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Published by Red Eagle Bushfire Protection Services, Melbourne, Australia 2014

Paper 8A

THREAT AND RISK

We need a solution for the bushfire problem. This paper asks if the solution to the bushfire problem can be achieved by the trade-off approach of ISO 31,000 risk management or the threat neutralisation approach of threat management model.

- We redefine the type of bushfire attack we are protecting against
- We redefine the correct diagnosis
- We redefine the bushfire problem
- We reset our goal we need to deliver the solution
- We compare the threat management model and the risk management model for suitability

Before we examine which model that will protect the community, we need to identify what type of bushfire we are targeting and determine the correct diagnosis.

WHAT BUSHFIRE SHOULD WE PLAN FOR?

We can identify two types of severe bushfires – One Day Inferno fires and Multi-day Campaign fires.

The **One Day Inferno fire** runs unchecked throughout the day and threatens houses and towns in its path. It typically occurs when the wind is very strong, and escapes the control of first attack fire crews. The death, house and damage toll can be huge. Eg, some Black Saturday fires – Bendigo, Redesdale, Horsham, and the 2012 season fires

The **Multi-day Campaign fire** runs unchecked for days or weeks. It may or may not originate from a One Day Inferno fire. Eg, Victorian alpine fires 2003, 2006, 2013, Grampians fires 2006, 2012

When the Multi-day Campaign fire runs for several days or weeks, the normal summer weather cycle of a severe weather day each week or so continues, and the large uncontrolled perimeter changes from a quiet edge into a raging One Day inferno, eg, Canberra fire 2003, Black Friday 1939. This can lead to a high death, house and damage toll.

The solution to our bushfire problem therefore needs a model that identifies and treats flame and ember attack under One Day inferno conditions. Why? Our aim is to protect the community from house loss. Flame and embers cause the damage to houses and they are at their worst on these days. Therefore, the Day One Inferno is our design criteria standard.

Furthermore, our solution requires each property and each town to expect a One Day Inferno assault each year. Why? We cannot predict when and where a One Day Inferno assault will occur, but we want to be prepared.

Summary: Our solution requires each property and each town to expect a One Day Inferno assault each year. Why? We cannot predict when and where a One Day Inferno assault will occur, but we want to be prepared. The One Day Inferno is our design criteria standard.

DIAGNOSIS

The bushfire problem can be dealt with properly once the correct diagnosis is made. Similar to a patient with persistent headaches. A poor diagnosis leads to treatment with Panadol tablets, and the doctor is surprised when the patient revisits with the same symptoms. An effective diagnosis finds the root cause is aneurism and prescribes an appropriate treatment. The problem is solved.

Bushfires are a problem when they affect people's lives in a serious way, eg, loss of life, loss of house or disruption of life / livelihood. The underlying cause of the problem is not so much the bushfire's flame or embers, but the damage done by their excessive heat.

- Heat can cause loss of life if people are not sheltered or at a safe distance.
- Heat can cause house loss if it comes too close via fire front or urban flame or ember ignition.
- Disruption is the consequence of either house loss or life loss.

Therefore, we can diagnose the problem as excessive heat causing "loss of life" or heat causing "loss of house".
This means the **cause** is destructive heat and the **symptom** is death or house loss.

If we diagnose the problem as "loss of life", or "loss of house" we are treating the symptoms. This leads to ineffective treatments like evacuation and house fortification. They are stop-gap and temporary treatments because they are not treating the cause.

If we diagnose the problem as destructive heat, we are treating the root cause.
There are two target options – we can protect life or we can protect house.
A We protect life by keeping destructive heat away from people by shelter or distance. The superficial solution is evacuation, but that creates more problems than it solves, like loss of houses and consequent community disruption.
B We protect the house by keeping destructive heat away from it by strategies like fuel management and distance. That means people have shelter from the heat and life is saved, and because life and house are saved, disruption is minimised.

Destructive heat is caused by flames that are too large and/or too close to control.
How to control flame size? Fuel bed management to reduce flame height; stop spot fires when small
How to control flame proximity? Manage fuel free gap size; make surfaces non flammable

Consider these consistent observations:

- Lives are saved when people escape in time. Lives can be lost if they get caught by surprise.
- Houses are lost when vacated.
- Even well prepared houses are lost when vacated.
- Houses are saved when well prepared and defended.
- Prepared houses are a lifesaving shelter for people.

