



Bushfire Garden Recovery | © Sophie Thomson | Edited 8 Jan 2020

Bushfire Garden Recovery - Rebuilding after the fire

“More grows in the garden than the gardener sows” Spanish proverb

In 2016 and 2017 I was asked by the Department of Water and Natural Resources to provide several workshops for people whose gardens had been burned in the Pinery fires in South Australia. These talks, work I had done with the Sampson Flat fire recovery, and my more recent learnings about the impact of fire on soils, provide the basis for this post. While the information is developed for dry, ‘Mediterranean’ climate areas of South Australia, the principles are the same wherever bushfires have burned in Australia. At the end of the post there are several resources and links to useful websites and information.

Remediating and caring for the soil

Starting from the ground up

While many people think of soil as an inanimate object, the reality is that soil is a living breathing organism and all fires, regardless of their intensity, have an effect on the soil. The effect of fire on soil includes:

1. The moisture content of the soil is reduced by the temperature of the fire
2. The microbiology within the soil can be killed by the fire.
3. Ash effects soil and in large fires the large volume of ash can have a very significant effect needing remediation.
4. Soil can be prone to erosion after fires.
5. Retardants used to fight fires can leave residues in the soil

This effect, even if only minor and temporary, must be understood when rebuilding a garden. If there has been significant burning in your garden knowing how to remediate your soil will help you to rebuild your garden successfully.

Effect of ash on the soil

PH levels

Across all of Australia soils vary from acidic to alkaline while some people are very lucky and have naturally neutral soil PH. Ash is highly alkaline and used as a liming agent and in areas where soils are very acidic such as parts of the Adelaide Hills, parts of Victoria, and parts of NSW small amounts of ash are recommended as being a beneficial additive for the garden. However, a lot of Australia including has alkaline soils and so adding ash to the garden is not recommended.

Where the fire has burnt areas with small amounts of crop stubble and very little vegetation, the effect of the ash will be minimal. However, in many of the 2019/2020 fires there has been much more to burn leading to a lot more ash deposited or a deeper “ash bed”. These areas are likely to have the pH level increased and the soil made more alkaline.



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Hydrophobic soils

Ash is hydrophobic by nature which means it repels water. This has three possible implications for the soil.

1. Firstly, where there is a layer of ash left on top of the soil, it will stop or at least reduce water from rain or irrigation soaking into the soil.
2. Secondly ash, is a small sized particle and very light, so when there are strong winds the ash and burned topsoil are easily moved.
3. Thirdly, heavy rain can also wash the ash into water way or dams where it causes pollution of the water.

Contamination

Soil contamination in fires can occur from burned structures and from some fire retardants.

If the fire has burned structures, there is the chance that the soil is contaminated. CCA (Copper, Chromium and Arsenic) treated timber known as Permapine is frequently used in garden settings as log garden edging, retaining walls, fence posts, or play equipment. Any structures containing asbestos which burnt will also contaminate the soil.

In addition, fire retardants are widely used in Australia to fight bushfires that are otherwise inaccessible. There are short- and longer-term soil effects that can impact your new garden. In South Australia, the fire retardant used is Phos-Chek which is an ammonium polyphosphate. Most of the effects of this retardant return to normal within 12 months, including increased soil salinity and reduced seed germination and viability, however the effects of reducing soil acidity and increasing soil phosphorus levels are evident after this time. Different firefighting services across Australia may use different retardants and so it is worth checking what is used in your jurisdiction to see what the soil affect is.

If your garden has had a fire retardant applied to it, or there is possibly other soil contamination, consider soil testing to provide an insight into what remedial activity you can do for your patch. You can utilize the [VegeSafe service soil testing from Macquarie Uni](https://research.science.mq.edu.au/vegesafe/) – great value at just \$20.

<https://research.science.mq.edu.au/vegesafe/> Knowing what and where your soil is contaminated means you can plan to grow your productive plants such as vegies and fruit trees in uncontaminated, or remediated soil, while your ornamental gardens can be grown on soil with low level of contaminants.

