costs for specific fires indicate that the types and magnitude of costs depend on the location of the wildfire. These costs do not end after a wildfire becomes contained, but are incurred over many years.

[1] Morton, Douglas C., Megan E. Roessing, Ann E. Camp, and Mary L. Tyrrell. 2003. Assessing the Environmental, Social, and Economic Impacts of Wildfire. Yale University: GISF Research Paper 001

Costs Depend on the Location of the Wildfire

The research by Morton et al. further reveals the wide variety of impacts resulting from wildfires depending on the location, severity and length of the fire. For example, a wildfire occurring near a heavily populated area may result in significant evacuation costs through the displacement of residents and businesses. In addition, smoke-related illnesses will likely be greater for a wildfire occurring near a more populated area. A wildfire occurring in a remote area may impose more costs on wildlife habitats, watershed and water supplies or recreation areas.

Costs are Incurred Initially and Over Succeeding Years

In addition to the types of specific impacts, there is a temporal dimension to wildfire costs. Many of the impacts and costs are incurred during or immediately after the wildfire. For example expenditures to suppress a wildfire are one of the first costs incurred. Evacuations of residents and businesses, tourism disruptions and transportation closures may also occur early in the wildfire timeline. Suppression costs and the other impacts mentioned will often affect individuals temporarily. Destruction of wildlife habitats, residential and commercial structures, and watershed areas may occur concurrent with the wildfire, but the rehabilitation, rebuilding and repair to these areas and structures will likely occur over a period of months and years after the fire has been extinguished. In addition, smoke-related illnesses from wildfires can affect residents for years after a wildfire.

Cost Categories and Results from the Western Forestry Leadership Coalition

A recent study by the Western Forestry Leadership Coalition (2010) investigates several case studies to determine the full cost of wildfire[2]. This analysis builds on the research by Morton et al. and categorizes wildfire costs as direct costs, rehabilitation costs, indirect costs and additional costs. The following presents excerpts from the Western Forestry Leadership Coalition report titled *The True Cost of Wildfire in the Western U.S.*

> **Direct Costs**
>
> Wildfire costs are most easily measured when they have immediate and direct impacts. This category prominently includes federal, state, and local suppression costs. These costs, in turn, can be broken down into expenditures on aviation, engines, firefighting crews, and agency personnel. In addition to suppression costs, other direct costs include private property losses (insured and uninsured), damage to utility lines, damage to recreation facilities, loss of timber resources, and aid to evacuated residents. Most of these costs are incurred during or immediately following the fire.

[2] Dale, Lisa 2010. The True Cost of Wildfire in the Western U.S. Western Forestry Leadership Coalition, Lakewood, Colorado.

Rehabilitation Costs

According to the case study reports, immediate emergency rehabilitation costs are sometimes considered direct, since those costs are incurred in the days, weeks, and months following the fire and are clearly attributable to the wildfire event. The costs are shouldered by federal, state, and local agencies and, again, the data are relatively accessible. Longer-term rehabilitation costs, however, are harder to measure, and ongoing rehabilitation expenses may not be clearly connected to the wildfire event. Watersheds damaged by fire, in particular, can take many years to recover and require significant restoration activities. Post-fire flooding events can create additional damage to the already scarred landscape, and subsequent impacts may include an increase in invasive species and erosion.

Indirect Costs

Once the fire has been extinguished and rehabilitation efforts have begun on the affected landscape, additional indirect costs continue to accumulate. These costs have historically escaped accounting by land management agencies, and may extend years beyond the wildfire event. Indirect wildfire costs include lost tax revenues in a number of categories such as sales and county taxes, as well as business revenue and property losses that accumulate over the longer term. For example, properties that escape damage in the fire may still experience dramatic drops in value as the area recovers. In several of the case studies, these indirect costs are labeled “impact” costs.

