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Back cover: *Epacris browniae* and Mt Solitary, Blue Mountains NSW – David Coleby

Australian Plants articles

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Editorial

As our title states, the interest which binds our readers together is that of Australian plants. With the number of species which are indigenous to this vast island continent conservatively estimated as in the vicinity of 30,000 and the prospect of understanding the occurrence of each species, the ecological communities within which they occur let alone their specific propagation techniques it seems overwhelming to consider that we could have an extensive knowledge of all species.

A strength of a Society such as ours is the knowledge of all its members. What an amazing resource we would have if we pooled the information held by all these plant enthusiasts. At a recent planning workshop in New South Wales the idea of collecting and cataloguing such information was discussed. That is indeed a challenge.

In this issue we feature reports on individual species and on a plant community from such “amateurs” who appreciate and study plant species and areas of special interest to them.

We also have one report from a professional researcher. Nathan Emery provides a scientific report on the reproduction and related environmental issues of that iconic plant, the flannel flower, *Actinotus helianthi* – a plant visitors to the eastern states most wish to see,

David Coleby writes of plants of the Blue Mountains area and adds the story of the person after whom one of these was named.

Max Jahn regularly explores areas and reserves and studies the plants found within these areas. In this article he gives a verbal and pictorial description of the Hale Conservation Park.

In a new venture we feature an article by Andre Jagger, not on plants themselves but on techniques of digital photography which enable us to record their special features. Initially Andre discussed writing on the area of south-western Western Australia which he has studied. Instead he is sharing with us his knowledge of photography with illustrations in his Andre own special style. He is currently living in Hong Kong and is enjoying learning about the natural flora of that very different clime.

But not all plants which grow in our gardens and communities and even in our bushland are ones which are part of the natural ecology. They are weeds – a plant out of place. Weeds can destroy or detract from our natural environment. Sandra Guy helps us understand weeds and how to eradicate them.





On the seed biology of the Sydney flannel flower (*Actinotus helianthi* Labill.)

Dr Nathan Emery

Currently a Scientific Officer at the Australian Botanic Garden, Mount Annan, Nathan's Ph.D. used *Actinotus helianthi* as a model species to examine how population-level variability can affect changes to species distributions in the future.



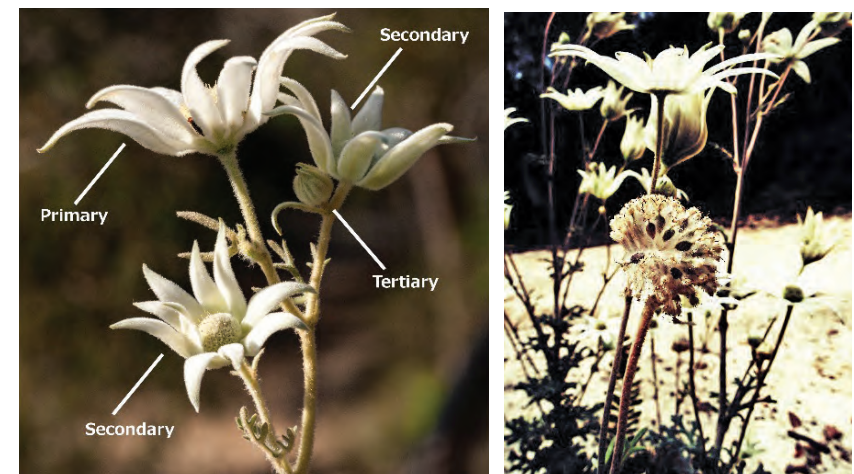
The Sydney flannel flower (*Actinotus helianthi* Labill., Apiaceae) is one of eastern Australia's most well-known native plant species. Everywhere I went for fieldwork during my Ph.D. I was asked whether the flannel flower would remain in the landscape for years to come. The flannel flower has a long history of being developed as a pot plant and cut flower crop. The species is propagated at the Australian Botanic Garden, Mount Annan by cuttings and tissue culture and, while this is suitable for low-scale production, seed propagation is required to produce plants *en masse* to be a viable option for large-scale horticulture. Flannel flowers are prolific seeders, producing upwards of a thousand seeds on a single plant. Several issues, however, surround the capacity to propagate the species by seed and vegetative tissue, causing limitations to mass production. While some of these issues have been overcome (Offord and Tyler 1993; von Richter and Offord 1997a; b), inconsistencies still occur when germinating seed from different source populations and years (Emery *et al.* 2011; Emery and Lacey 2010). It is likely, therefore, that germination is influenced by both spatial and temporal environmental variation. These issues are also relevant from a conservation perspective. Indeed, a poor understanding of the

requirements for germination and other factors surrounding the seed stage for any species means that subsequent management responses are reactionary rather than predictive. Importantly, the seed stage represents the most sensitive part of the plant life-cycle that can have an impact on its overall life-history. Here, I provide a concise synthesis of what is known about the seed biology of the flannel flower from previous research as well as my own.

The flannel flower is an erect perennial sub-shrub, commonly growing to around 50 cm, but individuals can grow as tall as 150 cm, occurring in eastern Australia in NSW and southern central QLD. The species is found on sandy or rocky, nutrient-poor soils along the coast of NSW. Populations are also found in the central-west Pilliga region of NSW, and as far north as the Brigalow Belt North region of central QLD. The recorded distribution of the species spans a latitudinal and longitudinal distance of approximately 1,255 km (35.61°S to 24.37°S) and 780 km (153.43°E to 147.18°E). The species is characterised by apetalous flowers aggregated in umbels, subtended by large, white bracts. Each inflorescence comprises a terminal primary umbel subtended by at least one secondary branch, each of which is further subtended by tertiary branches. There is significant variation in plant traits across populations (Emery *et al.* 2015).

Seed set

Before the seeds themselves can be examined, we need to know the factors that affect seed-set on the plants. Research by Lee (1995), for example, indicated that flannel flowers produce large numbers of embryo-less seeds but did not provide evidence for why. To examine





this in detail, we need to look at the reproductive biology of the species. Pollinators are an integral part of a plant's capacity to set viable seeds. It is commonly documented in the literature that taller plants with larger floral displays will be more attractive to pollinators than plants that are small and have few flowers. This was also the case for the flannel flower, where plant height and floral display size were positively associated with insect visitation (Emery 2014). From my observational work, some of the most common insect visitors to flannel flowers included *Apis mellifera* (European honey bee), *Exoneura bicolor* (reed bee), *Ischiodan scutellaris* (common hover fly), *Mordella spp.* and *Tomoxioda spp.* (pintail beetles). Bees visited around three times more umbels per plant than all other insect groups. Different populations also had unique diversities of insect visitors.

Preliminary evidence suggests that the flannel flower breeding system exhibits self-compatibility. Specifically, seed-set was greatest (28-38%) when flowers were pollinated using outcrossed pollen; however, pollen from another umbel on the same plant (i.e. geitonogamy) also produced comparable numbers of viable seed. Interestingly, when a second population was examined, seed set in flowers fertilised with outcrossed pollen was as high as 70% (Emery 2014). By contrast, pollen cannot be sourced from within the same umbel due to dichogamy. However, there is a sex-phase overlap within a plant as hermaphroditic flowers in secondary umbels are male and have pollen present when flowers in



A reed bee visiting an umbel of a flannel flower at Manly-Warringah War Memorial Park.

primary umbels are female and have receptive stigmas. This means that geitonogamous pollination is possible.