Fire effects on Organisms and Biological Processes

Microbial communities include fungi and bacteria that are critical for the health of our soils. Microbes are killed by extreme temperatures and also rely on moisture in the soil to thrive. Extremely hot fires like we have experienced this fire season are lethal for the biota and destroy their habitat in the topsoil. It's not all bad news though. Microbial communities are some of the most resilient of all and while the response to and recovery from fires is not well understood, normally the biota will recover with time.



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When planning a garden it is important to understand the state of the microbial community in your soil at a macro level. If your soil is thin, dry and burned, and highly alkaline it is going to need some help to recover quickly.

Restoring the soil after fire

1. Remove the ash:

If there is a thick layer of ash remaining where you wish to establish a garden, it may be worth scraping it away and removing it to elsewhere where it will not present a problem.

2. Improve the soil:

Unless planting local indigenous plant species, work on improving the soil prior to planting.

Organic Matter: All soils benefit from the addition of organic matter such as compost or aged animal manures, however this is even more important where you plan to have a vegetable garden.

Adding organic matter to soil improves its structure and dramatically increases the soil's water holding capacity dramatically, turning it into a sponge. Incorporating a 10cm layer of compost into the top 15cm of soil increases the water holding capacity of your soil by more than three buckets of water per one square metre.

The addition of organic matter also feeds and attracts earthworms and all the other soil microbes, which are the unseen but absolutely essential workers in the garden.

Heavy/Sandy soils: Heavy clay soils will benefit from the addition of gypsum and sandy soils will benefit from the addition of clay via a clay slurry.

Rebuilding a garden

How to start

The steps for rebuilding a garden are the same as if you were building a garden from scratch.

- **Plan big and then break it down.**

Consider your climate and microclimate, frost risk, watering capacity, family, your interests, your lifestyle and spend time creating an overall vision for your garden. Then create an overall plan and break it down into small steps and achievable projects.

- **Creating your wish list**

Make a wish list and then prioritize:

What do you want to include in your garden – an entertaining area, fruit trees, a vegie patch, a herb garden, a lawn for the kids, grandkids or pets.



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What sort of plants do you want to grow? Productive plants, plants which flower and provide color and interest all year round, plants to attract birds and butterflies, flowers that you can pick and bring inside in a vase?

Garden Elements:

Understanding your climate

In South Australia and much of Southern Australia our climate is often described as 'Mediterranean' and is characterised by long hot dry summers, short cold wet winters and relatively brief periods of spring and autumn (measured by plant patterns, not the calendar month). Plants that grow in such a climate are adapted to start growing with the first autumn rains, be in full growth, flowering and setting seed in winter and spring, and then growing stops in summer unless supplementary water is given. The belief that gardens are dormant in winter is not true in our climate, as, despite deciduous trees losing their leaves, the rest of the garden, both above and below ground, is in full growth. Just think about all the weeds that grow!

The ideal time to plant in our climate is in autumn and winter, as this allows a number of months for the plant to settle in and get established prior to the next hot summer. Throw away the calendar!

Understanding micro-climate

The secret to enjoying gardening in this hot dry state, and indeed anywhere in Australia, is to make the best of what we have, by creating a special microclimate in our garden - one that is favourable to life – plants, creatures and most importantly us! The way to do this is to use shade, shelter and reducing unnecessary hot reflective surfaces from large areas of paving or radiant heat of brick walls and tin fences and sheds, as well as adding limited areas of appropriately placed lawn.