Additional Costs

Beyond the indirect costs associated with wildfire are longer-term additional costs, often called “special” costs. Putting a numerical value on human life is always a dubious effort, but some standardized numbers do exist for guidance. When a firefighter perishes in the line of duty, families receive a set sum for their loss; this number serves as a proxy for the cost of lost life. Loss of civilian life, ongoing health problems for the young, old, and those with weak respiratory or immune systems, and mental health needs also fall into this category but are rarely quantified. Additionally, the extensive loss of ecosystem services, some of which are inherently difficult to quantify—aesthetic and scenic beauty, wildlife existence value, and others—can be included here.

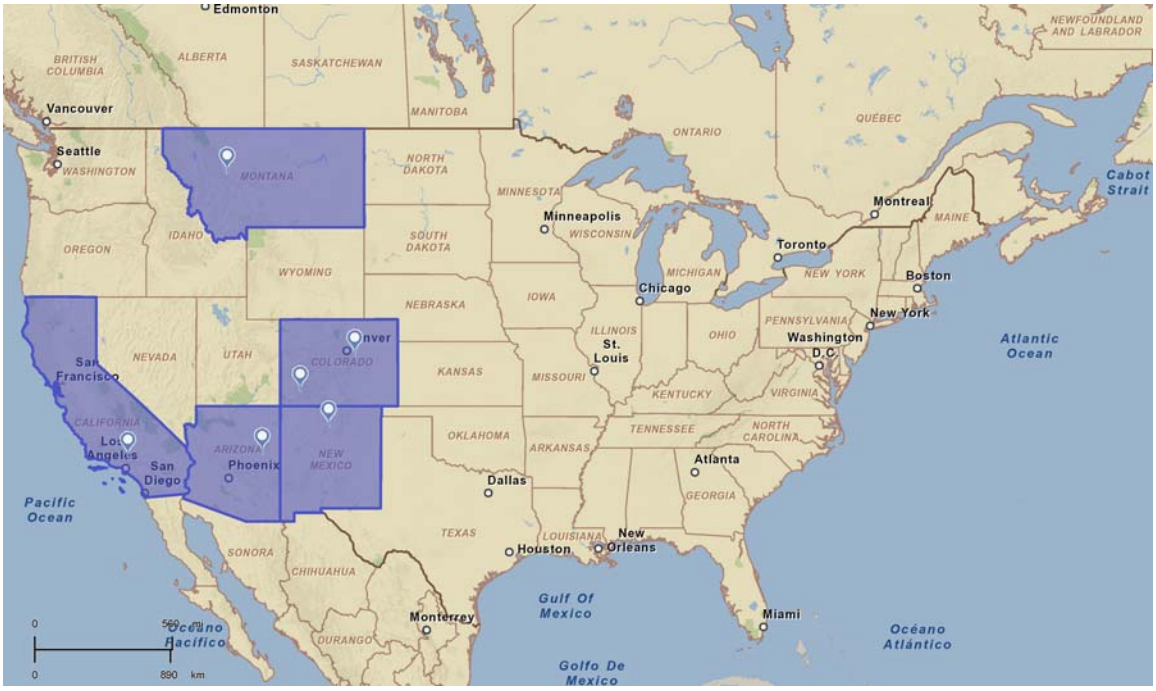
The Western Forestry Leadership Coalition report goes on to review six wildfire case studies and summarizes the associated costs. The table below shows the summary of cost information summarized in the Western Forestry Leadership Coalition report.