Taken together, these results indicate that the level of seed set in the flannel flower can vary considerably among and within different populations. The height of plants, as well as the number of umbels per plant, both have a role in attracting pollinators and increasing the probability of successful pollination. However, the likelihood of geitonogamy occurring increases with the number of umbels on a plant, highlighting a fine balance. From a horticultural perspective, within-plant pollination is not a major concern. By comparison, maximising genetic diversity is an important parameter for conservation management in which outcrossed pollination is the most desirable outcome.

Seed biology

Apiaceae, which includes the flannel flower, are characterised by seeds that have morpho-physiological dormancy. A combination of two requirements must be met before germination can commence. Morphological dormancy requires appropriate climatic conditions for the embryo to elongate to a critical length before the radicle emerges. In the lab, we find a constant temperature of 15°C to be most suitable for germination. Secondly, a physiological mechanism inhibits germination, requiring a chemical stimulant, such as gibberellic acid (GA₃) or smoke-water and/or appropriate temperatures for germination. Lee (1995) documented that dormancy in flannel flower seeds was partially induced by the seed coat. While this is true, removing seed coats is not a viable option for producing seedling *en masse*.

There has been considerable interest in the use of smoke-water as a germination stimulant for many Australian plant species. Flannel flowers are often observed in the bush as luxurious flowering dominant ground cover following a fire. Therefore, we would expect the seeds of this species to respond to smoke-water. Traditionally, flannel flower seeds were soaked in a 1% smoke-water solution prior to sowing. Recently it was determined that a more appropriate mode of application was to incorporate the smoke-water dilution into the agar (Emery and Lacey 2010). This improvement was attributed to the seeds having a fine layer of hydrophobic hairs protruding from the seed coat, which makes it difficult to ensure that seeds uniformly imbibe an aqueous solution over a short period of time.

Though smoke-water does indeed increase overall germination success in the flannel flower, the results are not uniform among populations. When seeds from 17 different flannel flower populations were incubated





Nathan Emery recording flannel flower plant traits at Sydney Harbour National Park.

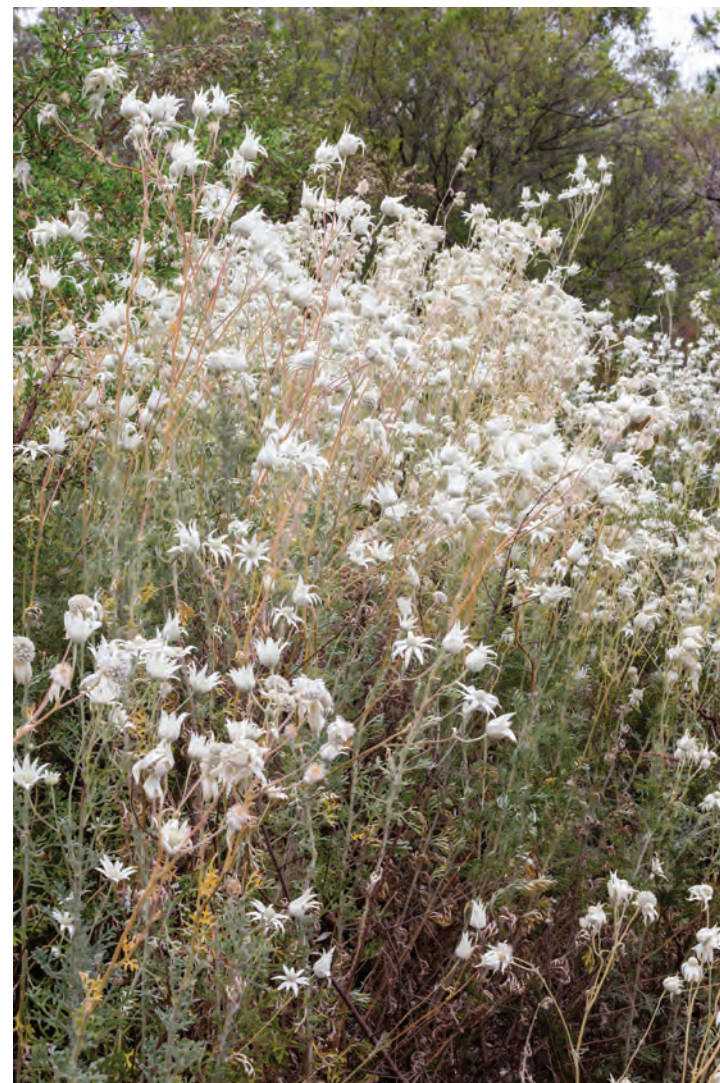
on smoke-water agar, final germination success ranged from 59% to 98% (Emery 2014). Furthermore, the capacity of seeds to germinate without smoke-water was also highly variable, ranging from 0% to 64%. This suggests that the level of seed dormancy also varies by population – a result also reported in an earlier study (Emery et al. 2011). As these seeds were germinated in a common environment (a constant temperature of 15°C), it suggests that flannel flower seeds from different populations have genetically-fixed variation as a consequence of local adaptation. If true, this could result in differential survival rates when seeds are dispersed to novel environments.

Research undertaken on a sister species, *Actinotus leucocephalus* Benth. in Western Australia, indicated that the seeds undergo dormancy cycling (Baker et al. 2005). That is, dormancy was relaxed following warmer temperatures and wetting events (i.e. rainfall) in the field. By contrast, cooler temperatures (i.e. 5°C) induced dormancy in these seeds. However, this could be subsequently alleviated by treating the seeds to warm temperature or after-ripening in dry storage. We might predict a similar dormancy cycle for *A. helianthi*, however this has not been examined.

Variability: the common denominator

Variability between populations is a prominent feature for the seed biology of the flannel flower. Indeed, one could make the argument that this is inevitable for common species with a distribution that spans a wide

range of environments. To standardise such a species requires rigorous selection over multiple generations. The work done on the flannel flower to date highlights that variability occurs at the adult plant stage in terms of its plant traits and interactions with other species in the environment, before any seeds begin to mature on the plant. Seeds from different populations are able to germinate without smoke-water to different degrees, suggesting that dormancy differs at a spatial scale. This could be due to a dormancy cycle causing temporal variability in germination.





Beyond the issue of maximising germination is the question of what happens to the seedlings once they have germinated? For example, having germinated 3,600 flannel seeds from 18 populations, we attempted to grow these seedlings in a common environment. Seedling survival was low, ranging from 0.8% to 36% between populations (Emery et al. in review). By contrast, survival of the horticulture cultivar 'Starbright' was 51%. These results provide further evidence that the progeny of flannel flower populations were adapted to their local environment.

From a seedling production perspective, it may still be possible to select for plants that produce seed with low dormancy levels. However, what this then means for seedling survival is a separate question requiring further investigation. For conservation, the flannel flower represents a useful study species for illustrating the need to examine population variation (in terms of seed biology) to then understand how plants interact with their local environments. There is never an easy answer!

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Encountering rare and special plants in the Blue Mountains, NSW

David Coleby, APS Blue Mountains Group, NSW.

