A barrier to help reduce the risks

By David Clode

Research into bushfires has shown that most lives are lost due to exposure to radiant heat, and most homes burn down because flying embers enter the house.

A system of multiple fire shields (protective barriers such as walls and plants) can be established to protect against fires. The fire shields should deflect fires around and past homes or stock, and each fire shield should intercept and reduce the intensity of the fire, so that the fire is significantly smaller by the time it reaches people, property or livestock.

In the most intense fires, the fire shields may burn and be destroyed, but they should still have provided some protection, as well as buying time. There are no guarantees of course, but these measures could make a difference, at least in low to medium intensity fires.

Fortunately, over the last 20 years or so, more information has become available on how to cope with fire. Up-to-date information is available from local authorities, and there are many excellent recommendations in books such as *The Complete Bushfire Safety Book*, and *Essential Bushfire Safety Tips* by Joan Webster (Random House, 2000). There is also information on the internet, such as the CSIRO website, and www.bushfireinfo.com.au.

Fire shields: The fire shield idea is based on having multiple defensive barriers. Where possible, the shield should point towards where the fire is most likely to come from. If you have the space, the first shield could include a frontline windbreak of low flammability plants. This would intercept flying embers, divide, deflect and reduce the wind, and so reduce the speed and intensity of the fire. Well-designed windbreaks can reduce the intensity of the wind for distances of about 10 - 25 times the height of the windbreak. For example, trees that are 10 metres high should reduce the wind on the leeward side for about 100 - 250 metres. In theory, winds can also be deflected upward, and possibly over, and past a house, shed, or stock. *Casuarina cunninghamiana* makes a good, reasonably low flammability frontline windbreak. It would be best with another two rows of fire retardant plants on the fireward side.

The windbreak would be backed up by the second shield, the garden fence. This could consist of a nonflammable wall, hedge or fence, so that once again, embers and radiant heat are intercepted. In this situation the shield should completely surround the house, in case the wind changes, or comes from a less likely direction. One of the best, but also relatively expensive, options would be a solid wall built of aerated, autoclaved concrete panels, such as the Hebel™ 'Staggered Powerwall'. Perhaps the best shield would be a wall made of no-fines concrete (also called pervious concrete), using scoria or pumice as the aggregate. The aggregate should be around 15-30 millimetres in diameter (20 millimetres is standard). Such a wall could be built using formwork, or tilt-up panels. The porous scoria or pumice would provide insulation, as well as the pores between the aggregate. Solid aggregate would also have the pores between the aggregate. The wall could be 10 centimetres or more thick. A suggested recipe for no-fines concrete would be 4-8 parts aggregate, to one part cement, and .3 to .4 of water, by volume. The Romans built the Pantheon using tufa and pumice as aggregate and it is still standing after nearly two thousand years. Other possibilities for walls would be standard hollow concrete blocks, dry-stone, mud brick and rammed earth. An alternative is an earth bank (berm), with topsoil packed around a rubble core. This could be held up by rocks, pavers or no-fines concrete on the outside, with a slope as steep as 60 degrees. (The steeper the slope, the less material needed.) The top of the bank could be added to with a wall, fence or mesh, and fire retardant plants.

The next best choice would be exterior fibre cement

Casuarina cunninghamiana makes a reasonably low flammability frontline windbreak.

Aloe arborescens makes an excellent fire retardant hedge, as well as being stockproof. *A. barberae.*

sheets, but these will crack and break under sustained, intense heat, and so may only be useful in low intensity fires that pass quickly. This might be improved by using fire retardant paint or whitewash.

