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The hidden cost of wildfires: Economic valuation of health effects of wildfire smoke exposure in Southern California

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ABSTRACT

There is a growing concern that human health impacts from exposure to wildfire smoke are ignored in estimates of monetized damages from wildfires. Current research highlights the need for better data collection and analysis of these impacts. Using unique primary data, this paper quantifies the economic cost of health effects from the largest wildfire in Los Angeles County's modern history. A cost of illness estimate is $9.50 per exposed person per day. However, theory and empirical research consistently find that this measure largely underestimates the true economic cost of health effects from exposure to a pollutant in that it ignores the cost of defensive actions taken as well as disutility. For the first time, the defensive behavior method is applied to calculate the willingness to pay for a reduction in one wildfire smoke induced symptom day, which is estimated to be $84.42 per exposed person per day.

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Introduction

As wildfire seasons increase in intensity and length in many parts of the world, it is becoming increasingly important to include the full cost of wildfire damages in any evaluation of future fire management policies. Nowhere does this issue seem more relevant than California, a state that has seen over three million acres of its land burned by wildfires since 2007 (CalFire, 2011). Increased levels of

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fire management and prevention practices are often proposed in California as a way to mitigate future losses from wildfires. These practices include vegetation management activities such as prescribed fire and forest thinning, community awareness and education, the creation of local and community Fire Safe Councils, and participation in the national Firewise/USA program. Although these practices may help to prevent losses from future wildfires, their implementation is often constrained by funding.

In determining whether increased funds for these practices are justified, policy makers need to be able to accurately evaluate relevant tradeoffs using sound economic analyses. At the federal level, The Federal Wildland Fire Management Policy of 1995 stresses the need to address economic efficiency of fire management and inform the public of the economic benefits of fuel treatment projects and the risks associated with not undertaking them (USDI–USDA, 1995). One of the nine guiding principles of the updated 2001 Policy is that "fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives" (NWCG, 2001). At the state level, California's 2010 Strategic Fire Plan calls for the use of economically efficient fuels treatment projects such as prescribed fire and forest thinning.

However, the only way for policy makers to accurately evaluate fire management actions on an economic efficiency based criterion is to be fully aware of the economic benefits of each management action, which includes the economic costs associated with not taking the management action. While suppression costs and insured damages to homeowners are often reported as the main economic costs of wildfires, there is a growing concern that this represents a very incomplete measure of the cost of the damages from wildfires (Butry et al., 2001; Morton et al., 2003; Dale, 2009; Zybach et al., 2009). One of the main issues is that human health impacts from wildfire smoke are typically ignored in estimates of monetized damages.

Human health effects from wildfire smoke exposure have been talked about for decades but rarely quantified. In a USDA Forest Service technical report, Gorte and Gorte (1979) explained that in a USDA Forest Service technical report explained that economic justification of fire management expenditures has been called for since the 1920s. They outline economic guidelines for determining how much should be spent to protect forests from fire and explain that the economically optimal level of funding for fire management based on a least-cost-plus-loss method are those that minimize the sum of wildfire suppression costs, presuppression costs, and resource losses, which includes damages to human health.[1] Twenty-two years later, Butry et al. (2001) explained that while this criterion outlined by Gorte and Gorte (1979) requires systematic calculations of the associated costs, losses and gains of a given wildfire, there is no organization in the United States which attempts to quantify the complete economic impacts. When evaluating fire prevention programs, an accurate analysis would require inclusion of the economic cost of human health damages from a wildfire that could be prevented by implementing these programs. Omitting these health benefits in a benefit cost analysis of such programs could result in underinvestment in prevention measures such as prescribed burns or forest thinning.

More recently, Abt et al. (2008) suggested immediate improvements in data collection to be used in economic impact assessments for U.S. Forest Service wildfire programs. They call for more research to achieve consistent estimation of the various resource losses associated with wildfires, including human health impacts. The authors cited two studies which have attempted to quantify the economic cost of the health impacts of wildfire smoke, Butry et al. (2001) and Rittmaster et al. (2006), and concluded that further research needs to be done to allow estimation of health impacts from wildfire program activities. Kochi et al. (2010) conducted an extensive review of the literature on the economic cost of health damages from wildfire smoke exposure and concluded that while this cost should be considered in wildfire management policy, the available research is scarce and incomplete.

This study seeks to address this gap in the literature by outlining an empirical method to quantify the economic cost of health effects associated with wildfire smoke exposure which can be utilized in damage assessments of future wildfires. This method is demonstrated with a case study that quantifies this cost for a sample of individuals exposed to wildfire smoke from California's Station Fire of 2009.

[1] Now referred to as the least-cost-plus-net-value-change method to recognize the fact that wildfires can also provide significant benefits.