David is a very knowledgeable native plant enthusiast who explores the Blue Mountains area with an extraordinary ability to notice special plants and identify differences which lead to understanding new species or varieties. In this article David writes of two special plants and of the person for whom one was named.

Atkinsonia ligustrina

One of the glorious moments in the Blue Mountains bush is to find a rare plant in full bloom. So it was with *Atkinsonia ligustrina* that Rae Druitt and I found on the west side of the Mt Hay Road, 7.1 km from the Great Western Highway in Leura in late November. There were three plants, the middle one of which was nearest the road and easily photographed.. Its spectacular yellow flowering made it stand out for all to see.



Atkinsonia ligustrina on Mt Hay Road, Leura.

At first glance it resembled *Persoonia myrtilloides*, another rare plant, but we soon changed our minds when we found that unlike all *Persoonias* in which four sepals roll back down the corolla, this plant





had six strappy petals, sometimes seven or even eight, and they were spreading. Not only that but the anthers were adnate and very pale (see photo).

Atkinsonia ligustrina is a robust upright shrub with many red-brown stems that divide into a canopy of smooth, red-brown, brittle branchlets. The leaves are opposite, although at times appearing randomly placed because one or more leaves has fallen. Each leaf is elliptic, spreading, green (and bright green when new), (20)–25–(30) mm long, (5)–7–(10) mm wide, discolorous and slightly fleshy, the lower surface covered in felted hairs; apex obtuse; base tapering; margins entire; petiole about 2 mm long.



Atkinsonia ligustrina,
close-up of flowers on 22
November 2015.



Atkinsonia ligustrina on
Mt Hay Road, 3 December
2015, fading flowers
turning orange-red,
and incipient fruit with
persistent style (left).



Above: Immature fruit of *Atkinsonia ligustrina*,
24 Dec 2015.



Left: Mature fruit of *Atkinsonia ligustrina*, 31
January 2016.

The inflorescences (in November) are axillary, in racemes almost the same length as the leaves, up to eight tubular flowers on each raceme, pedicels short, petals narrow, strappy, yellow, spreading and about 7 mm long; anthers adnate, short, pale.

Initially the fruit are green, ovoid-oblong (like a small olive) and about 15 mm long, but when they mature (in February) they become dark brown-red. They are not persistent, and all fruit will have fallen (or been eaten) before flowers set for next spring. Picked fruit turn black within days.





Atkinsonia ligustrina is a member of the family Loranthaceae, the mistletoes, which includes common genera such as *Amyema* and *Muellerina*. All are hemi-parasites on other plants, especially eucalypts. However, *Atkinsonia ligustrina* is unusual in that it is the only one of this group that is terrestrial, and not epiphytic. It is a hemi-parasite on the roots of neighbouring trees and shrubs: it obtains nutrients from them, but its own leaves make chlorophyll. The four families, Olacaceae, Loranthaceae, Viscaceae and Santalaceae make up the Order of Santales, the parasitic plants.

Atkinsonia ligustrina is classified a rare plant, ROTAP 2RCa, which means that it has a maximum geographic range of less than 100 km, that it is rare, that it occurs in a National Park, and that it is adequately conserved. It occurs mostly in the upper Blue Mountains, but has been recorded as far south as Yerranderie and as far northeast as Mellong.

Atkinsonia ligustrina was named by Ferdinand von Mueller, the great nineteenth century botanist and Director of the Royal Melbourne Botanic Gardens and Herbarium, to honour a remarkable lady who lived and worked in the Blue Mountains at Kurrajong Heights. Caroline Louisa Waring Atkinson had been born in 1834 at her parents' property "Oldbury", near Sutton Forest and Berrima on the Southern Tablelands of NSW. She was the youngest of four children. Her father, an author, died when she was only 8 weeks old, leaving her widowed mother to bring up the family. Her mother was also an author, this time of Australia's first children's book "*A Mother's Offering to her Children*". She remarried, but disastrously, for the new husband, George Barton, "became violently and irrevocably insane not long after the marriage", resulting in the family needing to leave Oldbury.

So mother, four children and a handful of loyal servants decamped to a family cottage down the escarpment at Budgong for several months, and then went to live in Sydney. Several years later they moved away from the city.

Thus Louisa, as she preferred to be known, lived most of her life at "Fernhurst", a house that her mother, Charlotte Barton, built at Kurrajong Heights in the Blue Mountains. Louisa was a somewhat frail child with a heart defect, but there was nothing wrong with her brain, and under her mother's tutelage she developed many skills. She became a well-known botanist, journalist, novelist and illustrator. Along the way she acted as un-paid scribe for the unlettered people of the community, and she organised and taught in the district's first Sunday School.

In her literary career, Louisa's first claim to fame came with the publication,

when she was 23, of a novel "*Gertrude the Emigrant*", the first by an Australian-born woman to be published in Australia. She was also the first author to illustrate her own work. Her second novel, "*Cowanda, the Veteran's Grant*" had a cover design by S T Gill. Numerous other novels followed, each with an educational and moralising import.

In 1853, aged 19, she had her first series of illustrated natural science articles published in the *Illustrated Sydney News* under the title of "*Nature Notes of the Month with Illustrations*". Later in 1860 for about ten years *The Sydney Morning Herald* published her series of natural history sketches titled "*A Voice from the Country*". She also became well-known as an amateur geologist, zoologist and taxidermist. There seemed little she could not do.

Louisa is acknowledged as a leading botanist who discovered new plant species in the Blue Mountains and Southern Highlands, and she championed the cause of conservation during a period of rapid land clearing. She travelled, either on foot or more often on horseback, to pursue her interests in botany. She would often visit the Grose Valley, Mt Tomah and Springwood, and collect specimens for both Rev Dr William Woolls (a well-known teacher and amateur botanist) and for Ferdinand von Mueller. As a consequence of the quality of her information and the professionalism of her approach she was commemorated in a number of names of native plants: *Atkinsonia ligustrina*, *Erechthites atkinsoniae*



Louisa Atkinson, aged about 12, painted either by her mother, Charlotte Waring Atkinson, or by Louisa's eldest sister Charlotte Elizabeth, probably in 1846.





(now *Senecio bipinnatisectus*), *Epacris calvertiana*, *Helichrysum calvertiana*, *Xanthosia atkinsoniana*, and *Doodia atkinsonii* (no longer a recognised species, no modern synonym, but believed to be a form of the modern *Doodia caudata*).

In 1865, when Louisa was 31, she and her mother returned to Oldbury, where her mother died in 1868. Louisa married the following year, when she was 35: James Snowden Calvert was a wounded survivor of Leichhardt's expedition of 1844–5, and had been manager of Cavan station at Wee Jasper near Yass. He, too, was keenly interested in botany. Louisa bore a daughter on 10 April 1872. Eighteen days later she saw from the window of their house her husband's riderless horse gallop into the yard. Imagining he had been killed in a fall, Louisa suffered a heart attack and died suddenly. Minutes later her husband walked into the yard, very much alive.

Louisa Atkinson is remembered in the local community as a pioneer of dress reform. She discarded the long dresses of the period for trousers because they were much more suitable for bushwalking and pony riding. Needless to say, this aroused "some twitterings in the ranks of the colonial Mrs Grundys" of the area.

