

ACTS OF GOD: URBAN TREE MANAGEMENT

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Abstract

Broadly speaking, an act of God is a contract or tort law defence for an event (accident) that was caused by natural forces that were outside human control and that could not have been prevented by ordinary skill and foresight. This defence is not commonly used in urban tree management and frequently it is used incorrectly, more often people merely mean that an accident was not caused through negligence.

In ancient times, lightning was the act of an angry God, however an act of God is related to knowledge, as our knowledge changes, so does are ability to apportion blame. Equally, the boundaries of 'ordinary skill and foresight' change.

Severe storms, tornadoes, floods, and other natural disasters occur regularly throughout Australia. The estimated annual cost of natural disasters is \$284 million. Tree failures are an inescapable part of such events and damage from tree failures are often a significant part of the costs.

Given that trees are structures and, like all structures, will fail under suitable conditions, can we rely on the act of God argument to defend/excuse tree failures? With our current knowledge of weather, particularly wind speeds, frequencies and loading on trees, is there a point where we can argue that it was acceptable for a tree to fail? From an act of God perspective it is possibly more important that we can demonstrate that human action or intervention did not contribute to the problem, there would be few urban situations where we could easily make such claims. For instance, how many wind connected tree failures are related to inadequate root zones, root zone damage, girdled roots, pruning wounds, planting of poor quality stock, etc?

The act of God defence becomes interesting in light of predictions that the climate is changing and that more extreme weather events are probable and are likely to occur more frequently. Could tree managers be held negligent 20 or 30 years hence when trees we plant now fail due to increased or more frequent wind events, or increased or decreased rainfall? Should we be taking action now to account for these probable future conditions?

An act of God is merely a legal defence where we claim that we have no obligation to pay for the consequences of an event, not too dissimilar to a defence against a claim of negligence. Both are process driven, what processes should be in place to argue an act of God? Robust risk management set within an asset management structure is the simple answer.

We have little data on tree failures and loadings or circumstances where failures occur, it is difficult to be proscriptive at the individual tree level, but at a societal level decisions can be made. I would like to think that the current SA Independent Inquiry into the Management of Trees on Public Land (Ecological Associates, 2010) will be the start of a good societal discussion on the validity of trees in urban environments.

Introduction

How valid is the act of God argument when managing urban trees? What is an act of God? Is lightning hitting a tree an act of God? What if the tree was on top of a hill, near the ocean and fitted with a steel frame to hold Christmas lights? Are urban trees structures? Can we quantify what is a reasonable loading for a tree? We require buildings, signage and other infrastructure to meet specific codes and design requirements. Can we reasonably require the same of a naturally growing living structure which reacts and interacts with its environment and produces a dynamic anisotropic structural material? How valid would such standards be with the predicted changes in climate, particularly, the increased frequency and magnitude of wind events and storms, or merely droughts? How do we explain or 'justify' failures or more particularly injuries or property damage that happens on 'our watch' and what if anything can we do, or what should we do? If not an act of God what shall we call it and where does the 'act of God' sit within a modern 'risk society' (Beck, 1999).

Most urban centres are forests, although the reducing canopy cover and increasing hardscape are challenging the concept. Regardless, the urban forest is an ecosystem (Perry, 1994), and as such, urban forests are not static, but dynamically changing over time and spatially, trees are removed and replaced and new trees are planted. The composition of the forest changes over time as do the relationships with other inhabitants of the forest. However, this tends to occur over a timescale that is far longer than communities and individuals tend to plan within. Similarly the climate constantly changes. The changes are small on a human scale, and hence are difficult to definitively prove, but cumulative.

I am not a lawyer hence the discussion here is limited to a lay person's understanding of the legal terms. What is an 'act of God'? Fortunately its definition does not rely on a religious belief, but clearly that is where the term originated. History provides the basis of this term because from ancient to at least medieval times, misfortunes were explained in terms of intervention by an external force, usually an evil spirit, demon or God (Lupton, 1999). The legal system has adopted the concept and applied a legal interpretation.