1. **Shade** from trees and vines makes a garden waterwise, by making it cooler and reducing evaporation. Breezes that pass through shaded areas are cooled, acting as natural air conditioning to cool your home and surrounds. Deciduous trees provide shade in summer while still allowing the precious winter sun to shine through – this can be used to create passive solar heating and cooling in your home.
2. **Shelter** basically protects our gardens from extremes, and in particular one of the most troublesome of our climatic conditions in South Australia, hot northerly winds. Gardens that are exposed to these winds will have a much higher rate of evaporation than those that are protected from them. A combination of fencing and established plantings of windbreaks, hedging or screening plants stop the garden within them from drying out as much so that the plants within it don't require watering as frequently. Such shelter will take a couple of years to establish when starting from scratch, but it is worth it.
3. **Lawn:** I am a fan of limited areas of appropriately placed, drought tolerant lawns as they too help to cool a garden. This is also important if you have children and pets, both of love lawn to play on. Lawns are also beneficial for adults as walking barefoot on them give us an opportunity to be grounded and connected with nature which is increasingly important in this fast paced, high tech, often 'low nature' world that many people live in.



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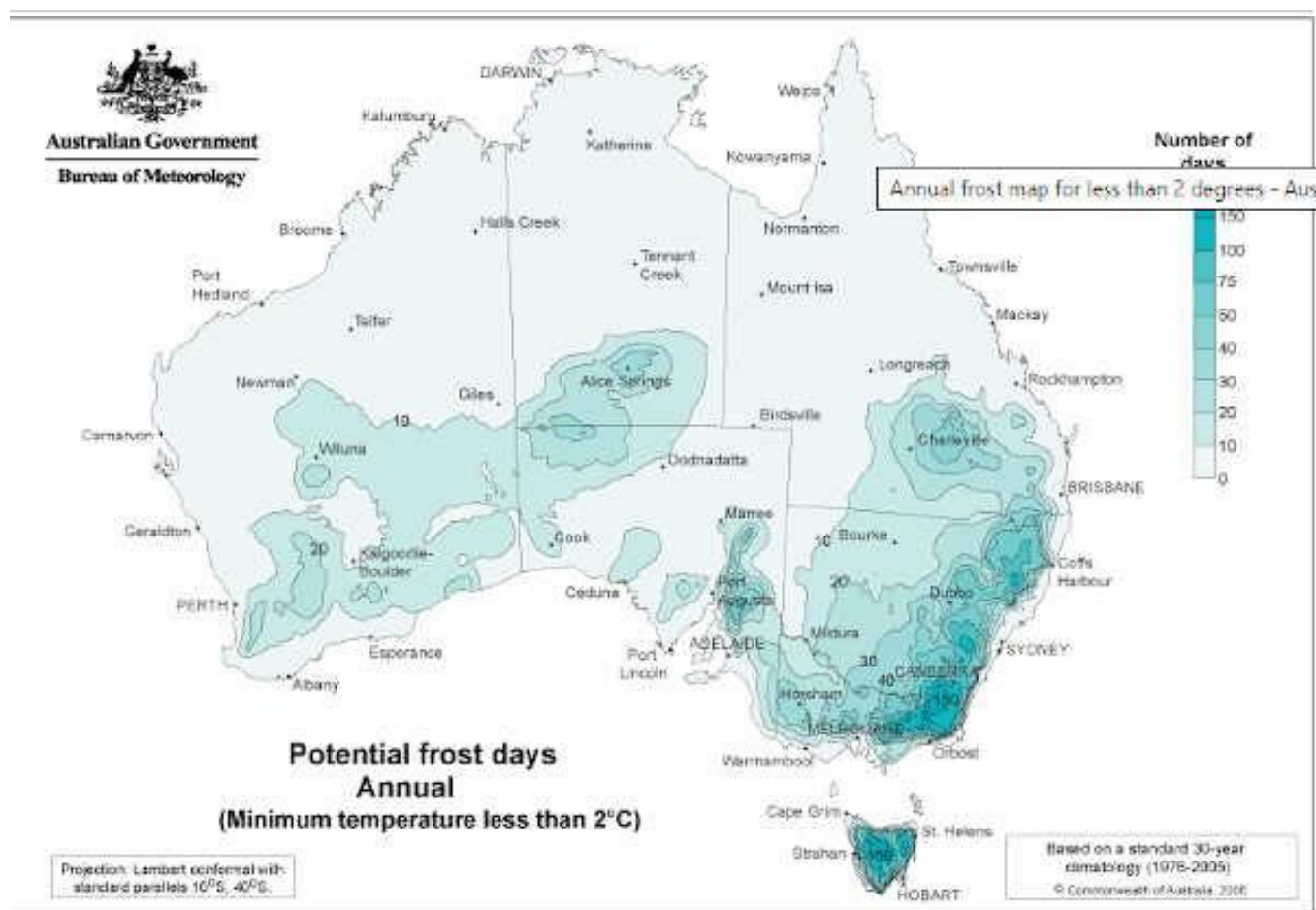
Siting a lawn on the northern or western sides of buildings will keep a garden cooler than alternate hard surfaces such as paving or concrete. These hard surfaces absorb the heat and act as heat banks with the temperature directly above them being far greater than the normal air temperature, and these surfaces also radiate the heat back out when the sun has passed. By understanding your soil, your site and by choosing the appropriate variety of turf, lawns need not be water guzzlers you can use lawn to provide sustainable and affordable cooling for your home and garden.