Her daughter, Louisa Snowden Annie Calvert survived, became a doctor, and married Dr John I C Cosh. They practised together in Moss Vale and she lived until 1956. Their daughter, Miss Janet Cosh was a teacher who, when she died in 1989, left her botanic library, herbarium and records collection to the University of Wollongong as "The Janet Cosh Herbarium."

Kate Forsyth, the present day author of romance, thrillers and children's books, notes that Charlotte Waring (Louisa Atkinson's mother) was her great–great–great–great grandmother.

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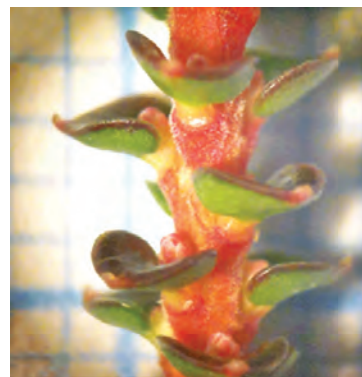
A new Epacris for the Blue Mountains



Epacris browniae and Mt Solitary.

Well, not new, just recently discovered! It is called *Epacris browniae* and honours the name of Dr Elizabeth Brown (1956–2013) an *Epacris* expert, and formerly the Scientific Editor of *Telopea*, who worked for nearly 24 years at the National Herbarium of New South Wales.

I discovered this plant in 2009 in south Leura while researching *Blandfordia cunninghamii* and a team of Parks and ConSoc volunteers* helped me find more of these *Epacris* over the next two years.



Epacris browniae joins a list of 28 other *Epacris* species (and varieties) in NSW, but whereas many are widespread, *Epacris browniae* is currently confined to the upper Blue Mountains, in treeless situations above 800 m and where rainfall exceeds 1300 mm a year.

The easiest time and place to see this new species in flower is at Sunset

Epacris browniae in bud.

* Blue Mountains Conservation Society for which David is a former nursery manager propagating indigenous plants of the area





Rock, Kedumba Road, on Kings Tableland, Wentworth Falls any time in November, where it grows alongside another epacrid, the shorter *Epacris rigida*, on the rocky steps down to the lookout.

Its distinguishing features are that it is a woody robust shrub, the branchlets are not hairy, and the broad leaves are thick, shiny dark green with a blunt apex (unlike its close relative *E microphylla* var *microphylla*). Flowers are white, and about 6 mm in diameter, with the corolla tube shorter than the sepals and lobes as long or longer than the tube.



Ordinarily *E browniae* is 70–120 cm high, and flowers in November (see opposite). North of the Great Western Highway in the upper Blue Mountains it grows on Flat Top and, in profusion, from the end of the Mt Hay Road out to Butterbox Point and Mt Hay. Plants in these areas tend to be shorter, thinner, less woody and more wiry than elsewhere

Left: *Epacris browniae*: first week of inflorescence.

Below: *Epacris browniae* holotype.



Epacris browniae in Sydney Montane Heath. Inset: Seeds of *Epacris browniae*, (scale = 1 mm).

E browniae sets seed (in February) in a small brown capsule about 2 mm long. The seeds themselves are minute, only about 0.6 mm long and looking like half-inflated rugby footballs (inset above). They weigh next to nothing (0.038 mg) which means that it takes 26,500 of them to make one gm.

Since *E browniae* has no lignotuber (unlike *E rigida*) it is classed as a facultative reseeder, that is, it relies on retention of seeds in a seedbank in the soil, which germinates after fire. However, some seed will germinate without fire, and give rise to a population of plants that exhibit all age classes since the previous fire.

Epacris browniae is a beautiful and worthy addition to the already diverse flora of Sydney Montane Heath in the upper Blue Mountains.

Further reading

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A stroll in "Hale Conservation Park"

Max Jahn: accompanied by friends Egon Shore and Brian Thom

Hale is a 77 hectare park, 60 km northeast of Adelaide, SA. It is about 3 km SE of Williamstown, on the SW side of Warren Road, the road from Williamstown to Birdwood. We walked the 3.6 km loop trail clockwise three times at different times of the year. The park soil consists of Aldgate Sandstone, heated and compressed to form mica deposits, fine particles of which glitter in the pathways.



The trail map is displayed at check points. Distance signs are placed every 200m.



Cassytha melantha (Snotty Goggle).



The main track. The most frequent animals we came across were nests of bull ants.



Hibbertia exutiacies



Hibbertia riparia

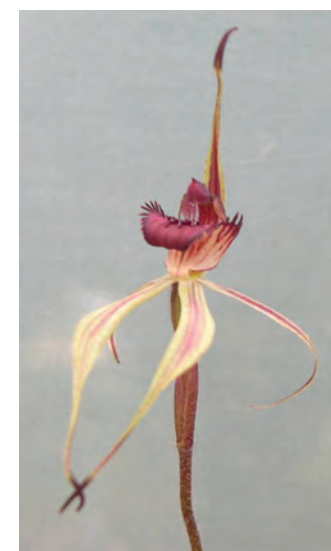


Hibbertia sericea

Guinea flowers were everywhere. So were orchids.



Glossodia major



Caladenia dilata



Acrotriche depressa (Native Currant): can make jam with the fruits.





Lookout: South Para Reservoir, Mt Gawler, Mt Lofty.



Tetratheca pilosa
(Black Eyed Susan)



Pimelea stricta



Cheiranthra alternifolia (Hand Flower)



Scaevola albida (Pale Fanflower)



Prostanthera spinosa (Spiny Mintbush)



Distinctive fruits of *Callitris rhomboidia*





The beauty of small plants: when you get down on your knees. Look under foot.



Drosera macrantha



Drosera whittakerii

Ophioglossum lustranicum
(Adder's Tongue, 2cm).



Chamaecilla corymbosa (3cm high).



If you wait at a hole long enough.

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The waterfall rarely flows, but the area still has a cool charm.



Ferns abound



Grevillea lavandulacea



Hakea rostrata



Prostanthera florifera





The going gets rough



Leptospermum myrsinoides



Callistemon teretifolius



Calytrix tetragona



Leucopogon rufus

Hale Conservation Park is a favourite of many people. It has diversity of terrain, and variety of vegetation regimes. I have tried to show its floriferous beauty. The 3.6 km trail varies from straight and flat, to scrambling over rocks, suitable for short distance walkers. I highly recommend Hale to everyone for a wonderful day's stroll.

Digital Scientific Illustration

Andre Jagger

Andre Jagger currently resides in the Hong Kong SAR, China and works for a large bank, in the Information Technology (I.T.) section as a Unix - Linux Operating Systems Engineer. He has worked in the I. T. industry for the last 20 years as a result of never securing a position in the sciences. Andre graduated from the University of Western Australia with the degrees BSc (Hons), MSc both in Mathematics and Statistics. Having grown up in the South West of Western Australia, Andre is familiar with many of the native plants of this region. With the bulk of his work career in the eastern states of Australia he has become acquainted with many native plants of the eastern states.

Introduction

With the advent of the digital revolution and cameras now using flash memory cards, mini hard drives and USB drives, the ability to take many more pictures than film would permit and to store vast numbers of pictures has become both a success story and a concern. The concern here, being around the quality of photographs taken, albeit that concern has been around for ages even with film, and of what to do with all these digital images. In the case of a scientist who may take tens to hundreds of photos of a given specimen, how best should the scientist go about presenting these in whatever forum they deem necessary?