REDEFINE THE BUSHFIRE PROBLEM AND TARGET THE SOLUTION

We redefine the bushfire problem as this:
Whenever a one day inferno bushfire attacks a community, it suffers house loss and disruption increases with house loss rate. How can we protect the community from house

loss, with safety and consistency? We seek a solution that is practical, economic and verifiable by science and logic.

Our solution will be realised when we can say this about all communities:
When a one day inferno bushfire attacks a community, house loss will be prevented safely and consistently.

Whilst our prime goal is to save lives, we have targeted house protection because it is the mechanism to save lives. We target the house because it is the heart of people's lives. But the house is a passive victim when attacked. The house cannot move, whereas the person is mobile. We acknowledge it is more difficult to protect the house. We propose the following theory as self evident.
When we protect the house, we protect the house and the person.
Meaning - when we save the house, we provide safe shelter and therefore save the person.

The rationale for the theory has been accepted knowledge for decades - "remaining in one's house is preferable to trying to escape to safety" (Luke and McArthur, 1978).
This concept was reinforced after the 1983 Ash Wednesday fires, when the Miller Review said that the capacity of people "to defend their own lives, homes and farms" be supported (evidence to Royal Commission, EXP.029.003.0013, Review of fatalities, Final Report 2010). It was further reinforced during the Black Saturday fires. A survey found that 61% of houses were occupied and defended at the time of the bushfire attack, and their survival rate was 81% (Paper 6A).

The Royal Commission found that many bodies were found inside burnt houses. Of approx 2000 destroyed houses, bodies were found in 52. Thus, only 2.5% of destroyed houses had bodies, but the number of bodies is alarming. Of 172 civilian deaths, 113 bodies were inside 52 houses (Paper 6B). Almost all these bodies were classified as sheltering inside the house. Just under half were in bathrooms. Just over half were in other rooms. A member of a CFA brigade searching for survivors in Marysville made the following statements. Going in the bathrooms I found 17 bodies in the first two days, 14 of whom I knew personally. His son said to him - 'Dad, dad, dad, we found X and Y. They (bodies) were in the bathroom exactly as per the CFA guidelines. (Whittaker et al, 2009)

The Royal Commission chose not to examine the quality of CFA advice. We, however, hypothesise that people faithfully followed what they believed was the teaching of the fire authorities. For example, (1) evidence was presented to the Royal Commission about multiple bodies being found in houses declared safe by local CFA. This corresponds with CFA teaching of shelter in a safer house. (2) Consistent CFA teaching asked people to fill their baths with water and said that people should go inside when the fire front came and emerge when it passes. CFA's Living in the Bush Workbook (2004 edition) said "stay inside your house while the fire front passes around the house" and "return outside as soon as the main fire front has passed to extinguish any small fires that may have started". And again "If your home catches fire … go outside onto burnt ground after the fire front has passed". We suggest this advice would have been confusing for faithful people if embers ignited spot fires well ahead of the alleged fire front. We suggest the CFA advice was incomplete, and people may have died because of it.

We propose that the so called "fire front" never arrived during the ember driven Black Saturday fires. We postulate that people mistook initial spot fires for the fire front and went inside, allowing other embers to ignite their house unattended. The Royal Commission did not investigate these hypotheses. But it told CFA to improve the quality of its message.

What has changed since? CFA's "Stay and Defend" was published in 2011. It still says to fill the bath. It now says embers may arrive before the fire front. It says go inside when radiant heat is too great. It says to remain inside as the fire front passes. It says if the house catches fire, do not get trapped in a room without an exit. It says go outside onto burnt ground but if too hot, seek shelter in another building. We are dismayed because the message has scarcely changed, and remains dangerously incomplete. Nevertheless, incomplete advice does not diminish our goal of protecting the house, because protecting the house also protects the person.

With the perspective of protecting the house from the damaging elements of the one day inferno, we firstly examine the risk management model that is being used by the fire agencies and then examine the threat management model.