At the lay person level the Oxford Dictionary defines an 'act of God' as:

'Action of uncontrollable natural forces in causing an accident, as the burning of a ship by lightning.' (Simpson et al., 1989)

In simple British Law terms an 'act of God' refers to events outside of human control for which no one (including corporations) can be held liable and hence accountable (Merullo and Valentine, 1992). It can have a slightly different emphasis depending on whether it is being considered from a Contract Law or Tort Law perspective. The oldest cited reference I could locate was in *Tennant v. Earl of Glasgow*, (House of Lords, 1864):

'Circumstances which no human foresight can provide against, and of which human prudence is not bound to recognize the possibility, and which when they do occur, therefore, are calamities that do not involve the obligation of paying for the consequences that may result from them.'

The key phrase that is possibly more relevant today than in 1864 is 'do not involve the obligation of paying for the consequences.'

A similar legal defence that is much wider in scope is *Force majeure*, typically referring to 'forces' or 'events' outside of the control of parties in a contract that effects the performance or outcomes of the contract. Typically cited events include riots, war, crime and acts of God.

From an arboricultural perspective Lilly (2001 p.141) contends that many legal defences based on acts of God fail, she suggests that this is because an 'act of God' is *'...an occurrence due to natural causes that could not have been prevented by ordinary skill and foresight'*, Merullo & Valentine (1992 p.8) concur adding the need for *'...the entire exclusion of human agency from the cause of loss or injury.'*

In Australia the Crown in *The Secretary to the Department of Natural Resources & Energy v. Megan Elizabeth Harper* 2000 argued the 'natural' nature of the area – described in the case as 'bush' meant that the event was outside human control and that no human intervention was involved (the Crown was defending a claim of negligence). This reinforces the argument that an 'act of God' must involve situations fundamentally removed from human interference or control. Generally, an act of God will be difficult to establish in urban areas, except in exceptional circumstances and will still probably fail if the defect that caused the failure was known of or should have been known to exist and should have been remedied or removed (Lilly, 2001, Mattheck et al, 1994). Exceptions could include lightning strikes.

The basic argument is about events outside human control and what is really being tested is the required 'duty of care' or more specifically the tort law of negligence. A duty of care is fundamentally the base element of the modern 'risk society'. The test for this duty of care has been increasing in line with societal changes to the point where Justice Gleeson (1991) suggested that in effect 'reasonable care' has reached the point that the test is virtually that of strict liability and therefore no process will protect against claims of negligence.

The key elements for an act of God are:

- What was reasonably foreseeable,
- What could have been done, and
- What level of human intervention exists?

In ancient and medieval times an act of God helped explain the unexplainable. As knowledge, particularly scientific knowledge, increases it becomes more difficult to use an 'act of God' as a reasoned cause for an event. Hence knowledge is the key measure.

How do tree failures in modern societies/communities stand alongside the act of God defence? What could be defined an act of God? Events that are interesting to consider include downburst winds, lightning strikes, tornadoes, severe storms, a cyclone in Adelaide, floods in areas that have never flooded, summer or sudden branch failure. Considering these elements against foreseeability, preventability or human intervention becomes interesting and no doubt debatable.

Lightning strikes

It is likely that more than a thousand people are killed by lightning each year. There are 350-450 lightning caused fatalities each year in the US alone, with hundreds more injured. This data is typically under reported (Curran et al., 1997). Lightning strikes cause fatalities and property damage across Australia. Between 1803 and 1991, at least 650 people have been killed in Australia (Coates et al., 1993). The overall death rate is 0.08 per 100,000, or converted to the current population it equates to an approximate annualised mean of 18 fatalities (Coates et al, 1993). Although the ABS only reported 3 deaths in 2007 and 4 in 2008 (ABS 2010).

It is estimated that over 8 million lightning strikes occur over the earth each day. Lightning is common in Australia with many strikes occurring each day. The ABC reported that one thunderstorm in Darwin produced 1634 lightning strikes, which is more than Perth receives in a year (Australian Broadcasting Corporation, 2002). Some 40% of Darwin's electricity outages are caused by lightning.

We understand when lightning is likely to occur and in many cases, lightning related accidents are somewhat foreseeable. For fatalities the male/female ratio is skewed with the younger male age groups over represented, 60% were work related and 20% recreational. These statistics illustrate that lightning fatalities are not random.

In ancient times lightning reflected the wrath of the Gods, it was undefendable. We understand lightning, the causes, when it is likely to occur. Lightning is tracked and mapped and proactive defensive strategies exist including national standards e.g. Lightning Risk and Protection AS 1768:2007.