Case Study Summary: ***The True Cost of Wildfire in the Western U.S.***

Fire	*Suppression Costs*	*Other Direct Costs*	*Rehabilitation Costs*	*Indirect Costs*	*Additional Costs*	*Total Costs*	*Pop. Density**
Canyon Ferry Complex (MT 2000)	$9,544,627	$400,000	$8,075,921	$55,310	n/a	**$18,075,858**	18.3
Cerro Grande (NM 2000)	$33,500,000	$864,500,000	$72,388,944	n/a	n/a	**$970,388,944**	76.5
Hayman (CO 2002)	$42,279,000	$93,269,834	$39,930,000	$2,691,601	$29,529,614	**$207,700,049**	197.4
Missionary Ridge (CO 2002)	$37,714,992	$52,561,331	$8,623,203	$50,499,849	$3,404,410	**$152,803,785**	30.3
Rodeo-Chedeski (AZ 2002)	$46,500,000	$122,500,000	$139,000,000	$403,000	n/a	**$308,403,000**	8.2
Old, Grand Prix, Padua (CA 2003)	$61,335,684	n/a	$534,593,425	$681,004,114	n/a	**$1,276,933,224**	101.5

**Population density of the county or counties where fire occurred. Source: U.S. Census Bureau, 2010 Census*

The following map demonstrates the locations of the six wildfires studied in the report.



The "pins" mark the approximate locations of the wildfires studied in the Western Forestry Leadership Coalition report

The results above from the Western Forestry Leadership Coalition report demonstrate the fact that suppression costs only represent a fraction of the total cost of wildfire and also underscore the wide variation in non-suppression costs.

There is great variation in the magnitude of total costs studied in the case study analysis. The table below shows the ratio of costs relative to suppression costs as calculated by Impact DataSource.

Ratio of Total Cost Components Relative to Suppression Costs

Fire	*Suppression Costs*	*Other Direct Costs*	*Rehabilitation Costs*	*Indirect Costs*	*Additional Costs*	*Total Costs*
Canyon Ferry Complex (MT 2000)	1.0	0.0	0.8	0.0	0.0	1.9
Cerro Grande (NM 2000)	1.0	25.8	2.2	0.0	0.0	29.0
Hayman (CO 2002)	1.0	2.2	0.9	0.1	0.7	4.9
Missionary Ridge (CO 2002)	1.0	1.4	0.2	1.3	0.1	4.1
Rodeo-Chedeski (AZ 2002)	1.0	2.6	3.0	0.0	0.0	6.6
Old, Grand Prix, Padua (CA 2003)	1.0	0.0	8.7	11.1	0.0	20.8
All Case Studies	**1.0**	**4.9**	**3.5**	**3.2**	**0.1**	**12.7**
Percent of Total	*7.9%*	*38.6%*	*27.4%*	*25.0%*	*1.1%*	*100.0%*

Of the six fires studied in the Western Forestry Leadership Coalition report, the total cost ranged from 2 to 29 times greater than the suppression costs. Notably, the fire estimated to have the greatest ratio of total costs to suppression costs (with total costs 29 times the suppression cost) took place in New Mexico – the Cerro Grande fire in 2000.

Across all case studies, the ratio of total costs to suppression costs is 12.7.

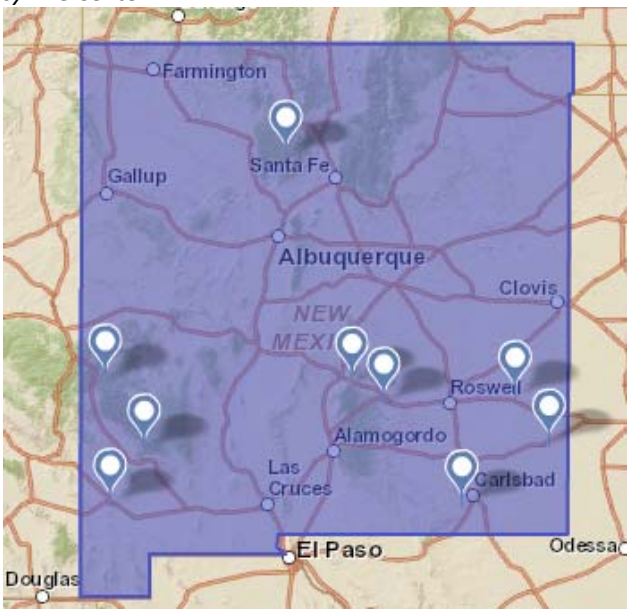
The suppression costs accounted for only 7.9% of the total wildfire costs while nearly 39% of the cost was attributed to other direct costs such as private property losses (insured and uninsured), damage to utility lines, damage to recreation facilities, loss of timber resources, and aid to evacuated residents. Most of these costs are incurred during or immediately following the fire. The burden of other direct costs is typically borne by a combination of private individuals and private businesses and public entities. Costs to rehabilitate the affected lands accounted for 27% of the total costs and are typically borne by federal, state and local governments. Indirect costs account for 25% of the costs and affect tourism business revenue and ultimately state and local tax revenues. The additional costs account for just 1% of the total costs and typically affect private individuals.

