

Estimating the net cost of the 2009 Black Saturday Fires to the affected regions

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Precede

The impacts associated with the 2009 Black Saturday Fires have been valued for the affected local government areas and are presented here. They extend beyond the clearly visible suppression activities and building losses, and include less obvious economic, social and environmental costs.

1. Introduction

The Black Saturday Fires were the worst in Australia's history, killing 174 people (including a fire fighter from the ACT on 17 February (Teague, McLeod and Pascoe 2009) and directly impacting on 78 towns, leaving some unrecognisable (Department of Sustainability and Environment 2009). These fires resulted in widespread economic, social and environmental destruction and disruption. Previous studies have estimated the costs of severe bushfires on society using economic analysis, with the Bureau of Transport Economics (BTE) (2001) for example estimating the total cost of the 1983 Ash Wednesday Fires (including Victoria and South Australia) at \$1.320 billion¹. A 2003 southern California fire burnt through 50,586 hectares of upper catchment vegetation (of which the catchment was a major source of drinking water) and residences scattered throughout the area (Dunn 2005). While this fire was approximately half the size of Black Saturday's Kilmore East fire, Dunn (2005) estimated the total loss to be \$1.892 billion.

The purpose of this study was to collect as much information as possible and estimate the net cost (i.e. losses minus benefits in the form of aid and insurance) of the Black Saturday

¹ All values are in 2009 Australian dollars. Any foreign currency amounts described in this report have been converted to 2009 Australian dollars.

Fires using an economic analysis framework similar to those above. Contrary to many previous studies an extensive range of impacts were valued. Including those not normally incorporated into one assessment, such as infrastructure losses within state and national parks, timber losses, fatalities and injuries, environmental losses and the money flowing into the affected areas after a fire.

Although many hundreds of fires began on or around Black Saturday (7 February 2009), twelve fires were selected for analysis due to the severity of their impacts. The names given reflect those used in the 2009 Victorian Bushfires Royal Commission Interim Report (Teague, McLeod and Pascoe 2009) and are as follows in order of date and time reported to fire authorities: Delburn (began 29 January), Bunyip (began 4 February), Kilmore East, Horsham, Coleraine, Pomborneit-Weerite, Churchill, Murrindindi, Redesdale, Bendigo, Beechworth-Mudgegonga (all began 7 February) and Wilsons Promontory (began 8 February).

2. Using an economic loss assessment to estimate the net cost of the Black Saturday Fires

Loss assessments based on sound economic principles are an important method for measuring the losses and benefits resulting from bushfires and other natural disasters, as they provide rigorous and unbiased information and enable comparability when evaluating separate events (Commission on Geosciences, Environment and Resources 1999; Handmer, Reed and Percovich 2002). Key features of an economic approach are that it assesses the impacts on all members of a society, impacts that are difficult to quantify, negative as well as positive impacts (thereby estimating the net cost), and places a temporal and spatial boundary around the assessment area (Handmer 2003).

Using selection criteria drawing on the desirable attributes of an economic assessment approach, 13 loss assessment frameworks were short-listed, with the Socio-Economic Impacts Assessment Model (SEIA-Model) developed by the Victorian Office of the Emergency Services Commissioner (OESC) (2008) best matching the criteria. This is because it adhered to the concepts of an economic loss assessment as outlined above and provided a clear template in which the impacts could be entered and the costs estimated. The impacts of the Black Saturday Fires were assessed up to May 2010 (i.e.

one year after the final fire was declared safe); thereby allowing those impacts not immediately obvious and longer term indirect impacts to be accounted for. Environmental impacts were valued at 70% of the first year cost per hectare. The value of 70% was used based on studies measuring the proportion of burnt vs. unburnt areas and vegetation defoliation when burnt during Australian bushfires (Hammill and Bradstock 2009; Lindenmayer and McCarthy 2002; Williams et al. 2008). The spatial boundary included local government areas that were burnt to some extent by the fires.