Given our knowledge, technical ability, the likelihood and frequency of lightning occurring, can lightning be considered an act of God?

Tornadoes

Many would think these were rare events in Australia. However, the Bureau of Meteorology states that in Victoria some 160 tornadoes have been reported over the last 90 years and that many more are unreported. Perth has the potential for nine tornadoes per year, whilst the average reported number is three (Jones et al, 2005 Chp 2).

Overseas tornado wind speeds have been recorded to 450 km/h. Damage to structures from tornadoes in Australia is not uncommon and they have caused at least 41 fatalities (Middelmann, 2007 pg. 88). Damage from tornadoes tends to be intense but limited to small areas.



Figure 1 August 2010 a tornado passes Moama Victoria. Picture: Herald Sun

The probability of any single building being impacted by a tornado in its lifetime is very low, and it is not a requirement to design structures to resist tornado winds.

Clearly the arrival of a tornado is outside of human control. However is damage caused by a tornado an act of God?

Severe storms

Probably the most common direct reason for tree failures is severe storms (the indirect reasons for such failures is another question). The damage from severe storms is generally less severe than tornadoes and lightning. However the damage is likely to be far more widespread.

Severe storms are relatively common, the average number of severe storms reported in NSW and the ACT is approximately 120 per year (Bureau of Meteorology, 2009). Severe storms produce wind gusts >90 km/h and the most damaging have winds gust of 160 km/h. The strongest wind gust recorded during an Australian thunderstorm was 196 km/h.

In May 1994, some areas of Perth experienced maximum wind gusts of 143 km/h, while winds averaged 107 km/h over a 30 minute period in nearby Fremantle. Damage from such storms is common place and largely to be expected, injuries and fatalities are far less common. Storms account for 26% of the annual cost of 'natural' disasters estimated to be \$284 million per annum (The Bureau of Transport Economics, 2001, Blong, 2005) and that severe winds account for around 40% of damage to Australian residential buildings (Blong 2005) significantly more than other natural hazards.

Trees commonly fail in strong winds. In Figure 2 James et al cite the works of Cullen and Spatzin identifying the zones where tree wind throw and breakage occurs (James et al., 2006). These are not uncommon wind speeds, and at the lower end of winds expected in severe storms.

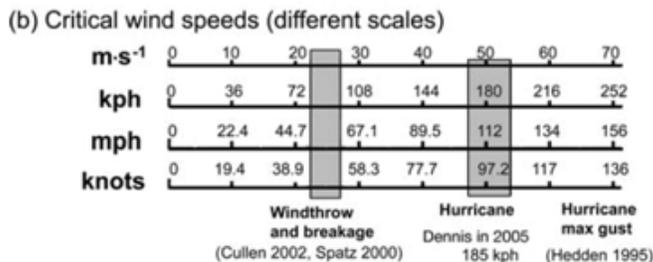


Figure 2 Critical wind speeds from James et al, 2006

In the 12 months from August 2009 the BOM at East Sale (Victoria, Aust.) reported maximum wind gusts exceeding 90 km/h five times and six times in 2006. It would be difficult to argue this data represents rare events. In the Gippsland area the building code of Australia requires new buildings to be designed to a wind speed of 33 m/s (≈ 120 km/h). This is above the point where trees begin to fail.

Once again given the knowledge that severe storms will occur and the frequency of the events, can severe storms be considered acts of God?

Sudden branch drop

Sudden or Summer branch drop is a widely reported occurrence. Harris (1983) describes SBD as 'apparently sound limbs breaking off mature urban trees....during calm summer weather'. Given that he implies, and I do not believe anyone has shown any differently, that this type of failure is unpredictable - can it be considered an act of God?

Discussion

Shigo (1991 p.359) states '*the modern arborist must understand liability and the legal machinery*'. An act of God is a legal defence. It is applied post an event and in effect it is used like other forms of legal defence generally against a claim of negligence. Hence from a tree management perspective there is really little difference from a claim of negligence. Similar questions will be

asked, such as was it foreseeable, could or should have anything been done, or was it uninfluenced by human intervention?

Slovic (1999) argues that risk is merely a '*social construct*' that changes over time, and that is clear with the act of God defence. For example, lightning was clearly the action of an angry God before we understood what caused lightning.

