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Dust Watch – monitoring the interaction between climate and land management.

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Introduction

Dust storms are the result of soil erosion by wind. They cause considerable damage both at their site of origin (e.g. the farm paddock, Leys and McTainsh1994) and down wind as they deposit unwanted dust and reduce air quality (Chan et al., 2005). There are few actual estimates of monetary costs associated with dust storms. Huszar and Piper (1986) in the United States determined that the major off-site impact of dust erosion was on households, principally due to interior cleaning and domestic landscaping clean ups. Williams and Young (1999), in an initial study of the costs of dust in Australia, included the health costs, incorporating mortality and morbidity costs, of dust storms in South Australia and concluded that a major cost of dust in South Australia was caused by adverse health effects, particularly on the portion of the population that suffered from respiratory diseases, especially asthma sufferers.

Impacts of Wind Erosion

Wind erosion causes basically two types of damage:

On-site damage: Loss of top soil can result in surface lowering and scalding and loss of soil nutrients, organic matter and soil carbon (Leys and McTainsh 1994; Leys 2002). Windblown sand can also damage vegetation by burying it or abrading/sandblasting it off. Infrastructure can also be buried or sandblasted.

Off-site damage: Dust can drastically limit human activities, including closure of transport networks and increased accidents caused by low visibility; health impacts, loss of sales by businesses and cause damage to utility systems such as electricity lines or transformers; buildings and results. Deposited dust also increases cleaning costs and can damage high value crops (e.g. vegetables) (Huszar and Piper 1994, Williams and Young 1999).

Measuring costs

Dust imposes significant costs on residents and business owners in both rural and metropolitan areas. For example Mildura in Victoria has had 168 events over the last 22 years when total suspended sediment (TSP) concentrations > 100 $\mu g/m^3$ (Figure 1). This is equivalent to a visibility reduction of about 10 km and would result in extra cleaning. Residents and businesses in Sydney have had five dust events in last 22 years.

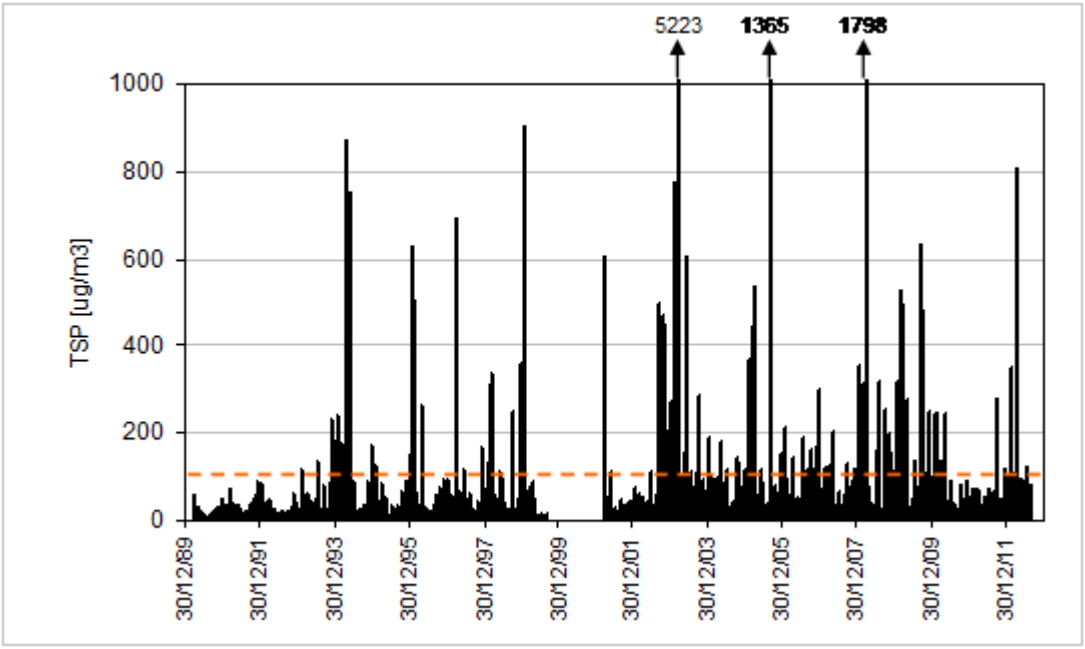

Figure 1: Total suspended particulate (TSP) matter concentrations at Buronga DustWatch site. Dotted line denotes 100 μg/m^3.

The economic impact of dust storms in Sydney is much higher than in the Mildura region because of the level of economic activity, number of residents and services and businesses affected in larger in metropolitan areas..