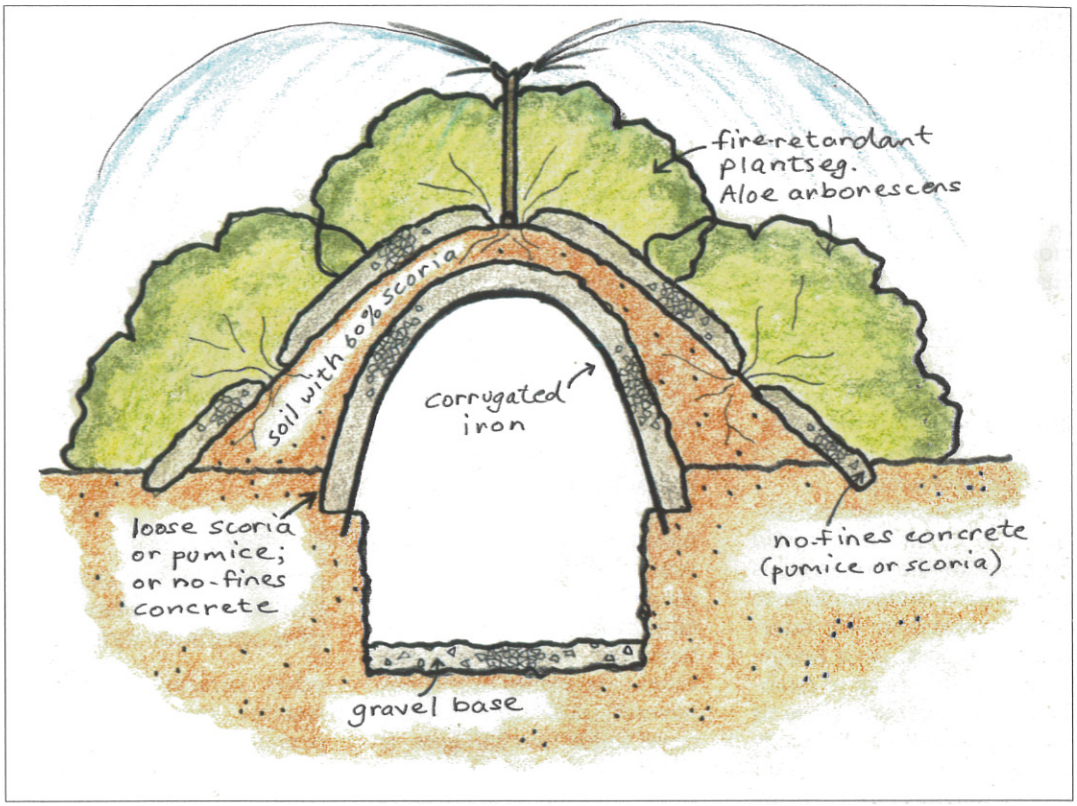
Applying a render of perlite concrete mix, or similar insulating concrete, to the fireward side would be even better. The sheet might need to be scored or spatterdashed to provide a key for the render. Sheets would need to be bolted onto hollow, square steel posts. The posts would be on the leeward side, and set in concrete. The wall or fence would probably need to be at least 1.8 metres high, but preferably 2.4 metres high, or more. It could be painted an unobtrusive dark olive green or brown. A wall provides instant protection.

The construction of a wall is likely to require a permit from local government authorities, and there may be height restrictions. The height of a wall and its effectiveness could be increased by building it on a raised garden bed/earth berm, or by adding fine weldmesh to the top, and growing climbing plants to the top.

If you are in the suburbs with an existing wooden fence, it could be painted with exterior fire retardant paint, which can be surprisingly effective,(see, for example, www.antiflame.com.au). A cheaper, but less effective possibility, would be to paint the fence with whitewash. I have experimented with this, and made a whitewash of 1 part borax, 3 parts hydrated lime and water with 20 percent acrylic paint binder medium (you could use bondcrete/exterior PVA glue), plus a few drops of dishwashing liquid, to help it soak in, and all mixed to a milky consistency. I tested this, applying two coats to a timber fence; it took much longer to ignite, and the rate and spread of combustion was slower. Three coats would be better, re-applied annually before the fire season. Whitewash is easy to apply, using a soft-bristled, long-handled broom, and a rectangular window cleaner's bucket.(Thanks to Ron Edwards for the suggestion to add PVA/acrylic medium.) Replacing at least one part of lime for fly-ash would probably be better. The Food and Agriculture Organisation recommends adding one handful of white cement to 10 litres of whitewash, to increase its durability. No doubt better recipes can be developed.