If we break down the House of Lords 1864 statement in *Tennant v. Earl of Glasgow* we end up with two key assessment statements.

- Circumstances which no human foresight can provide against.
- Of which human prudence is not bound to recognise the possibility.

These are a stronger criteria than the more recent Lilly's (2001 p.141) and Merullo & Valentine (1992 p.8) definition:

'an occurrence due to natural causes that could not have been prevented by ordinary skill and foresight'.

It is difficult for public authorities to argue that they do not have a duty of care to 'ensure that all persons who are so closely and directly affected by our acts or who rely on us for their safety are not placed in a position of risk' (Whiteside, 1991 p.30). To prove an event was an act of God and hence that the land manager was not responsible, a land manager will be required to 'prove' that the incident was largely not preventable and that human intervention was not the cause. Consider the following scenarios from a tree management perspective.

Lightning strikes

Clearly it not possible to predict when lightning is likely strike; although it is somewhat possible to estimate where and a probable frequency. Would it be an act of God if you had a 30 metre high Norfolk Island Pine on top of a hill near the sea on which you attach metal fixtures to mount Christmas lights on? It would be a rare situation in Australia where it could be considered reasonable to fit lightning protection systems to a tree. It is common place in parts of the USA, where the national standard for lightning protection even has a section for trees.

Clearly there are scenarios where one would argue that human foresight could have reasonably foreseen the possibility of a lightning strike. Hence, the 'act of God' defence would not be strong. However, whether it was reasonable to attempt to mitigate such a possibility is then a risk management decision based on what is reasonable (that is, acceptable) risk.

Severe storms and tornadoes

Extensive data exists in relation to weather and it is readily available. Severe storms regularly occur over most parts of Australia. Buildings and most structures are required to meet design guidelines, in particular wind loading requirement, these are to 'ensure' a safe standard such that the structures will deal with the likely local loadings.

Depending on the location, all buildings are designed to meet a defined wind speed. In non-cyclone areas this is typically around 33-35 m/sec (120-125 km/h). These wind speeds are possible in these areas although unlikely. Whilst in cyclone areas wind load designs cater for 250 km/h winds.

If the building code designates that for a particular area a wind load design speed of 125 km/h is required, then logically, this must be the point of acceptable risk. That is, someone has made the decision that a structure does not need to be stronger than this. As a tree is a structure then a similar point could be made. However, as previously noted tree failures start to occur at approximately 90-100 km/h and many, if not most, trees would fail at 250 km/h wind speeds.

Is it an act of God if a building fails in winds above its design criteria? In most instances it would be difficult to argue that it was an act of God, unless the winds were beyond human foresight, given the knowledge, data and modelling ability of modern climate scientists this would be significantly stronger than recorded for an area before. As with most other scenarios, wind or storm damage is far more likely to be assessed in terms of acceptable risk and hence was anyone negligent.

What is an acceptable wind speed loading for a tree, at what point can we say it failed above its designed loading and hence the failure was acceptable? For instance, in 2008 a massive storm hit Brisbane suburbs with wind speeds of >100 km/h widespread and a peak gust was recorded at 176

km/h. It was reported that up to 4,000 homes were damaged, with 300 homes 'significantly damaged' and 30 deemed unliveable (The Age November 17, 2008). Needless to say tree failures and damage caused by fallen trees was widespread. However the most interesting comment was the quote attributed to the then Mayor Mr Newman:

*'Nothing like this has happened to the city for at least 10 years,'...
'Perhaps it goes back to 1985 with a very big storm back in those days.'
(The Age November 17, 2008).*

Whilst no doubt a natural disaster, given the mayor's quote it would be difficult to argue it was beyond human foresight. It is another argument completely to consider what, if any actions could have been taken to prevent damage caused by the event.

Reinforcing the view of predictability, possibly future damage reduction and levels of acceptable risk, the Courier Mail (November 16, 2008) cites an Ipswich City Council planning spokesman calling for a review of building codes because of the level of damage from this storm.

Whilst arguably we have the technology and possibly the knowledge to estimate the wind fastness of trees, or at least the lower limits, (e.g. through the work of Ken James, Wessoly's SIA (Static Integrated Assessment/Methodology)) and other models, these approaches focus on individual trees and situations and are not transferable to populations of trees. Nevertheless what would be the consequences if the data existed where it could be shown that trees growing in suitable conditions had 'X' wind fastness, and that there was a 25% probability that winds would exceed that level in 1 in 20 years?