The Red Dawn Event - 23 September 2009

Red Dawn was the largest dust storm to hit Sydney since records commenced in the 1940s and 2.54Mt of dust blew off the coast (Figure 2). Red Dawn was caused by several factors: a series of hot dry years, low vegetation cover, low soil crust levels and 100km/h winds. The result was a 3000km long dust plume stretching from Eden to the Gulf of Carpentaria.

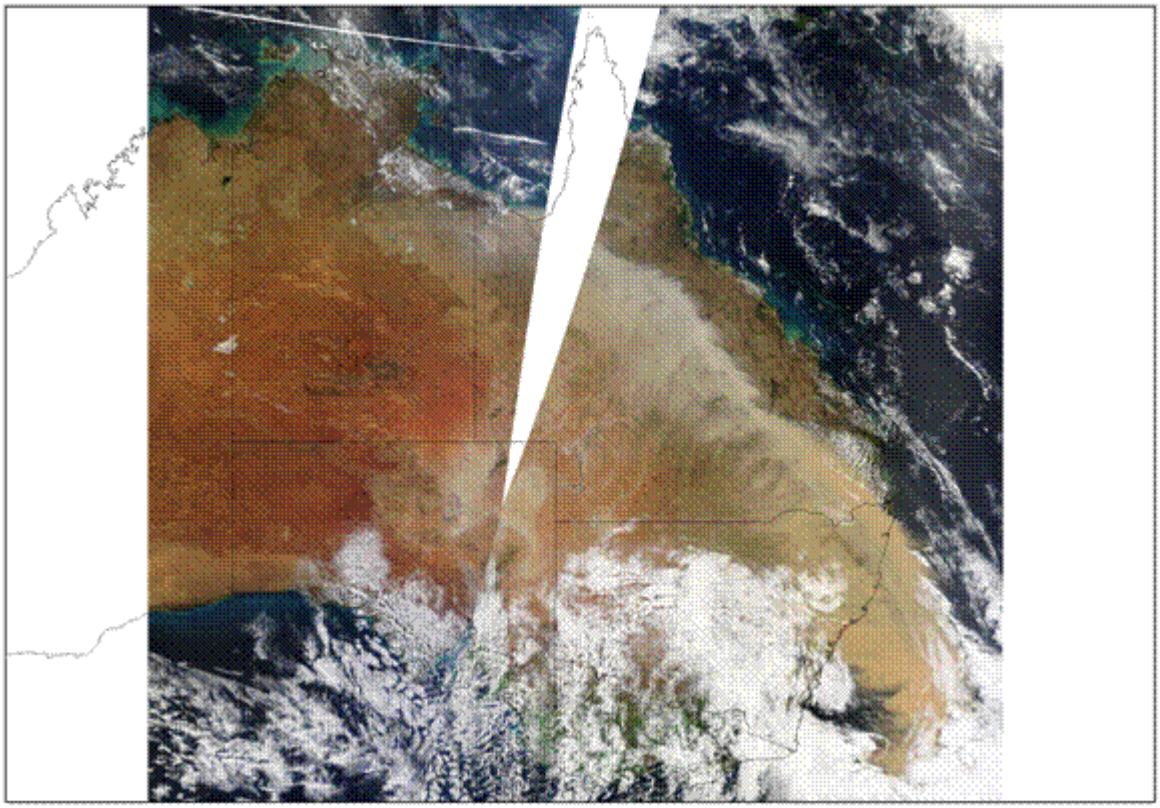

Figure 2: Red Dawn dust storm of 23 September 2009 (MODIS Rapid Response Project at NASA/GSFC)

Method, Data and Results

It is difficult to find information on the off-site impacts of dust storms because of the dispersed nature of the damage. This study is largely based on "Red Dawn" because there was a lot of media and science coverage which provided data about its impact. Only major costs are included below due to space limitations.

The cost analysis was based on data provided by those primarily affected by the dust storm or is derived from previous studies in Australia and overseas. In the analysis several assumptions are made regarding the population and number of households in Sydney and New South Wales (ABS 2010a, b). The number of households in Sydney were 2,718,172 and population was 7,068,287 in September 2009; the proportion of the NSW population in Sydney was approximately 63% (ABS 2009) and the proportion affected outside Sydney was 25% (north of a line running approximately from Broken Hill to Bathurst then to Newcastle. Costs in this section were 50% that of Sydney.

One of the major effects on transport services due to Red Dawn was the closure of Sydney Airport. Costs were estimated as approximately $10.8 million.

Commercial activity costs are separated into two categories; retail/service activities, including retail sales and cleaning costs after the dust event; and construction activity. The estimated costs to businesses in the Sydney were $34.7 million, and to businesses outside the Sydney $6.9 million. These two figures equate to approximately 21% of the daily retail turnover.