This article aims to begin a little series on a favourite topic of the author's, namely Digital Scientific Illustration. In this episode the author will intend a possible portion of a solution to the 'multiple pictures and how to present' question and demonstrate how that would be of use to documentation and taxonomical studies of Australian plants. (In fact, to plants anywhere in the world.) In the digital revolution almost anyone now can take a nice photo. Exceptional photos require a bit of extra work but are photos alone terribly useful?

Illustration

Scientific and Botanic Illustration has been around for ages, it has even become associated with courses in education¹ and rules². There are umpteen courses on Botanic Illustration out there. Some people aspire to, or have this as their career (examples are Margaret L. Flockton³

1 University of Newcastle NSW: www.newcastle.edu.au/bachelor-of-natural-history-illustration

2 Margaret Flockton Award www.gnsi.org/event/exhibit-call/margaret-flockton-award-2016

3 www.rbgsyd.nsw.gov.au/Science-Conservation/Botanical-Illustration/Margaret-Flockton





and Philippa Nikulinsky⁴) and there are rewards for successful achievement with the various competitions available and the printing of extremely beautiful books. Most, if not all this is garnered for the classical illustration where one uses a certain traditional scribing tool (pen, pencil, graphite, watercolour brush, oil paint brush) of choice on a certain traditional medium of choice (wood, paper, lino, cloth, bark...)

Suppose your scribing tool of choice happens to be a mouse, touchpad, stylus or finger and the medium is a touchpad, tablet or computer. The traditionalists would probably believe anything that comes of these to be the artistic licence of the devil and a pox be upon it! So how exactly should a positive light be cast upon these not so classical and hardly traditional tools?

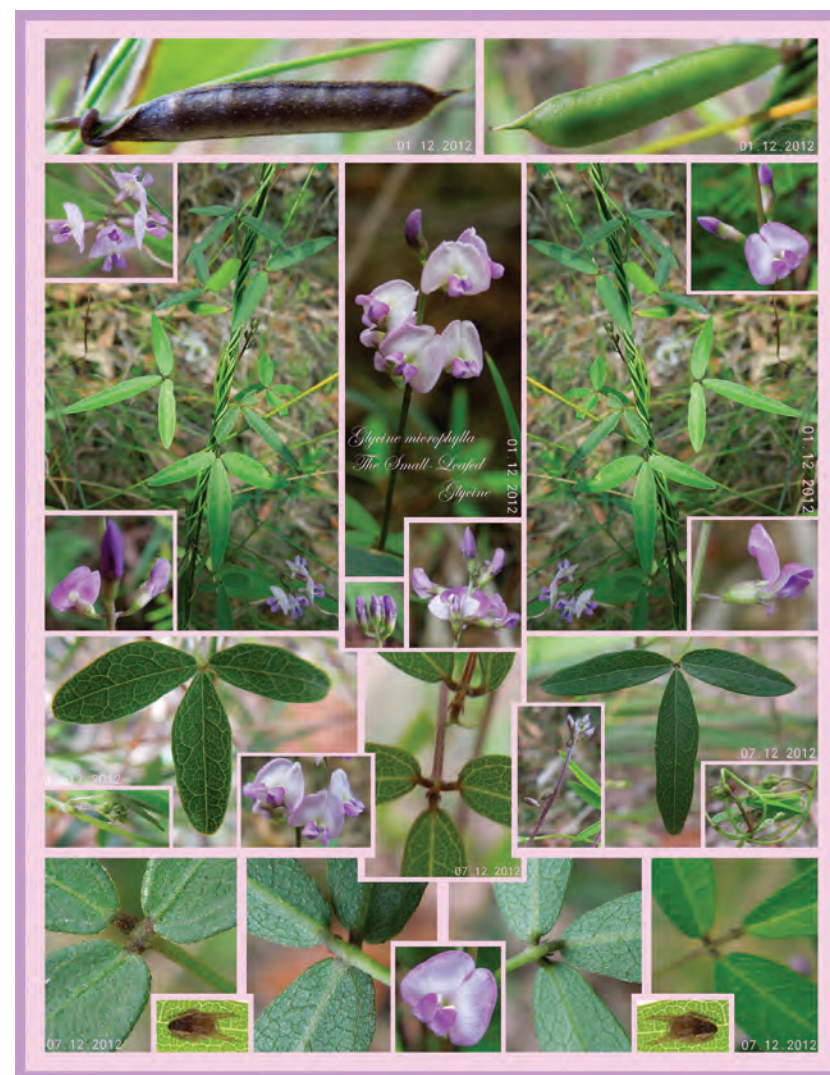
Ask for moment, if you will, why most illustrators engage in the task of illustration? Very few will reply that it is their job. Most would reply that it is; a hobby, a means of entertainment, a retirement pursuit, and so on. However, few would first think of the most basic need – it is **relaxing**. In most cases the illustrators get home from an exhausting day doing the needful at work, get themselves a tonic from the fridge, crack it open, a little too much gin and not enough tonic, and then sit down to do what relaxes them. It hence becomes a source of enjoyment, albeit frustrating sometimes but not commonly so.

So it is for a person involved in a profession that uses computers. Being computer literate and having gauged the scope that a computer can handle it would seem obvious that application of graphic design and illustration software may supply a form of entertainment[^], especially[^] when the television has become indefinitely annoying and negotiating the crowds outdoors would reduce your dignity to a ghost of its former self. A whole profession grew out of the needs of the printing industry, the digital graphic designers. In fact, there are some university courses dedicated to providing the skills required for this work too. In many cases, computer professionals find it quite relaxing in the twilight hours to attack a good bit of illustration or design if that is what inspires them. Perhaps a significant difference is that the computer professional often has to do things to meet a deadline but when they don't then they are in the same position as many of the traditional illustrators.

So what happens when you have a stack of photos and a digital artist gets hold of them? You do a 'Steve Parish', the author hears you all shout? You name it! The end result can be anything possible to be dreamed up. It will, however, be restricted to the electrons and bytes

⁴ www.nikulinsky.com.au

of the virtual world unless it is ever printed. The following example points toward a solution to using many photographs and sparing your Facebook friends from a thoroughly inconsiderate bombarding and leaving them feeling a degree of graphical overload – click 'like' and move on! If one were to really engage a person to look at pictures what kind of pictures would they have to be?



Glycine microphylla





Significant Properties of Digital Illustration

Probably the first and most important property of digital illustration is the combined effort of “undo” and “erase”. This is for when the gin to tonic ratio has exceeded 3:1 and you are feeling not just relaxed but rather slap happy! These terms don’t really need to be described as I think most can anticipate that these would be magical assets to classical or traditional illustration.

The second property is the ability to clone or endlessly reproduce the original. This is something you cannot do with a Da Vinci masterpiece. Whilst it is possible to take a photo of a Da Vinci you can’t clone it. In fact later, with scalable vector graphics becoming the normal for graphics artwork, you will also have the ability to blow up to a much larger size without losing much clarity.

The third property is the ability to make adjustments to a final product, so as the years go by the original can be refurbished to fit the future.