Sudden branch drop

Sudden or summer branch drop (SBD) is interesting from a tree physiology and a risk management perspective. Little or no data exists to aid predicting as to when a branch will fail due to SBD. Some preconditions are often stated but I doubt many would/could justify a probability of failure placed on a branch as more than intuition.

An act of God fundamentally precludes humans being able to stop the event occurring, and also the lack of human intervention in the cause. It is probably reasonable that our limited knowledge of SBD does mean we can do little to prevent an event, and in most instances it is probably not caused directly by human intervention.

However I doubt we can really consider SBD *per se* as an 'act of God'. We are aware of it occurring, we have some idea of the conditions required for it to occur and in many areas we have historical data to confirm it occurring, hence can reasonably predict on a broad scale that it will reoccur. In a general sense it is not outside of human foreseeability, however at the individual tree level it is not possible with any degree of certainty to be able to predict a failure.

Can we do more than place advisory signs in places we suspect it might occur to warn people of the potential? The moment we place a sign, we acknowledge that it is not an act of God because foreseeability is clearly admitted.

Acts of God as a valid defence

As discussed in the above simple examples, it is difficult to suggest that an act of God will be a valid defence in urban areas except in the rarest of instances. Natural disasters may or may not be acts of God in the sense that humanity could not have prevented them, but in many instances the consequences were foreseeable with only a reasonable level of foresight. Floods to houses built in low lying areas, localised flooding due to drainage systems being loaded beyond their design parameters are quite to be expected; as are roofs being blown from houses in winds above the design loadings and many other easily thought of scenarios.

The balance between cost to individuals and the community and the benefits is the reason for building codes and the like. Whilst for instance, it is possible to build structures to withstand 300 km/h winds, the community has decided that the benefits do not outweigh the costs given the likelihood of such events occurring. Insurance is one way that individuals and the community can pay a fee to cover the possibility of unfortunate events happening (insurance companies in effect spread the cost of paying for such events across a large and geographically diverse customer base).

Insurance should be based on cost/benefit analysis, (i.e. how does the cost of insurance compare to the cost of mitigating the risk of damage or injury). Unfortunately, from my experience this approach appears lost on some local government mutualised insurers. For example, CMP in Victoria expects an annual inspection of all park and street trees, but they will not provide any information so that councils can compare the cost of this against other options. Wellington Shire Council has some 35,000 planted urban trees, therefore even a quick inventory style inspection will cost around \$100,000 per annum. This represents some 20% of the annual recurrent maintenance budget (which is based on a 3-year cyclic pruning program). Would spending \$100,000 per annum on inspections at the cost of \$100,000 per annum less on works reduce the risk? I would suggest not.

Where does this leave the management of trees? Acts of God fundamentally will not apply to urban trees. It is doubtful we could argue that many trees are unaffected by our actions, and whilst few trees fail under 'normal' weather conditions, 'normal' trees appear to start failing at wind speeds greater than 100 km/h and such wind speeds are not uncommon in many urban areas.

This is possibly caused by two factors. Firstly, the commonly cited argument that most trees are derived from forested situations, and hence structurally are less adapted to being isolated trees (although I have yet to see any peer reviewed data supporting this view and it is contrary to Mattheck and Breloer's 1994 axiom of uniform stress). Secondly, it is a matter of population genetics; the strongest survive for a set of given conditions and little or no natural selection has been applied to urban trees. Although it could equally be argued that trees are as strong as they need to be and the loss of trees and branches in storms is a normal part of a treed ecosystem, increasing the likelihood of bio-diversity and a reduction in even-aged stands.

If trees begin to reach their design limits at winds speeds over 100 km/h, it must be accepted that occasionally a large number of trees will fail when wind speeds exceed this level. It is not an act of God, but a mechanical limitation, the result of a natural design limit. Many trees do not fail in wind speeds well above 100 km/h, so is it possible to identify such trees? There is a reasonable chance that highly stable trees could be identified, or at least the circumstances needed to provide for highly stable trees, although given the lack of funding for urban trees it is unlikely such data will be forthcoming.