Different assessment methods were used to value the economic, social and environmental impacts of the Black Saturday Fires. For economic impacts, a list of assets that could potentially be impacted was already included in the SEIA-Model template, as well as the estimation principles used to estimate the value of the impacts. Residential, commercial, industrial and public premises, stock and contents, infrastructure and public assets were valued according to the following formula: 'X'% of the replacement cost (i.e. depreciated value) or cost of repairs if damaged multiplied by the number of assets destroyed or damaged. The percentage value ranged from 85% for residential, commercial, agricultural and park buildings to 50% for many park structures (e.g. tables and seats, park signage). Depreciated (market) costs were used because they more accurately reflect the actual value of the lost asset. Other valuing methods, such as insurance valuations usually replace lost items with new ones, resulting in a much higher value for such items (Handmer 2003). Agricultural livestock and feed were valued according to their market value at the time of the fire, apart from pasture, in which the cost of restoration was used. For crop and timber losses, the market price at the time of the fire less input costs avoided was used.

While many social impacts are important (e.g. psychological trauma, memorabilia), it is currently not possible to value them in dollar terms. They are still included in an economic loss assessment as qualitative data. Two social impacts that were valued statistically were the loss of life and injuries. The value of a statistical life is \$3.7 million according to the Australian Government's Office of Best Practice Regulation (OBPR) and is an "*estimate of the financial value society places on reducing the average number of deaths by one*" (OBPR 2008, p. 1). Injuries were valued using the human capital approach, whereby people are viewed as a labour source and the [average] "*value to society of preventing an injury is the saving in potential output or productive capacity*" (BTE 2001, p. 129). The values used were \$439,000 for a serious injury and \$14,700 for a minor injury (BTE 2001).

The impact of the fires on the environment was valued in terms of ecosystem services the environment provides humans, such as water supply, nutrient cycling, climate regulation and recreation. Estimating these values in a common unit (i.e. currency) is important for use in policy decision-making, as it allows the services provided by the ecosystem to be compared with economic services and manufactured capital (Costanza et al. 1997). If these ecosystem services are not valued in dollar terms, then Costanza et al. (1997) advocates that the environment is given little consideration in policy decisions. The framework used in Costanza et al. (1997) was used in the current study because it provided a single value per hectare per year lost for each type of biome, i.e. forest, grasslands, cropland, thereby allowing consistency and comparability across the separate fires that make up Black Saturday.

The Costanza et al. (1997) approach does have some critical limitations; such as collating previous studies that valued ecosystem services at specific locations around the world and then extrapolating them to give one value for each service across the earth (i.e. benefits transfer). The values estimated in Costanza et al. (1997) were also treated as being capable of generating total economic values per hectare when they were mostly capable of generating marginal (i.e. incremental) values (Pagiola, von Ritter and Bishop 2004, p. 20). That is, non-market valuation techniques in particular are good at valuing a change from A to B, but not at identifying the total value of C. Another study that specifically reflects Australian ecosystem service values, however, could not be found.

The SEIA-Model template included insurance payment and government aid and recovery programs as benefits. Donations were also included by the author, including the benefits to a community after a bushfire or any natural disaster may sound strange, since the first thing we envisage is destruction. However, this is a fundamental part of any economic loss assessment. It is especially important when measuring the impacts on a small scale (i.e. regionally or smaller), as the money flowing into an economy partially offsets the losses flowing out of it (Handmer, Reed and Percovich 2002).

Once the total losses and benefits were estimated, the net cost was found by subtracting the benefits from the losses. The geographical boundary enables the flow of goods and services (and the costs of these) to be accounted for and identifies what is a loss, benefit or transfer. Losses can be viewed as the loss of goods and services within the assessment

boundary (e.g. crops, buildings, loss of business), while the benefits can be measured by the flow of goods and services (inc. money) into the assessment area. The exchange of goods, services or money wholly within the assessment boundary (i.e. does not move across the boundary) is considered a transfer effect and not an economic loss or benefit to the assessment area (Handmer, Reed and Percovich, 2002).

Some impacts were not estimated in this assessment. Timber losses in state forests were not valued, as the data were not available at the time of the analysis. Indirect impacts regarding disruption to businesses, transport networks, essential service provision, public services and households and health impacts were not valued. Identifying indirect costs can be difficult, as detailed business and household surveys are the best ways to obtain information on which calculations can be made. Creating, distributing and collating this type of data requires a large amount of resources and time (Barkmann et al. 2008), which were not available at the time of conducting the assessment. As a result, the cost of emergency response and smoke taint in viticulture crops were the only indirect impacts estimated. The cost of carbon released during the fire was not valued individually, as it was already included in the Costanza et al. (1997) framework under gas regulation.