Probably the cheapest choice, but slower and not as reliable as a wall, would be a steel post/star picket or concrete re-enforcing bar fence, with chicken wire or similar wire netting or mesh attached, and covered with fire retardant climbers. Climbers grow faster than shrubs and a two metre fence should be covered in 1-5 years. This would be better than nothing, but unless sturdily constructed, strong winds before a fire might damage this even before the fire comes, and the fire might melt the whole lot. Some climbers, such as ivy pelargonium (*Pelargonium peltatum cultivars*), and *Senecio angulatus* (synonymous with *Senecio tamoides*), can be grown cheaply from cuttings struck directly into improved soil.

Walls, exterior fibre cement sheets and wooden fences can all have wire netting/mesh attached, so that climbers can be grown over them. The plants may be destroyed, but they will absorb the initial blast of radiant heat. This will partially protect the fence, which in turn protects what's behind it. A line of screening low flammability shrubs or small trees should be planted inside the fence. These should be taller than the fence, to catch embers, and to form a shield against radiant heat.



A concept plan for a semi-underground shelter.

This photo shows the bubble like texture of the Hebel™ concrete panel.

They should also be one and a half or more times their height away from buildings, in case they do burn and perhaps fall over. You could simply plant a hedge, but fences and walls have the advantage of providing instant protection. It is often suggested that you should clear all vegetation around the house, but without some form of shield, there is nothing to stop radiant heat or embers coming straight at the house. Flammable trees and shrubs may need clearing.

A third shield against embers and radiant heat would be close to the house. This could be a wall/fence/wire mesh covered in fire retardant climbers, or a hedge, which can be cheap to establish, but relatively slow. If you decide on a hedge, cuttings of many succulent species such as aloes, *Portulacaria,* and *columnar cacti,* can be struck directly into the ground, to form a very economical hedge/shield. This could take 5-15 years to be effective, though, depending on plant selection, soil, climate etc.

Another advantage of plant shields and walls/fences, isthat they are permanent fixtures, which do not require set-up or maintenance during a fire, and are known as robust features. These are better than other measures which take time to set up and operate. They also work if no one is home.

Finally, the windows of the house should be protected with fine metal mesh, with everything sealed to keep out embers, and the house walls and roof could be painted with fire retardant paint. Assuming that the roof is made of a non-flammable material, and there are no leaves in the gutters, another possibility would be to fix roll-down awnings/blinds, to protect the windows and walls from radiant heat and ember attack. These could be attached under the eaves near the gutters, and could be rolled down to be nearly on the ground, held there with perhaps springs and hooks. The whole house could be protected, or at least the sides facing the probable fire sector. A suitable material might be something they use in the USA, a fire retardant 'structure wrap', or 'cabin wrap'. Firefighters in the United States Department of Agriculture Forest Service use a 'Fireshelter', which is basically a swag (covered sleeping bag) made of this reflective, fire retardant material. It is a composite material including aluminised fabric and Kevlar threads for strength. People have survived (sometimes burnt, but nevertheless, survived), intense forest fires in these. It should be possible to import them, though probably expensive, or perhaps a similar product could be made in Australia. In the USA, they wrap up entire houses with the stuff. (See www.firezat.com).

With many of the fires that occur in Australia, I think this would take too much time; there may not be enough time to roll down awnings, never mind wrap a house. An alternative would be a system where a fire retardant cover could be made for the whole house. It would need to be packed on the roof, and remotely controlled, to roll down and cover the whole house quickly (thanks to my friend Peter Brady for this idea).

Fire retardant fabric might also be suitable for vehicle covers, in case people are caught in their vehicles during a fire, and for cars left behind. Also this fabric might be lined with wool on the inside, to make a portable, personal fire blanket, or perhaps a hooded poncho.