If possible and practical, utilise grey water applied under the surface to water your lawn, as it is a resource too good to waste and turf is more tolerant of repeated, long term grey water use than many other garden plants.

With shade, shelter and strategically placed areas of hardy drought tolerant lawns the conditions in your garden can be radically altered, creating a favourable micro-climate with temperatures, rates of evaporation and water requirements reduced.

Coping with frost

As well as coping with heat and dry, many of us in Australia need to plan for Frost. This map by the Bureau of Meteorology http://www.bom.gov.au/jsp/ncc/climate_averages/frost/index.jsp shows the potential frost days across Australia. With high frost risk closely aligned with the 2019/20 fires across Victoria, New South Wales, SA and Tasmania as well as some parts of southern Queensland it is clear that people rebuilding their gardens after these fires are going to need to consider Frost.



The obvious solution for gardeners in frosty areas is to choose plants that are frost tolerant, however with the varying degrees of frost, a plant that survives frost to -2 or -3 degrees may be killed by -5 degrees. Also, some plants may be frost hardy once established but can still be frost tender when young.

While you can cover plants on nights when frost is expected, this is time consuming and often gets forgotten until too late! Instead, use tree guards to provide some frost protection when plants are young, and treat your new tender plants with seaweed-based plant tonics and a spray of an anti-transpirant spray such as Droughtshield. These last two treatments should be done monthly on susceptible plants in their first year when there is a risk of frost and can give you between 2 and 5 degrees of frost protection.

Water and Irrigation

Water zoning

Australia is prone to drought and with the frequency and severity of drought predicted to increase designing your garden with water requirements in mind will potentially save you money and heartache. When designing or redesigning your garden give some thought to the water requirements of your plants and try to group those with similar water requirements together. The 'ideal' or optimal garden scenario which I use, and I often suggest is 50% no water use, 25% low water use and 25% high water use.



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The 50% no water use section of garden includes plants chosen specifically for their ability to survive with no supplementary watering once established. Plant selection is critical here and plants may be indigenous varieties, natives or exotics chosen from comparable climates, matched specifically to the conditions and micro-climate of your garden. On occasion, they may need to be given some supplementary irrigation if there are uncommon periods of extended drought, but this is an 'as required' scenario.

The 25% low water zone would get a good soaking water every week or so in summer and could include fruit trees, roses and limited areas of lawn.

The highwater zone would require watering more frequently than once a week and would include pots plants in a fernery or shade house and in ground vegie gardens.

Plant selection

The three main groups of plants to add to your garden are

- Local indigenous plants which are obviously great plants choices as they grow naturally in your area.
- Australian natives from comparable climates within Australia. In Southern Australia avoid plants from tropical sub-tropical climates as they are used to summer rain and will require regular watering through our dry summer.
- Climate compatible exotics from places like the Mediterranean, South Africa, Western China, the Middle East, California, Mexico, and Chile. Many of these plants will have physical adaptations suitable for our climate and lack of water, such as summer dormancy, tough leathery or waxy leaves, small needle-like leaves, succulent leaves, silver grey and hairy foliage, swollen or water storing roots, bulbs and rhizomes and swollen water storing trunks.