Encountering a digital canvas is quite different from a paper canvas. The differences can be summarised succinctly as follows:

- a. The canvas can be varied in size on the fly.
- b. The canvas can have any base colour and any textural appearance, also variable on the fly.
- c. The canvas can have an any rectangular shape, again also variable on the fly.
- d. The canvas can be rotated or flipped on the fly.

With 3-D printing coming of age the “textural appearance” will soon become a real texture once printed, not maybe on traditional media.

On top of this canvas you may commit; art, graphics, composition, murder or what not and just leave it like this. [The software will not provide an alibi...] Most digital artists would introduce the concept of a layer for the inclusion of various steps of their master plan. A layer is like another canvas superimposed over the base canvas but the layer has additional properties.

- i. Layers do not have to be the same size as the canvas.
- ii. Layers can vary in colour, shape, textural appearance.
- iii. Layers can vary in opacity / transparency.
- iv. Layers can be superimposed on each other and so can be blended into each other.
- v. Layers can be positioned over the canvas in any manner.

- vi. Layers can be geometrically transformed (flipped horizontally, flipped vertically, rotated, skewed).

A canvas with multiple layers can be saved as such and so each layer can be edited or even replaced or another layer added. A canvas with multiple layers can be flattened and this is advisable to reduce the size of the master image but after flattening, editing of layers is no longer possible. Given the average size of a USB Thumb Drive (or most hard drives) now is 16 Gb (or hundreds of Gbs for hard drives) there is not the need to flatten an image so the image can be left unflattened and available for editing for the term of your natural life if necessary. Printing requires an image to be flattened currently. The digital age makes this a trivial matter as you simply duplicate the file in which the image is stored – flatten that one – and then print it! Editing layers is often done with masks and the author won’t say much about that here as that becomes a little more software dependent. An immediate application



Stenocarpus sinuatus





of transparency in layers is to trace an image or parts of an image to create a drawing style (line art) picture from an original that had much more depth of colour in it and usually, sharp, well defined edges.

Colour is an extremely important consideration. An artist in traditional illustration will spend countless amounts of time mixing colours and then needs assurance the colours get preserved if they need remixing at some stage for another location in a big mural. In the digital world a colour is precisely coded and repeatable with ease. Perhaps the hardest part is identifying which colour should be used and whether a gradient of colour would be better. In the case of using photos as the layers, many of the needed colours have already been supplied by the camera itself. With colour there are also options to change; shadows, contrast, brightness, and lighting, within the layer or overall picture. This can be done easily in the digital world.

Finally there are the 'tools'. Unfortunately, corkscrews and can openers are not part of the equipment! Yes, the software can be used to alter:

- what digital instrument is used: brush, pencil, ink ... all dynamically changed and defined



Gastrolobium bilobum



Leptospermum sericeum

- the apparent textures, patterns and colour palette
- the selection tools, extraction tools, surgery tools.
- the blending tools and cloning tools

For that unwanted fly in the froth on the beer - just clone the froth to eradicate it!

The author feels a little stupid spouting all this since the digital artist would know all this and take it for granted. However, a person not familiar with any of the digital graphic and illustration software may not realise the benefit of using it. Having introduced the concept of layers it is only natural to ask what can be used as a layer? Anything really! You can photograph a brilliant pencil drawing and use the detailed photo as a layer, possibly in a bigger project that may have digital painting in other layers and diagrams and text layers.

So in actual fact a digital artist can be a traditional illustrator too and mix and match. This can be rather important, since in a larger work photos or maps from historical sources and drawings from others could be used (copyright excepted of course) and combined into a detailed brochure.

Acquiring Graphic Design Software and Experimentation

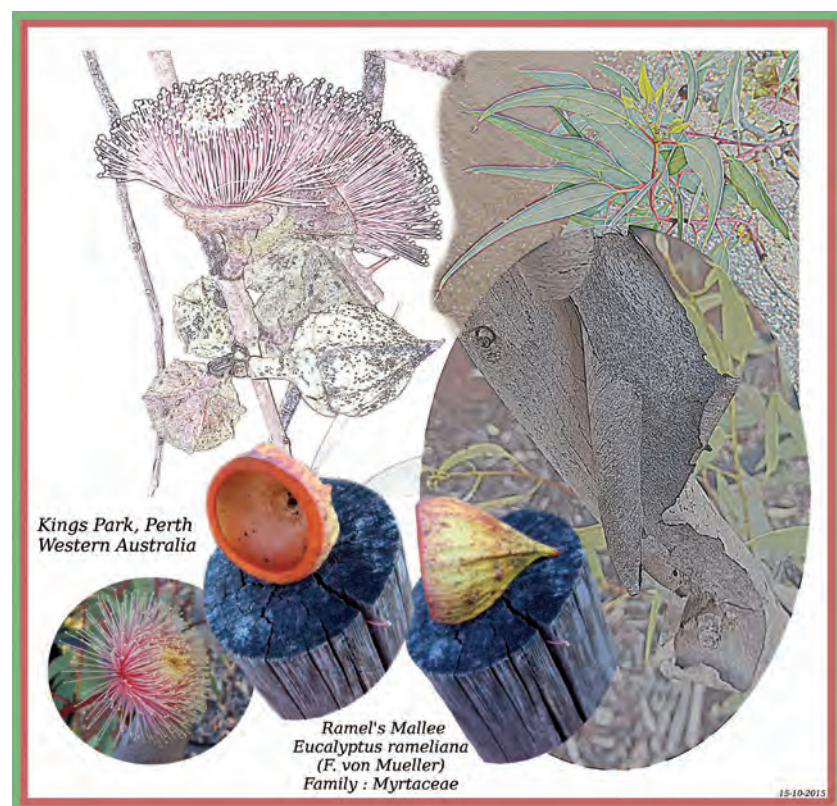
The author uses a version of the Linux Operating System and so uses the GNU Foundation Software that comes freely available with it. The





software rivals the proprietary software of the Adobe Corporation and others and is equally as powerful in scope and depth. On the Windows Operating Systems one can download and install Windows equivalents of the GNU Foundation Software or buy the proprietary software. One can always start by using Windows Paint. However, Paint has none of the nice options or features of the more powerful; Gimp, Inkscape, Krita, or the proprietary Photoshop and Illustrator. The author would recommend the reader to try the GNU software and use internet help pages to provide assistance in learning the software.

This has been rather enjoyable and the author would hope others can find as much suitable relaxation and endeavour in trying it. Some guidance has been provided on how multiple pictures can be used to great effect as the one picture, hinting at what might be better than presenting multiple pictures as they are. There are suggestions of how to describe a real plant with a lot more clarity, in a single picture, from multiple pictures of that plant, while retaining an air of artistic licence



Eucalyptus rameliana



Leptospermum sericeum



Gleichenia microphylla

that is surprisingly pleasant and does not detract from the portraying of the plant subject. In the next episode, the author will look at techniques to be able to illustrate plants sorting out one or two of the problems of combining pictures seamlessly and offer a depth of field to the final creation.