RISK MANAGEMENT MODEL

In recent years, the planning arms of Australian fire agencies have applied a risk management model to determine risk level. For example, to determine the bushfire risk within the Hepburn Shire for the municipal fire protection plan (2011 – 2014) and Macedon Ranges (2012 – 2015), assessment was undertaken using the Victorian Fire Risk Register process (now called VFRR-B). Originating in NSW, the VFRR claims to be a systematic process that identifies assets at risk from bushfire and assesses their level of risk on a consistent state wide basis using ISO 31000 Risk Management (McCann, 2013). But there are two fundamental problems. Firstly, ISO 31000 is not designed for or relevant to bushfire risk assessment. The ISO web site makes it very clear that "ISO 31000 cannot be used for certification purposes" and that ISO 31000 is designed for risk management within an organisation. Secondly, the VFRR risk ratings or processes have no correlation to ISO 31000 and are in effect, a confused and dishonest replica of it. Also see Paper 8B.

Wrong tool for the job

The ISO system has two core components that prevent it from delivering our solution of house protection - its principle of creating value and its use of the risk matrix.

Create value
ISO 31000 seeks to achieve a balance between resources spent on risk management against losses caused by risk events and what could be spent on more profitable activities. It is a net gain / net loss approach. One of the key principles of ISO 31000 is to "create value" - resources expended to mitigate risk should be less than the consequence of inaction. This means that cost spent on risk mitigation should not exceed losses if no mitigation occurred. This can be explained as follows:

If no risk mitigation expenditure, Losses = $L ie, total cost + loss = $L
If risk mitigation expenditure is $R, Losses = $Lr ie, total cost + loss = $R + $Lr
To deliver value, ISO 31000 requires that $R + $Lr < $L

These totals can be measured annually, or cumulatively, eg, 5 or ten or 20 year periods.

In addition, ISO 31000 defines **acceptable risk** as the risk that is tolerated when we know the cost to implement risk mitigation exceeds the value of loss. When this principle is applied to our goal of preventing house loss in bushfires, we see it is incompatible because it tolerates some house loss collateral damage.

Risk matrix
ISO 31000 allows for use of a risk management matrix to determine risk level. Risk levels can be understood as the **product** of the probability or likelihood of harm and the harm severity, ie, **risk = likelihood of the event X consequence** of the event. For example, the harm severity can be categorized qualitatively as: Catastrophic - multiple deaths, Critical - One Death or Multiple Severe Injuries, Marginal - one severe injury or multiple minor injuries, Negligible - one minor injury.

The probability of harm occurring might be categorized as 'Certain', 'Likely', 'Possible', 'Unlikely' and 'Rare'. The resulting Risk Matrix could be:

	Negligible	**Marginal**	**Critical**	**Catastrophic**
Certain	High	High	Extreme	Extreme
Likely	Moderate	High	High	Extreme
Possible	Low	Moderate	High	Extreme
Unlikely	Low	Low	Moderate	Extreme
Rare	Low	Low	Moderate	High

Fire authorities apply the following risk matrix to calculate risk levels for specific areas or buildings (source Macedon Ranges Fire Protection Plan (2012-2015).

Qualitative Risk Analysis Matrix – Level of Risk:

	CONSEQUENCE			
LIKELIHOOD	1 MINOR	2 MODERATE	3 MAJOR	4 CATASTROPHIC
5 ALMOST CERTAIN	MODERATE	HIGH	HIGH	EXTREME
4 LIKELY	MODERATE	HIGH	HIGH	EXTREME
3 POSSIBLE	LOW	MODERATE	HIGH	HIGH
2 UNLIKELY	LOW	MODERATE	MODERATE	HIGH
1 RARE	LOW	LOW	MODERATE	MODERATE

Our concern is how our solution of people and house protection can be achieved. This matrix implies risk level can only be managed via two components - scale of damage during a bushfire attack and its likelihood. This issue has been highlighted as a factor that limits application of countermeasures (eg, Cox, 2008).

The fire authorities also provide the following definitions of consequence and likelihood (source Macedon Ranges Fire Protection Plan (2012-2015). Our concern is that neither is manageable. Consequence is presented as inevitable and likelihood is historical fact. Therefore, using this system, risk level is not manageable.