3. Estimated costs of the 2009 Black Saturday Fires

The estimated net cost of the Black Saturday Fires was \$942 million, being the difference between the total losses and total benefits. The impact categories that contributed to the total losses and benefits for the Black Saturday Fires are shown in Table 1. Agricultural impacts were found to be the highest (25%), with fatalities (22%) and the destruction of residential buildings (21%) also resulting in large losses. Total benefits came to just under \$2 billion, equating to 68% of the total losses. Over half of the benefits received were provided by the insurance industry (55%), Government aid, in the form of financial assistance and recovery programs, also provided a significant amount, accounting for 26%, followed by donations at 19%. The amount of donations received was substantial, being acknowledged as the “*largest single charitable appeal in Australia’s history*” (Victorian Bushfire Appeal Fund 2010, p. 4).

Table 1 Breakdown of the total losses and benefits resulting from the Black Saturday Fires

Impact Category	Cost (\$'000,000)	Percentage of Total
Losses		
Residential Buildings and Contents	\$623	21%
Commercial, Industrial and Public Buildings and Contents	\$38	1%
Park Buildings, Contents and Infrastructure	\$34	1%
Public Infrastructure (inc. utilities and roads)	\$7	0%
Agriculture (inc. stock, feed, crops, buildings and fencing)	\$733	25%
Timber (plantation)	\$80	3%
Emergency Response Operations	\$344	12%
Fatalities	\$643	22%
Injuries	\$71	2%
Environment	\$366	12%
Total	\$2,939	
Benefits		
Government Aid and Programs	\$517	26%
Donations	\$389	19%
Insurance	\$1,092	55%
Total	\$1,998	
Net Loss	\$942	

4. High priority requirements when accounting for bushfires

When accounting for bushfire losses in the future, the results of this study indicate a number of high priority impacts that lead to substantial losses and hence efforts should be made to manage these impacts to mitigate future costs.

Human lives

The highest priority when responding to natural disasters is the preservation of life. The Black Saturday Fires resulted in 174 fatalities, 130 serious injuries and 670 minor injuries (Victorian Bushfire Reconstruction and Recovery Authority 2009)². The total loss attributed to fatalities and injuries was \$714 million. Although it is inappropriate to place a dollar value on a life in one sense, the BTE (2001) argues that estimating the costs of intangible impacts such as this generates better opportunities for more informed decision making. It also creates a more accurate and holistic estimate of the total economic loss that is used by policy-makers when making decisions about hazard prevention and mitigation strategies.

Agriculture

The agricultural industry sustained the highest loss with \$733 million. Losses to the viticulture industry accounted for \$330 million or 45% and was the result of direct contact with the flames and the spoiling of grapes through smoke taint. Since smoke taint is such an expensive impact, government agencies, universities and the wine industry are working together to understand the impact of smoke on grape quality and find ways to combat it (Kennison et al., 2007; Whiting and Krstic, 2007).

Houses, Commercial, Industrial and Community buildings

The Black Saturday Fires reduced whole towns to ash and rubble, destroying 2,300 houses, 57 business and numerous community buildings, such as schools, police buildings and community centres (Committee of Parents & Friends of Glenvale School 2009; Teague, McLeod and Pascoe 2009). The total cost of this destruction was estimated to be \$661 million, or 22% of the total losses.

Ecosystem services (i.e. Environmental losses)

The lack of ecosystem service values relating to Australian natural environments was a large limitation in analysing the impact on the environment. Even so, the Costanza et al. (1997) framework resulted in a value of \$366 million and highlights how valuable the environment is when compared to other loss types.

² The ACT fire fighter fatality was not included in this assessment, as the fire fighter lived outside the assessment boundary.

Even without knowledge of the study of 'ecosystem services', their importance is implicitly recognised, being given a high priority by land and fire managers. A prime example is the early recognition during the 2006/07 Great Divide Fires that the Thompson Dam catchment (the main source of Melbourne's water) was under threat, which was saved by the construction of a 107 km control line (Flinn, Wareing and Wadsley 2008). Translating the importance of the environment into a dollar value is therefore an important step in an economic loss assessment, providing valuable data for the development of policies, prevention, preparedness, response and recovery (PPRR) strategies and risk management.