When using plants which are exotic or from different parts of Australia be careful not to use any which have the potential to 'jump the fence' and become an environmental weed.

Low flammability

It is also worth considering plants with low flammability. Although all plants can and will burn if the conditions are right, there are some plants we should avoid planting close to houses or sheds. These include those with high oil content in their leaves such as gum trees or pine trees. Instead choose plants with high moisture content in their leaves such as deciduous trees or broad fleshy leaves such as succulents. Other characteristics of plants with low flammability include high salt content in their leaves, those which don't retain dead matter within their structure and those with smooth bark on their trunks as opposed to rough bark.

From my experience of Ash Wednesday and our home garden, I was aware that deciduous trees close to a home are less flammable than plants with high oil content in their leaves like gums and conifers such as pine trees. Deciduous trees have moisture in their leaves and this can act to dampen a fire, while the high oil content makes the latter plants explosively flammable. Now obviously there are many variables, and both can burn if the fire is hot enough. At Sophie's Patch we are using appropriate plant choices and our



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watering zones to help reduce fire risk, watering closest to our house the most to keep it lush and green and act as a fire break. Our wildlife corridor of native vegetation which survives on rainfall alone and is dry and more flammable is further away from our home.

Here is another article written after Victoria's Black Saturday fires about the benefit deciduous trees in a fire. <https://www.recreatingthecountry.com.au/blog/deciduous-trees-can-provide-crucial-bushfire-protection>

The vegie patch

When planning your new vegie patch, you need to choose a suitable site in a sunny position, free from the root competition of trees and large shrubs. Ideally, choose a site that gets morning sun and some protection from the fierceness of the late afternoon sun in summer. If you are building or rebuilding a vegetable garden, and there is a layer of ash left on the soil, it would be best to scrape it away before working on improving the soil with organic matter.

However, if your soil is very heavy, the ideal site is impacted by tree roots, or you want to save on bending, you might like to consider creating a raised vegetable bed or wicking bed.

Raised beds can be done a number of ways, the two most popular being hardwood sleepers or corrugated iron pre-formed tanks. If going for a tank garden, only choose heritage grade galvanised iron as it will have a far better lifespan than aquaplate, colourbond or zincalume, which corrode due to the acids in the soil. Be aware though that corrugated iron beds can get too hot for many vegetables in the peak of summer, causing scorch on the plants and fruits, and causing roots in the raised bed to die, so you may need to shade the sides of a metal raised bed for your vegetables to thrive.

Since most vegetables have high water requirements in the warmer weather, you might also like to consider making your vegie garden a wicking bed, which is self-watering and only needs to have water added every 7-10 days depending on the conditions. You can see how I made one on Gardening Australia at <https://www.abc.net.au/gardening/factsheets/wicking-works/9652718> or read the fact sheet <http://www.nrcgawler.org.au/wp-content/uploads/2013/11/WICKING-BED-Handout-2014.pdf>.

If purchasing the soil to fill these beds always choose good quality blend suitable for vegetable growing and if using your own soil, make sure that you improve it with lots of organic matter as the quality of your crops is dependent on the quality of your soil.

Mulching – essential for success

Whether you have planted natives, exotics or vegetables, the last step is to mulch them. This is important after any planting and is even more important where the soil is fire affected.

The reason we mulch is to keep moisture in the soil. More specifically it can reduce the loss of water by surface evaporation by 70%. It can also smother or at least suppress existing weeds, which not only look unsightly, but they compete with your plants for moisture nutrients, space and light, and if left to flourish they will outcompete with many young plants. A good layer of mulch will also reduce weed seed



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germination. Seeds that do not touch the soil have less chance of germinating. Mulching also insulates the soil, keeping it cooler in hot weather, which keeps the worms and soil microbes happy and stops plant roots from stressing. Another benefit of mulch is it slows the flow of water across the soil to increase absorption and decrease erosion and stormwater runoff.