Qualitative Measures of Consequence:

LEVEL	DESCRIPTOR	EXAMPLE DETAIL DESCRIPTION
1	Insignificant	Less than 2 ha fire, low or no assets damaged small scrub, paddock fire, small hazmat incident. $0 – $10,000
2	Minor	2-10 ha fire, vehicle fire, room of a house, medium hazmat incident. $10,000 - $100,000
3	Moderate	10-100ha fire, large hazmat incident, house/shop fire. $100,000 - $1,000,000
4	Major	100-1,000 ha fire, industrial estate, nursing home, 1-10 houses, multiple businesses. $1,000,000 - $10,000,000
5	Catastrophic	1,000+ha, fuel depot, block in CBD, Hospital, 10+ houses. $10,000,000 Plus

Qualitative Measures of Likelihood:

LEVEL	DESCRIPTOR	GENERIC DESCRIPTION	STATE DESCRIPTION
1	RARE	MAY OCCUR IN EXCEPTIONAL CIRCUMSTANCES ONLY	1% (ONCE IN EVERY 100 YEARS
2	UNLIKELY	COULD OCCUR AT SOME TIME	3% (ONCE IN EVERY 30 YEARS)
3	POSSIBLE	MIGHT OCCUR AT SOME TIME	10% (ONCE IN EVERY 10 YEARS)
4	LIKELY	WILL PROBABLY OCCUR IN MOST CIRCUMSTANCES	33% (ONCE IN EVERY 3 YEARS)
5	ALMOST CERTAIN	IS EXPECTED TO OCCUR IN MOST CIRCUMSTANCES	CLOSE TO 100%-ANNUALLY

Furthermore, it is well known that the root causes of damage are flame and embers, but the authorities have not explained any causal link or correlation between the root causes and the "main components". Eg, if we control (eg, halve) flame height, do we then reduce (eg, halve) consequence? Or again, if we control (eg, halve) ember density, do we then reduce (eg, halve) consequence?

We accept that the ISO 31000 process for risk management is useful (ie, establish context, identify risks, assess risks, identify treatments, prioritise responses, review and evaluate). But the ISO Guide describes the prioritization process whereby the risks with the greatest loss or impact and the greatest probability of occurring are given first priority, and risks with lower probability of occurrence and lower loss are handled in descending order. We can immediately see that risk priority setting is subjective, depending on who does it. The fire authority considers the fate of a million houses, whereas the house owner considers the fate of one house. If the fire authority allocates resources to town X to save a hundred threatened houses, the threatened house in another town is seen as unavoidable loss. Thus the risk management trade-off process is appropriate if the goal is to minimise or reduce house losses, but inappropriate if the goal is to prevent house loss because it tolerates collateral damage. Furthermore, the taxpayer who pays for fire protection services will understandably be unwilling to sacrifice his house for the greater good.

Moreover, if the one day inferno fire is regarded as a natural disaster, fire authorities assess outcomes like future repair costs, business interruption losses, effects on the environment and insurance costs, and weigh it up against the proposed costs of reducing the risk. They also look at frequency. If it is a huge loss that occurs once in a generation, they may be willing to wear the temporary disruption, and not change their modus operandi. Thus the risk

management trade-off process is appropriate if the goal is to minimise or reduce house losses, but inappropriate if the goal is prevent house loss.

The risk management trade-off approach allows the following recognisable Government perspectives:
The government can explain that in low risk areas, expenditure on prevention cannot be justified.
When a major bushfire occurs, it is beyond anyone's control, government can only respond with suppression effort, investigation, and rehabilitation.
Mother Nature delivered a bushfire that was beyond government control.
If people and houses are in the path of a bushfire, they chose to live there at own risk.
Collateral damage is inevitable.
Rebuilding can stimulate a local economy. A major bushfire can add over 1% to the state's GDP. The Royal Commission calculated that Black Saturday fires cost over $4B. This was 1.3% of Victoria's then GDP $310B.

These perspectives are incompatible with our goal of protecting houses and the wishes of the individual house owner. We therefore conclude that the fire agency diagnosis and treatment options cannot deliver our solution of protecting the community from house loss. In fact, we are concerned it will achieve the opposite. In the next section, we describe a threat management model that provides a framework for a direct and practical approach.

BUSHFIRE THREAT MANAGEMENT MODEL

The threat model concept derives from ISO/IEC 27000. The model views a severe bushfire attack as a threat to be neutralised or eradicated so that assets are protected. Threat modelling differs from the risk management model. The threat model seeks to neutralise or eliminate the damage caused by a threat agent, whereas the risk management model seeks to achieve a balance between resources spent on risk management and losses caused by risk events.

Threats are anything (e.g., object, substance, human, etc.) that are capable of acting against an asset in a manner that can result in harm. A tornado is a threat, as is a bushfire, as is a hacker. Threat modelling is based on the notion that assets have value that is worth protecting, that these assets have vulnerabilities, that threats infiltrate these vulnerabilities and cause damage to the assets, and that countermeasures exist that mitigate or eradicate the threats.