The loss in value in construction is due to the delay in the overall project as well as costs that are incurred whether construction is undertaken or not. The cost to the construction industry ranged from $1.2 to $3.2 million.

Domestic costs are estimated utilising the approach of Huszar and Piper (1986). The estimates for domestic cleaning costs per person yielded a value of $115 per household. This equates to $196.5 million for Sydney and $58.3 million for non Sydney households.

Agricultural losses in New South Wales (Figure 3) amounted to about $5 million. Agriculture also incurred about $9 million in costs due to losses in sequestered soil carbon and soil nutrients.

The total costs of Red Dawn to the NSW economy were estimated to be around $331 million. Many businesses were also adversely affected by high worker absences on the day of the storm.

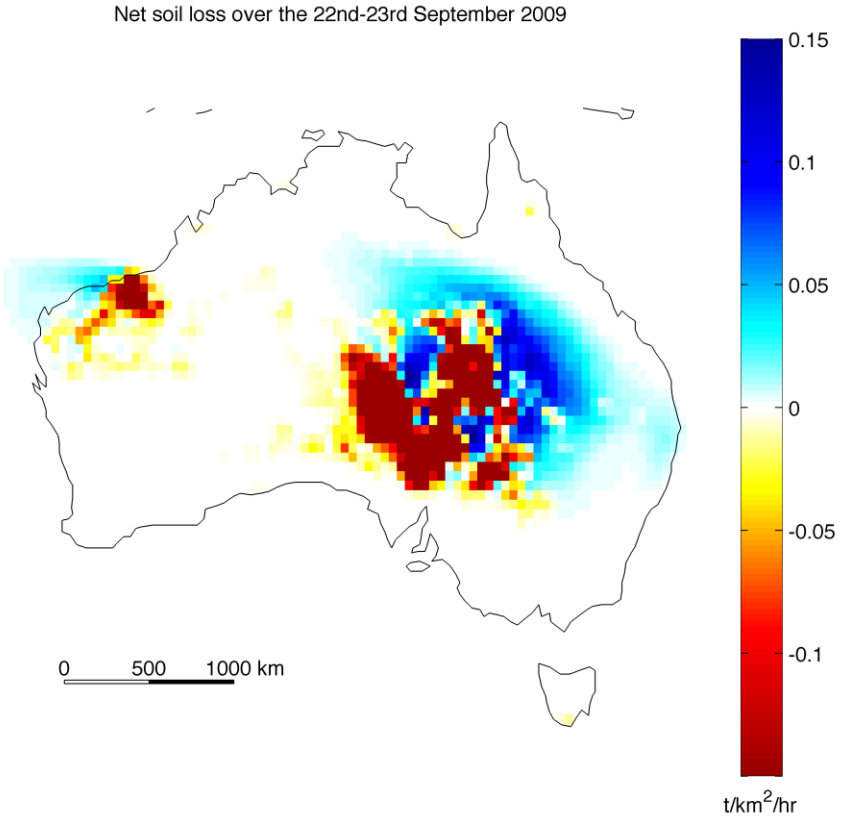

Figure 3: Modelled data showing area of soil loss (red and yellow tones) and areas of dust deposition (blue areas) for Red Dawn (22 to 23 September 2009) (Source Harry Butler Uni Southern Queensland)

Using similar data to that for the Sydney event it was estimated that the average costs of dust storms to the residents of the Mildura/Buronga region were approximately $3 million per year. This cost includes cleaning and losses to businesses, but does not include the health costs of dust to residents of the area nor losses in agricultural production due to the sand blasting due to the lack of data. The actual cost per year would vary depending on the number of events per year.

Benefits of abatement measures

From a natural resource management policy perspective an important aspect of the cost analysis is the scale of the off-site costs relative to the on-site costs.

The regional and metropolitan estimates of economic impact can be used to evaluate the cost benefit of investments aimed at controlling erosion. If erosion and dust control actions cost

less than the impact costs then it would be beneficial and profitable to the state economy to invest in these measures.

The dust source was from rural areas but its impact was not just confined to local communities but also extended to metropolitan areas. Red Dawn was estimated to cost $331 million and assuming these types of events occur 1 year in 50, the average annual off-site cost would be approximately $6 million. Thus, if dust mitigation programs were undertaken at a cost equal to or less than $9 million ($6 million for Sydney plus $3 million for Mildura) then society would be better off. This estimate only uses one rural city and one metropolitan area; thus, is a very conservative estimate. Therefore, investment in dust mitigation strategies in rural areas, where dust is typically sourced from, would not only have a positive impact on regional areas, but also on the more populous coastal and city areas of New South Wales.

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