The reality is that urban trees do not pose a significant threat to the community. This is reflected in the small number of fatalities caused by trees and the limited costs borne by the community for tree related damage.

Hoy and Holley (2004) in a report for Melbourne University extracted tree related fatality data from the National Coroners Information System database for the period July 2000 – November 2004. This identified 17 non-work related fatalities due to trees across Australia. Simplistically this can be expressed as a societal risk of 1:5.2 million per annum. Further analysis divided the data into rural and urban fatalities, resulting in an urban fatality rate for the 53 months of five and hence a societal risk of 1:17.7 million per annum.

Forbes-Laird (2003) in the UK Tree Forum claims that in Great Britain 32 fatalities and 22 serious injuries occurred over five years (1998-2003). This includes non-industry accidents in rural, urban, roadsides, and forested areas. This data has not been substantiated. Whilst any death will be seen as tragic, given that some 57 million people live in Britain (National Statistics, 2004) this suggests a tree-accident fatality rate 1:8.9 million per annum and a 'serious' accident fatality rate of 1:5 million per annum.

Injury rates are difficult to identify. Dunster (2003) suggests that little information exists as most tree related injury cases are settled out of court. As the judicial system provides greater compensation in the case of injury it could be considered that severe injury is potentially the greatest financial risk for public authorities.

Damage caused by trees directly or indirectly is difficult to quantify. Barley (1990) in discussion of '*injury from roadside trees*' presents a small amount of information provided by Melbourne City Council in relation to branch failures onto vehicles, however it is not detailed nor extensive. Typically mutualised local government insurers do not make such information publically available. Fortunately, the current Independent Inquiry into Management of Trees on Public Land (Ecological Associates, 2010) provides a limited but interesting 'snapshot'.

The SA Mutual Liability Scheme (MLS) reported 2759 tree related claims over a 20 year period (July 1989 – May 2010), of which 55% lead to damage or injury from fallen trees or failed branches. This translates to a mean of 76 claims per annum for South Australia. With a December 2009 South Australian population of 1,633,900, this broadly equates to damage or injury from fallen trees or a failed branches claim rate of 1:21,500 people per annum. They report claims involving pedestrians or cyclists (injury or near-misses) averaging a little over 1 per annum (24 total), giving a claim rate of 1:1.6 million people per annum. To place some proportion to this, in 2009 there were 119 vehicle fatalities in South Australia, giving a fatality rate of 1:13,700 per annum. In Australia during 2008 three people died from dog bites, four from bee or wasp stings, four from lightning, and 169 people drowned (ABS, 2010).

Unfortunately the Issues Paper data provided is very incomplete, and does not allow any in depth analysis. Nevertheless what is provided would seem to indicate that costs from claims made to MLS are low (It does detail that annual claims related to tree or limb failure are approximately 17% of total claims received. However, it does not detail what percentage of the actual costs is apportioned to tree or limb failure). The equivalent Victorian local government insurer is unwilling to supply any information.

Whilst 'acts of God' exist, Australians are an urbanised community, with 87% living in urban situations (2004, ABS, 2003, ABS, 2004a, ABS, 2004b), hence living in a built environment. Some elements of nature, e.g. tornadoes, cyclones, severe storms we will never be able to prevent. Nevertheless, we will become better at predicting them. Humanity and trees are intrinsically linked; communities are not going to accept treeless suburbs. However trees are structures and as such will fail once forces exceed the design loadings.

The greatest unknown that I have not yet addressed is climate change; whether it is caused by humanity is largely meaningless. The CSIRO (2010) predictions are that the effects of climate change will be superimposed on natural climate variability, leading to changes in the frequency and intensity of extreme weather events. Including more extreme fire weather, increased number of hot days, more intense heavy rain, stronger cyclones and increased hail events.

Given our current knowledge and the variable and somewhat inconclusive prediction of climate change can we really claim an act of God in 2060 for plantings undertaken in 2010? Maybe more to the point is that climate change in all likelihood will lead to more urban tree failures and possibly greater damage and injuries. What should we be planning in 2010?

We are a knowledge based society, how much do we know about trees growing in urban areas, what we need to know, what are the gaps in our knowledge. No longer can we claim an act of God when something unfortunate occurs, any post mortem will most likely show that we had the *human prudence to recognise the possibility*.