There are four types of mulch and what you select is ultimately personal choice. The first is living mulch where groundcovers cover the soil. Then there are bark based mulches will stay around for one or two years depending on the coarseness of the bark and straw based mulches such as pea straw which are usually preferred around vegetables as they break down in less than a year, adding extra organic matter to the soil. In high fire risk areas, inorganic mulches such as crushed brick, gravel, scoria or pebbles can also be used which are inflammable.

As a very general rule of thumb, apply mulch 3 to 5 centimetres thick on soils that are moist or well-watered. The depth of mulch you apply does depend on the type of mulch you use. Heavy bark mulch should not be as thick as a light straw-based mulch which is full of air. If you don't apply enough mulch it won't work and too much will stop rainfall and irrigation penetrating down to the soil and may even cause problems with collar rot on the plants.

Bushfire recovery a final word

For those who have not been directly affected by fire but are shaken and interested in what they can do to make their garden bush fire safe, at the end of this flyer there are a number of links which are great reading.

<https://sophiespatch.com.au/wordpress/wp-content/uploads/2020/01/reducingfireriskingardens.pdf>

Losing a garden in a bushfire can be devastating and yet with the right soil remediation and planning gardens can be rebuilt and thrive.

For more information

Natural Resources - Adelaide and Mt Lofty Ranges

<https://www.naturalresources.sa.gov.au/adelaidemtlofyranges/land/fire-management/cudlee-creek-fire-recovery> - this page links to lots of individual fact sheets with useful information on subjects such as bush fire recovery, erosion and water supply. It is also worth clicking through to the pages on the Sampson Flat and Pinery fires as they also have lots of useful links.

Sustainable Gardening Australia www.sgaonline.org.au or specifically <https://www.sgaonline.org.au/we-will-rebuild-gardening-after-bushfires/> and <https://www.sgaonline.org.au/we-will-rebuild-gardening-after-bushfires-part-2/>

CFS website https://www.cfs.sa.gov.au/site/prepare_for_a_fire/prepare_your_home_and_property.jsp

Barossa Bushgardens - CFS Firewise Garden www.barossabushgardens.com.au



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Sustainable Landscapes Project – Department of Environment and Natural Resources & NRM

<https://sophiespatch.com.au/wordpress/wp-content/uploads/2020/01/reducingfireriskgardens.pdf>

<https://www.abc.net.au/gardening/factsheets/wicking-works/9652718> or read the fact sheet

<http://www.nrcgawler.org.au/wp-content/uploads/2013/11/WICKING-BED-Handout-2014.pdf>

https://www.ffm.vic.gov.au/_data/assets/pdf_file/0018/21087/Report-70-Effects-of-fire-retardant-on-soils-of-heathland-in-Victoria.pdf

https://www.ffm.vic.gov.au/_data/assets/pdf_file/0009/21060/Report-50-Assessment-of-the-Effectiveness-and-Environmental-Risk-of-the-Use-of-Retardants-to-Assist-in-Wi.pdf

[https://www.researchgate.net/publication/234073792_Effects_of_a_long-term_fire_retardant_chemical_Fire-](https://www.researchgate.net/publication/234073792_Effects_of_a_long-term_fire_retardant_chemical_Fire-Trol_934_on_seed_viability_and_germination_of_plants_growing_in_a_burned_Mediterranean_area)

[Trol 934 on seed viability and germination of plants growing in a burned Mediterranean area](https://www.researchgate.net/publication/234073792_Effects_of_a_long-term_fire_retardant_chemical_Fire-Trol_934_on_seed_viability_and_germination_of_plants_growing_in_a_burned_Mediterranean_area)

<https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Land-and-soil/fire-and-soils-170691.pdf>

https://www.firescience.gov/projects/98-S-01/project/Soil_and_Water.pdf

http://www.bom.gov.au/jsp/ncc/climate_averages/frost/index.jsp

<https://www.recreatingthecountry.com.au/blog/deciduous-trees-can-provide-crucial-bushfire-protection>