IV. ESTIMATING THE FULL COST OF NEW MEXICO WILDFIRES

For the purposes of this report, the wildfires studied have been limited to those fires in New Mexico that occurred between 2009 and 2012 and that affected more than 40,000 acres. Accurate suppression cost data was available for these fires. The following table contains summary information for each of these fires, and the corresponding map indicates the approximate location of the fires.

New Mexico Wildfire Summary: 2009-2012: Greater than 40,000 Acres							
Fire	**Year**	**Start Date**	**Control Date**	**Cause**	**Population Density***	**Acreage****	**Suppression Costs ($)*****
Whitewater - Baldy	2012	5/19/12	6/23/12	Lightning	0.5	297,845	$23,000,000[3]
Little Bear	2012	6/4/12	6/29/12	Lightning	4.2	44,330	$19,400,000[4]
Las Conchas	2011	6/26/11	7/13/11	Human	35.5	156,593	$48,385,000
Miller	2011	4/28/11	6/14/11	Human	7.5	88,835	$18,100,000
Donaldson	2011	6/28/11	7/9/11	Lightning	4.2	101,563	$5,700,000
Last Chance	2011	4/24/11	5/9/11	Human	12.9	53,342	$2,062,400
Enterprise	2011	2/27/11	2/28/11	Human	14.7	64,936	$37,000
Cato	2009	6/10/09	6/13/09	Lightning	10.8	55,080	$460,000
Pasco	2009	6/10/09	6/23/09	Lightning	1.4	93,029	$450,000
				Totals		**955,553**	**$117,594,400**

**Represents the population density of the county where fire occurred. Source: U.S. Census Bureau, 2010 Census*
*** Sources: National Interagency Fire Center, InciWeb Incident Information System*
****Source: National Interagency Fire Center*



The "pins" mark the approximate locations of the 2009-12 NM wildfires that affected areas greater than 40k acres

[3] Southwest Fire Science Consortium. *2012 Whitewater Baldy Fire Gila National Forest*. 2012. <http://swfireconsortium.org/wp-content/uploads/2012/10/FINAL-WB-fact-sheet.pdf>
[4] Kalvelage, Jim. "Cost of Little Bear Fire suppression tops $19 million", 26 June 2012. *The Farmington New Mexico Daily Times. <http://www.daily-times.com/nmnews/ci_21163264/cost-little-bear-fire-suppression-tops-19-million>*

As discussed in the previous section, the true costs of wildfire far exceed the costs commonly reported to the public (typically given as suppression costs). Per the Western Forestry Leadership Coalition report, total costs for the six case studies range from 1.9 to 29 times suppression costs with a midpoint of approximately 12.7. This wide range is evidence of the difficulty and complexity of accurately capturing true wildfire impacts. The majority of the detailed data needed to accurately estimate the true full cost of a wildfire is not centrally tracked or readily available.