Conclusions

The act of God defence is weakened as knowledge increases. As knowledge increases humanity, not God(s), have to make the choices about what is acceptable and what is not. The act of God is not a defence for urban trees. The standard we will be held accountable for is that of the tort of negligence (Appendix 1 contains general principles in establishing negligence), and the best defence will not be driven by a fear of litigation, but one driven by suitable consideration of holistic risk management (not risk assessments).

Risk management is:

- an integral part of community processes
- part of decision making
- systematic, structured and timely
- based on the best available information
- takes human and cultural factors into account
- transparent and inclusive
- dynamic, iterative and responsive to change
- facilitates continual improvement

Quite simply, managing urban trees is about managing an asset for now and for the future; that asset is the urban forest. Included in that asset management is the risk management process, however risk should not be the sole driver, because if all of the risk management points above were included in an asset management plan, risk levels would be low by default. Good asset management leads to a low risk urban forest.

The current SA issues paper is an excellent way of engaging the community and to ask the big questions: what is an acceptable level of risk, how much do you value trees, and what are the knowledge gaps?

Whilst writing this paper was a great big picture exercise, the lack of data and the limited research conducted on urban trees was annoyingly apparent. The SA Issues Paper raises some good questions, but we do not have the data to answer most. This is an industry that relies too much on opinion, conjecture and 'common sense' rules.

There are over 600 local governments in Australia and no doubt millions of urban trees. In other industries much of the research is conducted using industry levies, often with matching government funding. Conservatively there are over 5 million urban trees, if an industry level of 10 cents per tree was placed in a research fund, and matched with government funding this would give an annual fund of 1 million dollars. How much targeted research could this produce?

Appendix 1 General principles in establishing negligence

To complicate the issue of trees the law and public authorities, substantial civil liability reform legislation has been implemented in all States and Territories since the landmark High Court's affective removal of the nonfeasance defence in *Brodie v Singleton Shire Council*(2001). While these changes are substantial, they do not change the generally accepted 'duty of care' requirements typically cited to establish negligence, for instance the Civil Liability Act 2002 (NSW, section 5B) details:

General principles

(1) A person is not negligent in failing to take precautions against a risk of harm unless:

- (a) the risk was foreseeable (that is, it is a risk of which the person knew or ought to have known), and*
- (b) the risk was not insignificant, and*
- (c) in the circumstances, a reasonable person in the person's position would have taken those precautions*

(2) In determining whether a reasonable person would have taken precautions against a risk of harm, the court is to consider the following (amongst other relevant things):

- (a) the probability that the harm would occur if care were not taken,*
- (b) the likely seriousness of the harm,*
- (c) the burden of taking precautions to avoid the risk of harm,*
- (d) the social utility of the activity that creates the risk of harm.*