Others who are peers in this area

Niki Simpson (Traditional & Digital Botanic Illustration)
www.nikisimpson.co.uk and www.visualbotany.co.uk

Juan Luis Castillo (Traditional & Digital Botanic Illustration)
www.juanluiscastillo.com/endemic-and-threatened-spanish-plants.html

Anne Hayes (Traditional Botanic Illustration)
www.designmontage.com.au/2012/06/anne-hayes-artist-illustrator

Macoto Murayama (Abstract Floral Art)
frantic.jp/en/artist/artist-murayama
www.treehugger.com/natural-sciences/art-intelligence-nature-luminous-photographic-art-macoto-murayama.html



Incubaceae, *Tuberia* sp.

Weeds, herbicides, the law and you

Sandra Guy

Virtually every property, whether a small garden or substantial acreage, has weeds; which are simply plants thriving where they're not wanted. Most have been introduced from overseas but even some Australian natives, such as Cootamundra wattle, have gone weedy after being planted outside their normal range.

Approximately 80% of Australia's current weed species were introduced intentionally. Not unlike the notorious cane toad, many of these plants were useless in the first place and are now causing rampant destruction.

We have weedy garden and orchard escapees, pond and landscape ornamentals (eg lantana, blackberry, Madera vine, water hyacinth, camphor laurel and African olive); plants intended to improve agricultural pastures (gamba grass, paspalum, African lovegrass); plants to supply industry (prickly pear for red cochineal dye for fabric); and, with extraordinary irony, plants incorporated in "environmental improvement projects" such as dune stabilisation (bitou bush).

Gamba grass is an excellent example. Extensively promoted for over 100 years, it is now wild over vast areas of northern Australia, transforming native woodlands into exotic and often impenetrable grasslands. It increases fire intensity five-fold and increases the cost of



Bitou bush infestation. All photos courtesy NSW DPI WeedWise.





fire management ten-fold. The eventual environmental and economic impact of gamba grass alone will likely be too great to accurately quantify.

It is estimated weeds currently cost Australian farmers around \$4 billion pa; and do a similar amount of damage to the environment. They destroy biodiversity and wildlife habitat; degrade the landscape; reduce tourism; diminish agricultural and forest productivity; cause significant social impact and hardship; and reduce property values. Weeds can also poison or injure animals – stock, wildlife and pets – as well as increase fire risk to both private property and native landscapes.

Obviously we've made some pretty poor decisions in the past regarding what we planted and where; and we're now paying a substantial price. The lesson, if we're prepared to learn from history, is to be circumspect in future; so *before* we introduce a new plant to our gardens we should ask, "Will it turn weedy? Am I planting a problem?" With the exception of locally endemic natives, all new plants should be treated with a healthy degree of suspicion and, where possible, we should plant only sterile hybrids.

Unfortunately, agribusinesses and the plant nursery industry are still developing and promoting new plant varieties and species which are already known to be invasive weeds. They make the profits but pay none of the costs; so it's unlikely their business models will alter without a significant change to legislation. Controls on introducing plants, similar to those that now apply to the introduction of animals/viruses/bacteria etc seem remarkably sensible, if not overdue.

Given the significance of the problems it is not surprising that land managers have a legal obligation to control weeds; with noxious weeds designated in Classes 1–5. The Classes 1, 2 and 5 are the most serious, being "notifiable weeds"; meaning outbreaks must be reported to the local control authority within 24 hours of discovery. You can check the listing of noxious weeds in your area with the local council or shire.

The very worst of our weeds are now also been classified as "Weeds of National Significance" (WoNS). In a world-first, Australia has identified 20 weeds (of a potential 3,000 considered) which meet certain essential criteria and which represent the greatest future risk; because everything weeds do well, these weeds do best. It is perhaps a little frightening that many APS members will know at least some of these 20 weeds well, and probably have them on our properties. (See more at www.weeds.org.au/WoNS).

If you want to give yourself a fright, check the "potential distribution" maps for our 20 WoNS on the Weeds Australia website; as below, for Athel Pine. If you think blackberry, fireweed, lantana, broom, serrated tussock or willows are no big deal, you might need to reconsider.

Athel Pine



Current distribution (left)



Potential distribution (right)

When weeds get out of control on one site the problem cascades, affecting nearby sites as they're spread by wind, water and animals. Every viable seed produced on one property can cause a problem somewhere else; and this can be tens of thousands of seeds each season, from just one plant.

For this reason, councils can issue a landholder with a weed control notice requiring immediate action. If the problem persists, council can send in pesticide contractors - with the bill to be met by the landholder. In the worst scenario; a property can be forcibly sold by the council to recoup the cost of the weed control. Now I think I've got your attention. Yes, weeds are certainly serious stuff.

A healthy garden or bushland area has a propensity to resist weeds establishing a foothold, so try to mimic natural ecosystems with your choice of plantings. Observe the species balance in natural ecological communities and try to replicate something similar at your site. Include species that add nitrogen to the soil; ensure there is adequate natural mulch and nourishment; and encourage beneficial insects.

Become familiar with your local weeds and inspect your site regularly. Identifying a weed problem early means it is much easier to control. When weeds become established they build up a seed bank in the soil which can lead to years or even decades of new sproutings, even well



Kudzu vine in tree canopy.

after mature plants have been removed. The adage, “One year weeds; seven years seeds” is usually an understatement.

However, even with the most concerted vigilance, more active intervention is sometimes required to control weeds. Various control methods are required for different weeds and each method has its benefits and limitations.

Depending on the site and the number and type of weed species, and how well-established they are, it might be necessary to combine a variety of control methods, which is called integrated weed management.

The more common weed control methods include:

- manual removal (roots and all);
- smothering them in situ with plastic or mulch;
- mowing, slashing or grazing (by farm stock or pets);
- heat (in the forms of steaming, flaming, solarising and fire);
- biological control using natural enemies such as insects, mites and disease; or
- chemical control with herbicides.

Often, given the limitations of the site or the scale of the problem, herbicides must be employed. Herbicides give us access to the most advanced chemical control options available but many of us are unaware of how to correctly select and use them for best effect; and

unfamiliar with the strict laws and conditions on their use. Some people prefer to employ organic options; but even these ‘natural’ controls are covered by the pesticides legislation.

Every state and territory has its own pesticide laws but the general principles are identical. Essentially, the label on the container stipulates legally-binding conditions of use, including which specific weeds can be treated with each herbicide; as well as when, where and how the herbicide can be used. Breaches of the law are investigated by your Environment Protection Authority, or similar department.

The herbicide label is not a suggestion; it is a strict, legal stipulation which binds the user. It is a breach of legislation to use a herbicide on a weed that it is not registered for; or to use a different strength solution; or to use it at a time of year not specified; or in any manner not specified on the label.

Perhaps equally important, ignoring the label is likely to be a waste of your time, effort and money because rigorous field testing has demonstrated which herbicides work on each weed; and the most effective herbicides are registered for that purpose.

Causing overspray, by allowing herbicide spray to drift onto a neighbouring property or into a waterway, is also a breach of legislation and can seriously disrupt neighbour relations; so check the weather conditions and avoid spraying if it is windy or too hot.

Don’t spray when rain is forecast as it will wash the herbicide off – which will be wasteful, ineffective and can cause water pollution and/or affect neighbouring properties.

Affecting ‘non-target species’ (a plant you didn’t mean to poison) is also against the law. This means careful planning, correct herbicide selection; appropriate and careful application methods; considering the site’s specific features and limitations; and the weather. Adjusting or even ceasing operations during application might be necessary to avoid accidentally poisoning the wrong plants.