The threat model is appropriate for our solution because it targets the threat and neutralises the threat. This means the individual house or community can be valued as worthy of protection, rather than be sacrificed for the greater good, as the risk management model requires.

If the one day inferno fire is regarded as a natural disaster, the threat model identifies the threat agents and seeks to neutralise the impact of each one so that damage can be prevented. If bushfire is regarded as a manageable event, the same process is applied, and in this case, the causes of the threats will be neutralised as well as their impacts. Thus the threat management model is appropriate for our goal of preventing house loss.

Bushfire is often regarded as natural disaster. We are concerned that this view restricts our ability to deal with bushfires rationally. We then compare the threat modelling approach to the bushfire. This view is confirmed by Maranghides and Mell (2013) "the distinction between a hurricane (or other natural hazard) and a WUI fire is that the hazard level of a fire

may be mitigated ahead of time through fuel removal" To illustrate the point, we apply the threat management model to a true natural disaster - the tornado.

The following list of threat causes, threat agents, vulnerabilities and countermeasures is not complete. It is indicative to illustrate a point.

Tornado		
Threat	**Damage potential is proportional to:**	**Counter measures to neutralise or remove:**
Threat cause Intense low pressure weather system, and low thunderstorm	Intensity of low pressure	none
Threat agents • Lateral force due to high winds • Uplift forces due to low pressure gradient • Flying debris • Trees falling	**Damage potential is proportional to:** • Wind speed • Intensity of low pressure • Amount of unsecured debris • Proximity of tree	 • none • none • Secure potential debris • Remove tree or strengthen against potential wind-throw
Vulnerabilities ***People*** if outside, or if house damaged, if in sheltered area	**Damage potential is proportional to:** Ferocity of all threat agents Security of shelter	 Seek shelter Stay in shelter
House • structure damage – lateral and uplift forces • Battering by debris • Damage by falling trees and branches	 • Wind speed. Intensity of low pressure • Amount of debris • Proximity of tree	 • Strengthen walls and windows; Strengthen roof structure • Secure potential debris • Remove tree or strengthen against potential wind-throw

In a natural disaster, the **threat causes** are the direct source of the **threat agents**.
The threat causes cannot be controlled or mitigated with counter measures
The two most damaging threat agents cannot be controlled or mitigated with counter measures
The two minor threat agents (debris and trees) can be mitigated prior to the tornado with counter measures

In a natural disaster, the vulnerability of people can be mitigated prior to the tornado by avoidance strategies, eg, shelter in secure area
The vulnerability of the house can be mitigated prior to the tornado by fortification, eg, stronger construction measures
The vulnerability of the house can be mitigated during the tornado, eg, protection measures can be checked or re-affixed if they come loose.

Thus, while impossible to eliminate the threat of a natural disaster like a tornado, it can be neutralised. The threat model has identified the threat causes and threat agents but the range

of countermeasures is limited to minor threat agents. Nevertheless, the threat model has identified the vulnerabilities of assets, and we have been able to deploy the countermeasure of fortification against loss or damage. These counter measures are largely passive. Active countermeasures during the height of the tornado are limited to resecuring fortifications that come loose.

In summary, the countermeasures are defensive, rather than adversarial. Defensive measures are done before the event. Resecuring is not possible is evacuation has occurred. The natural disaster has a direct link between threat cause and threat agent and there is a direct link between threat agent and damage, eg, strong winds and low pressure cause lateral and uplift forces that destroy houses.

By contrast, bushfires do not have a direct link between threat cause and threat agent and damage. There are coincidences and dependencies that have to occur before the **threat cause** generates the threat agent. There are coincidences and dependencies that have to occur before the **threat agent** generates damage. We now apply the threat model to bushfire.