An expensive, but effective 'shield' would be a sprinkler system to augment all the other measures. Sprinkler systems require an independent water supply, pump and generator. Sprinklers could be placed on the apex of the roof, and on the closest wall/fence/plant shield, wetting the walls of the house and the shield. Also available now are portable hand trolley sprayer systems for fighting spot fires, the 'Quickstrike' pump trolley, (see the website www.blazecontrol.com.au).

A possible set-up of multiple shields protecting a house in an ember attack with the added protection of a sprinkler system.

Inside the house, curtains and furniture could be sprayed with fire-retardant fabric spray. Fire-retardant fabric sprays include "Inspecta Shield' (see www.fireshield.com.au), and Cease-fire fabric FR (see www.ceasefire.com.au).

Fire retardant sprays usually include borax, which is cheap and easily obtainable at supermarkets, and so it should be possible to make something nearly as good at home. A borax solution could be used in a knapsack sprayer, both indoors and out. You could also add a few drops of dishwashing liquid as a wetting and foaming agent. I tried soaking hessian/burlap with a saturated solution of borax and water, allowed it to dry out, and then burned it. The borax treated hessian was much better than the untreated hessian, basically charring and glowing, but not flaming.

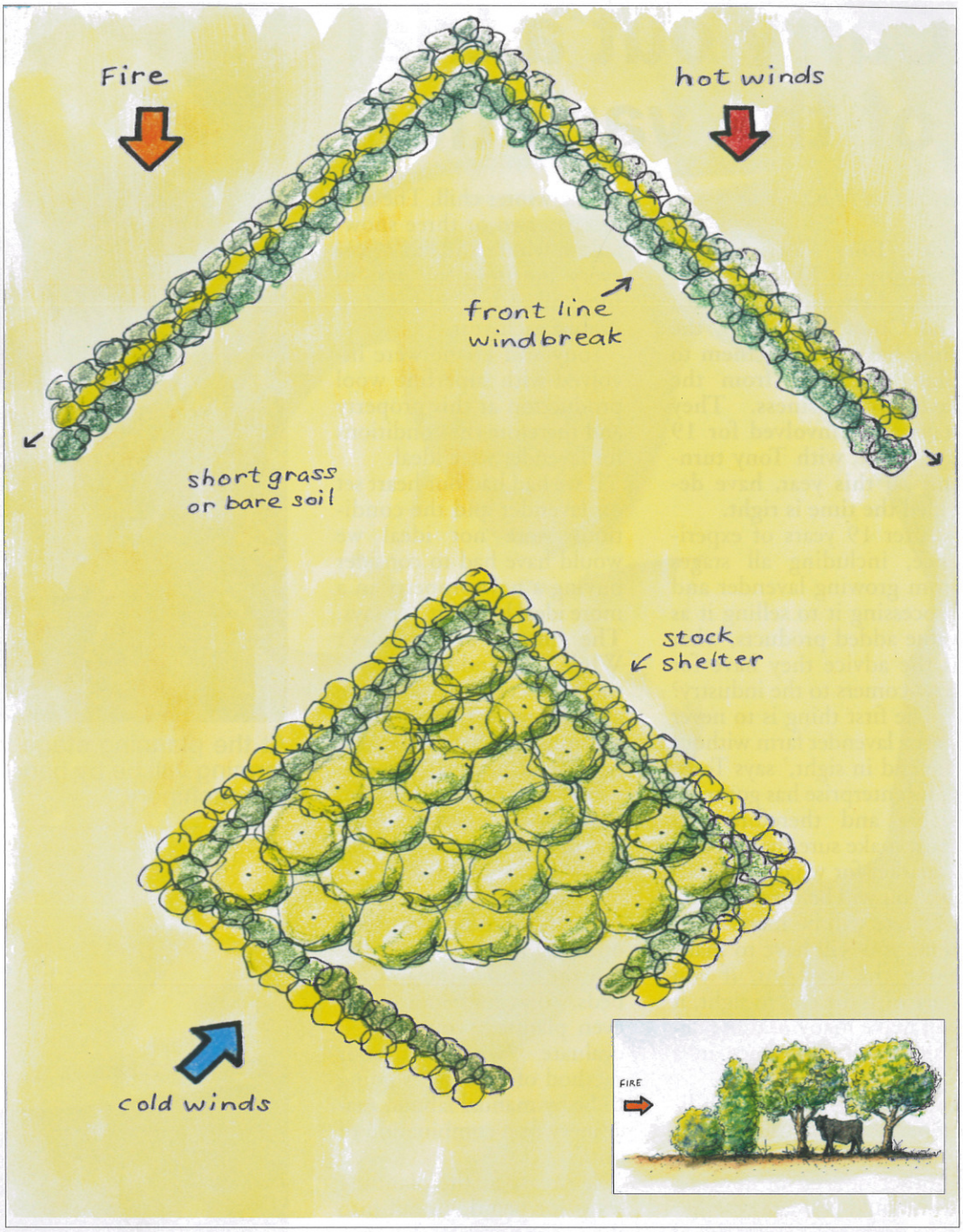
Stock shelter: It is horrendous that so many animals are injured or die in bushfires. The stock shelter illustrated should help, and is intended as a multi-purpose shelter, to reduce the impact of fire, hot summer winds, cold winter winds, and to provide shade.