5. Policy and land management implications

Land managers have the task of managing bushfire threats by using different methods to minimise economic, social and environmental losses with limited human and financial resources (Ganewatta 2008, p. 151). For this reason, land managers are required to make choices and trade-offs between these limited resources. This concept of allocating scarce resources is the primary concern of economics. The results produced in this loss assessment will increase the range of information available to those in land and fire management on which more informed decisions can be made. The applications of this analysis are broad. It can provide an initial framework that can be built on to show what costs can be reduced and what costs cannot through a economic risk based analysis, which are informed through historic events. It could also be used in conjunction with existing tools and knowledge to select between alternative fire suppression technologies (or at the very least select a number of options that give the best overall outcome) or be used in a risk management framework to identify important assets or regions to protect.

Policy-makers may also find the results of this study (as well as the general concept of using an economic framework) helpful as it presents a common basis for valuing impacts (Ganewatta and Handmer 2006). It also provides actual data on which policy decisions could be justified (although this data should not be the only evidence used to create and justify policies). Along with other tools and information on which decisions are made, the data presented in this study may assist policy-makers to compare the losses and benefits within and between each individual fire and construct policies that minimise the losses. These may include the improvement of assistance measures during the recovery phase or

more informed policies that focus on alleviating the impacts and concerns of regional and remote communities (as this is where many bushfires occur). From a financial point of view, policy-makers and treasury officials may want to know how the losses sustained by different levels of Government affected their budgets and where budgetary stress may have occurred when responding to and recovering from the fires.

6. Future research needs

While collecting and valuing fire impacts, some important knowledge gaps became apparent, the most noticeable was the lack of ecosystem service values relating to Australian natural environments. This is a contentious area, with the question not so much about whether ecosystem services should be valued, but how they should be valued. Several international reports exist that tackle this issue, including Ecosystems and Human Well-being (Hassan, Scholes and Ash 2005), Assessing the Economic Value of Ecosystem Conservation (Pagiola, von Ritter and Bishop 2004) and The Economics of Ecosystems & Biodiversity (TEEB 2009). Applying the concepts described in reports such as these to Australian conditions will allow more accurate estimates to be made.

Due to time constraints and the difficulties in valuing indirect economic and social impacts, some of these impacts were not valued during the analysis. Collecting this information usually requires surveying affected people and businesses shortly after the fire and is therefore relatively labour intensive. Surveys specifically designed to value indirect and social losses (e.g. business, transport and household disruption) that are able to be distributed shortly after a fire, however, would be advantageous as a way of filling the gap in knowledge and providing a more systematic way of accounting for these types of losses.

7. Conclusion

By valuing a wide range of economic, social and environmental impacts and benefits through an economic loss assessment, the net cost of the Black Saturday Fires was estimated to be \$942 million. This value was reached by deducting the total benefits (\$1.998 billion) from the total losses (\$2.939 billion). Agricultural losses, fatalities and residential losses as well as the benefits received in insurance payments were all identified as producing high costs. Not all impacts that could be valued were, such as indirect

business and household disruption. This was due the difficulties of valuing these types of impacts and the limited resources available to conduct this part of the assessment. If these were valued, then the net cost would be much higher. The need to develop ecosystem services values specifically for Australian conditions as a way of valuing environmental impacts has been identified as requiring further research.

The results of this study may provide useful information for those involved in fire management. Coupled with existing tools and knowledge, these results could be used by fire managers to allocate fire fighting resources more efficiently and inform Prevention Preparedness Readiness and Response strategies, by policy-makers to create policies that attempt to minimise bushfire losses, by managers in the process of creating risk frameworks and treasury officials requiring detailed and objective information on which they can base their decisions. Until a large majority of the economic, social and environmental losses associated with bushfires are know, policies and strategies incorporating bushfire information will not be fully informed.

Practical applications of this study

The information obtained through analysing the costs associated with severe fires can be used to inform and support fire management strategic directions of increased risk management to communities, industry and the environment through increased planned burning.

It will assist in updating state level risk assessments and inform the risk framework.

The study provides insight into adding an economics component to the risk and strategy modelling work currently being undertaken in the Future Fire Management Project.

The literature review and literature database will be used by the Department of Sustainability and Environment's Bushfire Rapid Risk Assessment Teams as part of the Bushfire Recovery program.

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