Due to the lack of available data, to arrive at an estimate of the full cost of historical New Mexico wildfires, Impact DataSource has applied the range of the ratios of total costs to suppression costs from 2009 to 2012 based on the Western Forestry Leadership Coalition report. The low, high and midpoint factors were applied to the documented suppression costs for these fires. As the table below demonstrates, the midpoint of the estimated total cost of these New Mexico wildfires is $1.5 billion. The wide range of cost estimates reinforces the difficulty of estimating the true cost of the wildfire and the case-specific nature of each fire.

New Mexico Wildfire Full Cost Estimates: 2009-2012					
			Total Costs / Suppression Cost Estimate Factors		
			Low	Mid	High
Fire	Year	Suppression Costs ($)	1.9	12.7	29.0
Whitewater - Baldy	2012	$23,000,000	$43,700,000	$292,100,000	$667,000,000
Little Bear	2012	$19,400,000	$36,860,000	$246,380,000	$562,600,000
Las Conchas	2011	$48,385,000	$91,931,500	$614,489,500	$1,403,165,000
Miller	2011	$18,100,000	$34,390,000	$229,870,000	$524,900,000
Donaldson	2011	$5,700,000	$10,830,000	$72,390,000	$165,300,000
Last Chance	2011	$2,062,400	$3,918,560	$26,192,480	$59,809,600
Enterprise	2011	$37,000	$70,300	$469,900	$1,073,000
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Pasco	2009	$450,000	$855,000	$5,715,000	$13,050,000
Totals		**$117,594,400**	**$223,429,360**	**$1,493,448,880**	**$3,410,237,600**

Additionally, Impact DataSource was provided with an independent report from the New Mexico Forestry Department that estimates the on-going total costs of the Whitewater-Baldy fire. The ratio of total costs to suppression costs for the Whitewater-Baldy fire based off those estimates falls within the ranges mentioned above.

Burden of Costs

Just as the magnitude and type of cost is case-specific for each wildfire, the distribution of who absorbs these costs is differs for each wildfire. With the Sam Donaldson wildfire, which affected mainly private lands, private land and property owners and private insurers will bear the majority of the costs. Contrarily, a fire such as the historic Whitewater-Baldy Complex fire, which mainly affected national forest land, the financial responsibility will lie with the responsible state, local or other public agency or agencies.

For each wildfire there is a possibility that the majority of the costs could be borne by state and local governments. The table below illustrates the estimated distribution of costs for the midpoint estimate of wildfire cost for New Mexico from fires from 2009-2012. The distribution of costs is based on the calculation shown in the previous section which is based on the six case studies analyzed in the Western Forestry Leadership Coalition report.

Cost	***Percent***	***New Mexico Wildfire Cost***	***Cost Burden***
Suppression Costs	7.9%	$117,506,185	Public
Other Direct Costs	38.6%	$576,771,295	Public & Private
Rehabilitation Costs	27.4%	$408,498,535	Public & Private
Indirect Costs	25.0%	$373,910,707	Public & Private
Additional Costs	1.1%	$16,762,158	Private
Total	**100.0%**	**$1,493,448,879**	

While it is again difficult to determine the precise burden borne by local and state governments or even public or private entities, it is clear from these estimates that federal, state and local governments will bear a significant share of the wildfire burden.

V. Conclusion

It is probable that future weather conditions will be more conducive to wildfires. Studies indicate that future wildfire potential will increase significantly in the United States[5]. For the state of New Mexico, 2012 was another year of significant wildfire activity: the Whitewater-Baldy Complex wildfire burned more acres than any other wildfire in state history, the Little Bear fire destroyed more homes than any previous wildfire[6] in the state, and the debate of how the U.S. Forest Service is treating wildfires in New Mexico gained national attention[7].

Although the true costs of a wildfire remain difficult to estimate due to lack of available and consistent data, the total impact of a wildfire far exceeds the suppression costs that are typically quoted in the media. Since the future conditions for wildfires are projected to worsen, it is imperative that necessary additional steps be taken to further prevent the spreading of wildfires. After adding up all the pieces to arrive at the full cost of a wildfire over time, spending more on up-front and proactive measures will be a good investment.