Timeless wisdom from the book of Proverbs states that: 'A righteous man cares for the needs of his animals.'(Proverbs 12:10a, NIV). The principles are the same as for protecting the home, but this design relies more heavily on plants. Of course, if heat-shielding earth berms and trenches can be made, all the better. Rock walls are particularly effective and would obviously be useful.

The first line of defence would be a relatively permeable windbreak of low flammability plants to reduce the wind, and possibly direct it up and over the stock shelter, catch embers, and slow down the fire. After this, the fire has to burn across a short grass or bare soil firebreak. It

then has to get through a barrier of a row (or more) of atriplex or aloes, for example. The second row should be tall screening plants, and the final plants umbrella-shaped trees or large shrubs for overhead protection. In the worst case scenario, even if the whole shelter catches fire, it should burn less intensely, and take longer to ignite and spread than the surrounding grass. Stock would hopefully move out of the shelter and onto ground that is already burnt. Shelters could be established on less productive sites, such as those affected by salinity, and should include a water source, and preferably fodder as well. (*Portulacaria afra* provides both food and moisture).

A 'Whole Farm' Strategy: The whole farm could be compartmentalised by criss-crossing it with fire shields. These should reduce the speed and intensity of the fire, and might limit the fire to some, but not all of the compartments; and so more animals, crops and pasture should survive. Allowance would of course have to be made for access for fire-fighting, stock and machinery movement etc. Fire shields could follow fence lines, preferably on the fireward side, and so reduce or prevent damage to fences. Ideally, fire shields should follow horizontal contours, preferably on water-collecting swales, and follow ridges and drainage lines. Swales would increase the choice of plants, including plants that need more water, such as willows and poplars. Even dry climate plants will usually grow better on a swale. Even without earthworks to collect water, dense shrubs such as atriplex, planted along the contour, would slow down the run-off, and allow infiltration of more water, and so speed up growth, and produce larger, more succulent plants.



A possible design for a stock shelter viewed from above. Inset photo of a side view.

Where there is natural, fire-prone vegetation, a fire shield could be grown on the leeward side of the vegetation, but at some distance from the vegetation, perhaps 20 metres or more. The area of short grass or bare soil between would act as a fire-break, providing defence in depth. Assets such as forestry plantations could also be surrounded by fire shields. Future plantations could have fire shields within them, dividing the plantation into blocks, and so perhaps saving some of the blocks, or at least reducing the damage.

If neighbours can co-ordinate their efforts, conceivably much of the country could eventually be criss-crossed by fire shields, providing, in the Reverend John Flynn's words, a 'mantle of safety'.

Economic considerations: Fireproofing your house and property should increase its value. It might be possible to negotiate reduced household and contents insurance, or to get such insurance in the first place. Government grants may become available for fireproofing improvements to properties in the future. ■