Bushfire		
Threat	**Damage potential is proportional to:**	**Counter measures to neutralise or remove threat agent:**
Threat cause ALL three threat causes must coincide to generate threat agents:		
➔Weather pattern	➔Strength of weather system	➔None
➔Flammable fuel bed on ground	➔Fuel load. Fuel continuity	➔Remove fuel or make fuel non flammable
➔Ignition sources: • Human causes • Lightning • Ember throw	➔Location of ignition and subsequent wind directions determine if flame is upwind of asset	➔ • Reduce incidence of human causes • None • Reduce ember generation
Threat agents	**Damage potential is proportional to:**	
Flame (= Heat)	Proximity to flame Flame height Flame width	Enlarge separation gap between flame and asset Reduce flame height Increase fuel bed discontinuity
Ember	Height of flame at ember generation site Distance from ember source Ember supply	Reduce flame height Reduce flame height Ember reduction works
Lateral force due to high winds	Wind speed	Secure potential debris
Trees falling	Proximity of tree	Remove tree or strengthen against potential wind-throw

Vulnerabilities	**Damage potential is proportional to:**	
People		
if outside, or if house damaged,	Proximity and duration of heat exposure	Enlarge separation gap between flame and asset Reduce flame height
if in sheltered area	Security of shelter	Stay in shelter when flame is a threat
House		
Ignition by radiation Ignition by flame contact	Proximity and duration of heat exposure Speed of extinguishment	Enlarge separation gap between flame and asset Reduce flame height
Ignition by embers on external surfaces	Ignitability of surface Speed of extinguishment	Eliminate potential ignition sites Active defenders extinguish unexpected spot fires
Ignition by embers internally	Size of entry gap Speed of extinguishment	Reduce gap size Active defenders extinguish …
Damage by falling trees and branches	Proximity of tree	Remove tree or strengthen against potential wind-throw

Three **threat causes** must coincide before **threat agents** are generated.
Two of the three threat causes (flammable fuel bed and ignition source) can be controlled or mitigated with counter measures.
The two most damaging threat agents can be controlled or mitigated by prior management with counter measures
The two minor threat agents (debris and trees) can be mitigated prior to the bushfire with counter measures

The vulnerability of people can be mitigated prior to the bushfire by flame management and separation strategies and by avoidance strategies, eg, shelter in secure area
The vulnerability of the house can be mitigated prior to the bushfire by flame management and separation strategies and by fortification, eg, stronger construction measures
The vulnerability of the house can be controlled and mitigated during the bushfire, eg, direct suppression of spot fires on and near the house.

We now use the example of fuel bed discontinuity to demonstrate how the two manageable threat causes can seriously mitigate the threat agents. If the fuel bed is continuous, the threat is simultaneous multiple moving flames and ember throw. If the fuel bed is discontinuous, the threat is multiple stationary flames between the fuel free gaps and ember throw. Where a flame cannot ignite, neither severe weather conditions nor ember attack can be a threat. Thus, we see that the bushfire threat can be managed to extinction, and that therefore a bushfire cannot be explained away as a natural hazard.
If the fire agencies advise a town X to evacuate to a larger town when severe fire weather occurs, we suggest they learn what makes the larger town "safe" and apply the same principles to town X.

SUMMARY

This paper compares two models for achieving a solution for the bushfire problem - the trade-off approach of ISO 31,000 risk management and the threat neutralisation approach of threat management model.

We define the one day inferno fire as the target bushfire we are protecting against.

We re-diagnose the root cause of the bushfire problem as excessive heat causing "loss of life" or "loss of house". This means the **cause** is destructive heat and the **symptom** is death or house loss.

We redefine the bushfire problem as this:
Whenever a one day inferno bushfire attacks a community, it suffers house loss and disruption increases with house loss rate.

We redefine our solution as this:
When a one day inferno bushfire attacks a community, house loss will be prevented safely and consistently.

We reset our goal as protecting the house from the damaging elements of a severe bushfire because when we protect the house, we protect house and life.

We compared the threat management model and the risk management model for suitability

We find the ISO 31000 risk management model is the wrong tool. Even though it has useful risk management concepts, it is designed for risk management within organisations, not for bushfire management. We describe how the fire authorities vainly attempt to manipulate it for application to bushfire management. We conclude that this fire agency approach cannot deliver our solution of protecting the community from house loss. In fact, we are concerned its trade-off approach tolerates house loss as collateral damage.

By contrast, the threat management model is appropriate for our solution because it recognises the value of each house and is concerned with nothing other than countermeasures to neutralise the threats. We can see that if a house is ever threatened by flame height and flame proximity and ember threat, the threat can be neutralised by three simple controllable factors - fuel bed factors, fuel bed discontinuity and fuel free separation gaps. Thus the threat management model shows how the level of bushfire threat is inversely correlated to the level of management of controllable factors. The analysis also shows that a severe bushfire attack is not a true natural disaster because the causal factors are manageable.

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