Derived from the NSW Civil Liabilities Act 2002 Section 5B

References

2001. Brodie v Singleton Shire Council. High Court of Australia.
- Australia's Changing Population Distribution*, Year. Radio Broadcast. Aust: ABC - Radio National.
- ABS. 2003. *2035.0 Census of Population and Housing: Population Growth and Distribution, Australia* [Online]. Australian Bureau of Statistics. Available: <http://www.abs.gov.au/Ausstats/abs%40.nsf/e8ae5488b598839cca25682000131612/4274f3e53c143e57ca256d46008193a0!OpenDocument> [Accessed 2/4/2004 2004].
- ABS. 2004a. *Population Article - How many people live in Australia's coastal areas?* [Online]. Australian Bureau of Statistics. Available: <http://www.abs.gov.au/Ausstats/abs%40.nsf/94713ad445ff1425ca25682000192af2/0ec9360424ea347eca256dea00053a70!OpenDocument> [Accessed 2/4/2004 2004].
- ABS. 2004b. *Population Article - How many people live in Australia's remote areas?* [Online]. Australian Bureau of Statistics. Available: <http://www.abs.gov.au/Ausstats/abs%40.nsf/94713ad445ff1425ca25682000192af2/794d620169dd1a89ca256dea00053a6e!OpenDocument> [Accessed 2/4/2004 2004].
- ABS. 2010. *3303.0 - Causes of Death, Australia, 2008* [Online]. Australian Bureau of Statistics. Available: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3303.0Explanatory%20Notes12008?OpenDocument> [Accessed 10/8/2010 2010].
- Australian Broadcasting Corporation. 2002. *Lightning Storms in the Top End* [Online]. Australian Broadcasting Corporation. [Accessed 13/8/2010].
- Barley, R. 1990. *Trees : the law and valuation. Volume 1. Trees and the law*, Burnley, VCAH.
- Beck, U. 1999. *World risk society*, Malden, Mass :, Polity Press,.
- Coates, L., Blong, R. & Siciliano, F. 1993. Lightning fatalities in Australia, 1824–1991. *Natural Hazards*, 8, 217-233.
- Csiro. 2010. *Fact Sheet: Australia is vulnerable to climate change* [Online]. Available: http://www.csiro.au/resources/Climate-Change-Vulnerable--ci_pageNo-1.html [Accessed 10/8/ 2010].
- Currán, Holle & Lopez 1997. Lightning Fatalities, Injuries and Damage Reports in the United States, 1959-1994, NOAA Tech. Memo. No. NWS SR-193
- National Weather Service Forecast Office Scientific Services Division
- Dunster, J. A. 2003. An Overview of Legal Considerations. In: Wildlife Tree Committee (ed.) *Wildlife/Danger Tree Assessor's Course - Parks and Recreation Sites*. Forest Practices Branch, Ministry of Forests - British Columbia.
- Ecological Associates 2010. Independent Inquiry into Management of Trees on Public Land Issues Paper EL001-1-A.
- Adelaide: Prepared for The Independent Inquiry into Trees on Public Land.
- Forbes-Laird, J. 2003. *BBC NEWS England Schoolgirl killed by falling tree* [Online]. the UK Tree Care mailing list. Available: <http://lists.tree-care.info/uktc/archive/2003/msg00551.php> [Accessed 17-6-2004 2004].
- Gleeson, V. 1991. The Law and Risk Management Strategies. In: Baird, I. A. & Royal Australian Institute of Parks Recreation (eds.) *Trees : management issues for urban Australia. Proceedings of the 1991 National Seminar (Canberra)*. Dickson, ACT: Raipr.
- Harris, R. W. 1983. Summer branch drop. *Journal of Arboriculture* 6, 111-113.
- Hoy, M. & Holley, K. 2004. National Coroners Information System, Database Search - Accidental Tree / Limb Failure - Related Deaths
- Between 1st July 2000 – 4th November 2004. Victorian Institute of Forensic Medicine.
- James, K. R., Haritos, N. & Ades, P. K. 2006. Mechanical stability of trees under dynamic loads. *Am. J. Bot.*, 93, 1522-1530.

- Jones, T., Middelmann, M. & Corby, N. 2005. Perth Community Risk Report Cities Project Perth Report - 2005. Commonwealth of Australia.
- Lilly, S. 2001. Tree assessment and risk management. *Arborists certification study guide*. Savoy, IL.: International Society of Arboriculture,.
- Lupton, D. 1999. *Risk*, London, Routledge.
- Mattheck, C., Breloer, H., Lonsdale, D. & Strouts, S. 1994. *The body language of trees: a handbook for failure analysis*. Research for Amenity Trees No. 4; 76, HMSO Publications Centre, London, UK.
- Merullo, V. & Valentine, M. 1992. *Arboriculture & The Law*, Champaign, International Society of Arboriculture.
- Middelmann, M. H. (ed.) 2007. *Natural Hazards in Australia. Identifying Risk Analysis Requirements*, Canberra: Geoscience Australia.
- National Statistics 2004. Great Britain; estimated resident population by single year of age and sex; Mid-2001 Population Estimates. National Statistics.
- Perry, D. A. 1994. *Forest ecosystems*, Baltimore ; London, Johns Hopkins University Press.
- Shigo, A. L. 1991. *Modern arboriculture: a systems approach to the care of trees and their associates*, Durham, New Hampshire, Shigo and Trees.
- Simpson, J. A., Weiner, E. S. C. & Oxford University Press. 1989. *The Oxford English dictionary*, Oxford University Press, Clarendon Press ;New York .:
- Slovic, P. 1999. Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, 19, 689-701.
- Whiteside, H. Year. Legal Issues. *In: Baird, I. A., ed. Trees : Management Issues for Urban Australia.*, 1991 Dickson, ACT. No MN Library: Royal Australian Institute of Parks and Recreation, 27-44.