[5] Liu, Yongqiang, John Stanturf, Scott Goodrick. 2009. Trends in Global Wildfire Potential in a Changing Climate. Center for Forest Disturbance Science, US Forest Service

[6] Torres, Melissa. "Little Bear fire destroys record number of homes", 18 June 2012. *KOB 4 Eyewitness News.* <*http://www.kob.com/article/stories/S2660689.shtml*>

[7] Bryan, Susan Montoya. "Wildfire fight adjustments stir up debate", 19 August 2012. *The Washington Times.* <*http://www.washingtontimes.com/news/2012/aug/19/wildfire-fight-adjustments-stir-up-debate/*>

VI. CONDUCT OF THIS ANALYSIS

This analysis was conducted by Impact DataSource. Impact DataSource is a 19-year-old Austin, Texas economic consulting, research and analysis firm. The company has conducted over 2,500 economic impact analyses of firms, projects and activities in most industry groups and in Texas and 26 other states. In addition, Impact DataSource has prepared and customized over 50 economic impact models for its clients to perform their own analyses of economic development projects. These clients include the New Mexico Economic Development and the Metro Orlando (Florida) Economic Development Commission.

The New Mexico Department of Economic Development uses Impact DataSource's computer model to project the economic impact of new or expanding firms in the state and costs and benefits for the State of New Mexico and each local taxing district. The model also calculates the amount of eligible state and local incentives and calculates a rate of return and payback period for these incentives.

The People of Impact DataSource:
Impact DataSource's team includes the following members:

- Jerry Walker, principal/economist,
- Paul Scheuren, principal/economist, and
- Michael Kester, economist

Jerry Walker is an economist and Impact DataSource Principal. Over the past 19 years, he has conducted economic and fiscal impact analyses and cost-benefit studies of a variety of firms, facilities, projects and activities. He has also developed several economic impact analysis computer programs for clients to do their own economic impact analyses of firms, projects, activities and organizations.

He also has a background in government accounting and auditing.

Prior to his economic consulting career, he had a 15-year career as a supervisory auditor with two federal departments – the U.S. Department of Education and the U.S. Department of Health and Human Services. He reviewed federal programs operated by states, local governments, colleges and universities, local education agencies, and nonprofit organizations in a six state area from Austin, Texas. He performed financial audits and operational reviews. During the operational reviews, the operations of the federal programs were reviewed for economy, efficiency and effectiveness. The financial audits included analyzing costs incurred for federal programs and components of indirect cost rates.

He has Bachelor of Science and Master of Business Administration degrees in accounting and economics from Nicholls State University, Thibodaux, Louisiana.

Paul Scheuren is an economist and Impact DataSource Principal.

His advanced research and analytical skills as well as expertise in Excel and other software programs make him uniquely qualified to provide the most insightful and useful economic analysis and research. He has been the lead on several large projects at Impact DataSource and coordinates work on all large projects.

He honed his research skills at Clemson University where he completed several in-depth statistical research projects including a research paper concerning internal U.S. migration presented by his co-author at the North American Regional Science Council annual conference.

Prior to joining Impact DataSource, Paul worked as a compensation analyst at the Texas Association of School Boards where he supported compensation consulting projects and helped streamline data analysis for a statewide salary survey.

Paul has a Master of Arts in Economics from Clemson University as well as a Bachelor of Business Administration in actuarial science from Temple University.

Michael Kester is an Impact DataSource economist.

His diverse consulting background in healthcare and compensation combined with his advanced analytical skills make him a great addition to the Impact DataSource team.

Michael previously worked in New York as an actuarial healthcare consultant for Deloitte where he provided in-depth financial and claims projections to his clients. Michael has also worked as a compensation analyst at the Texas Association of School Boards where he supported compensation consulting projects and analyzed key trends in survey data.

Michael has a Bachelor of Science in Mathematics from Kansas State University.