Pesticides all have a strong odour, so it is good to advise neighbours before using significant quantities. The smell is produced by an added odourising agent which is designed to vaporise into a harmless gas at normal air temperatures so that it travels further than the liquid pesticide. The odour is a handy signal that pesticides are in use nearby; but neighbours might worry they are inhaling a pesticide rather than just a harmless, albeit unpleasant, odour. Advance notice can alleviate those concern and misunderstandings.



So much to know. But how do we find out what we need to know before we start - before we even buy or use a herbicide? Government agencies and their internet sites can provide all the information we need. Not social media sites, not anecdotal recommendations; just facts, laws, labels and science.

Herbicides & pesticides: Firstly, herbicides belong to the chemical family known as pesticides; as do all the chemicals that control pests. ie insecticides, rodenticides (including baits), fungicides, algaecides; and all the 'organic' or 'natural' concoctions, whether purchased or mixed at home in a laundry bucket. It is not correct to assume that if a mixture is not a registered pesticide then the pesticides law doesn't apply. If it is used as a pesticide, then the law applies. In fact, using an *unregistered* pesticide is actually a breach of the legislation!



A groundsel bush infestation with the horses.

Weed Identification: To begin at the beginning, we need to know what we've got. Many plants look very similar to others, so correct identification of the plant is the essential first step.

Talk to the Weeds Officer at your local Council or Shire; or with your state or territory's department of agriculture or primary industries. Some states also have an agency that provides advice to landholders with acreage (in NSW this is the Local Land Services, previously known as the Catchment Management Authority). These agencies might also run weed workshops and field days.

Volunteering for BushCare, through your local Council or Shire, will put you in touch with a trained Coordinator who will be the proverbial font of knowledge. It's also fun, will provide invaluable field training and is an excellent way to meet like-minded people who are passionate about native plants and experienced in local weed identification.

A sample of the weed is almost always essential for correct identification. Officers might visit your site; or ask you to post or deliver samples. But if you take photos include a ruler, tape or object in the shot to clearly indicate scale and/or measurements. Show the back, front and side of the leaves in close-up; and the leaf held to the light to show the vein pattern. Take shots against a plain white background when possible. Also, show how the leaves attach to the stem. A photograph of the plant in situ is helpful; and indicate if it is a tree, shrub, groundcover or vine.

Descriptions should be precise. "Very big" is too vague: so give dimensions. eg "7m high x 2m wide". Describe if the leaf is hairy, spiky or smooth; shiny or dull; and if it is a different colour on the front and back. If you don't have a photo of the flower describe the colour and shape; state if it is a simple flower or a compound inflorescence; and indicate when it flowers. Liken it to a flower you know, if necessary.



Photos for weed identification must show detail: size, shape, colour variation, weed in situ, etc. as these four examples of an African Olive.





Also, ask your local government agencies to recommend the best books and key guides for weeds in your area. Websites are also improving rapidly and can greatly assist with weed identification.

Choosing your herbicide: The federal body that registers herbicides in Australia is the APVMA – the Australian Pesticides and Veterinary Medicines Authority and you can search the website (www.apvma.gov.au) to identify which herbicides are right for your weeds; and read the herbicide labels.

Herbicide registration is reassessed regularly and they can be deregistered; and adverse reactions should be reported to the APVMA. Adverse reactions include any personal symptoms like headaches or rashes; or unexpected results, such as the herbicide not working effectively.

You can also check if your state department of agriculture produces a ‘weed bible’; as this publication can be invaluable, especially for those with numerous weed species. (In NSW, this publication is the “*Noxious and Environmental Weed Control Handbook in non-crop, aquatic and bushland situations*” and it is likely to have a similar title in other states.) This handbook is available in hard copy and on the internet and will list the weeds found in your area and which herbicides can be used on them; the appropriate solution strength; as well as when and how it should be applied.

Your state or territory ‘weed bible’ will cover all the essentials:

- Integrated weed management (combining various control methods)
- Legal responsibilities associated with pesticide use
- Reducing herbicide spray drift
- Using adjuvants (additives that improve herbicide effectiveness)
- Cleaning spray equipment
- Withholding periods
- Herbicide resistance
- Control techniques using herbicides
- Weeds declared noxious in your state or territory
- Minor-use permits (or off-label Permits)
- Noxious and environmental weed control (weeds/herbicides)
- Spray calibration methods

In some states there is also a free weeds app for mobile phones;

incorporating the local ‘weed bible’ as well as weed profiles and legal requirements for weeds in that state. In NSW this app is called WeedWise from the Dept of Primary Industries; available on Google Play and the App Store.

If there is no herbicide listed for your weed, check if there is an “off label Permit” approval by the APVMA. A Permit allows the use of a herbicide on the weed when the label does not mention it – hence “off-label”. However, users must obtain a copy of the Permit; read all the details, conditions and limitations’ and comply strictly with them all.

Primary producers and hobby farmers who use pesticides face further restrictions to ensure their produce (and our food) is not tainted with chemical residues; and are likely to require a Pesticide Licence. This applies no matter how small the quantities sold. If in doubt, check with your state’s EPA (or similar). This requires training, testing; and requires complete and accurate record keeping of all pesticides used.

Some herbicides must be mixed with diesel rather than water. As well as being more expensive than water, diesel is incompatible with most spray equipment as it quickly degrades the seals and causes leaks; and you don’t want to be carrying a leaky backpack. The specialised spray equipment will probably need to be ordered from an agricultural supply company and is comparatively expensive. So, while a diesel mix can be expensive and inconvenient, there are some weeds that can only be treated with a diesel solution.

Your research might show that one herbicide can be applied to several weeds; whereas others might only control one weed. Obviously it is more cost-effective to buy the herbicide with the wider use; but the herbicides that are ‘broad-scale’ will likely effect any plant they land on; so careful application is essential to avoid unintended damage. However, when herbicides are more selective or specialised they can sometimes safely be used over a wider area without killing the non-target species they land on; such as native grasses. Site specific considerations like these are always going to influence your choice of herbicides.

Timing: Herbicides are chemically designed to kill specific plants; but must be effectively absorbed to do so. If the plant is dormant – usually due to stress, heat or cold – the plant sap is not circulating, the plant is not in an active growing phase; and so the herbicide cannot work. It just sits on the surface and harmlessly degrades. Spraying the leaves or bark will not kill the roots unless the plant effectively absorbs the poison. Different plants shut down at different times of the year; and for different periods of time; so be advised by experts.





Additionally, because plants undergo chemical changes during their growth cycle they might only be susceptible to specific herbicides for short periods. Mother of Millions (*Bryophyllum* spp) for example, can be treated with some herbicides before flowering, but others during flowering. Using the wrong herbicides at the wrong growth stage will have less effect on the plant and, being contrary to the label, is a breach of the legislation. It can also assist in the weeds developing herbicide resistance.

Application Methods: These are also specified for each weed and even the size of the plant. They include:

- rope/wick/wand application - wiping the herbicide across the leaves
- basal application – applying herbicide to the bark around the full circumference of the plant, from the ground to a specified height
- foliar application - spraying a weak solution over the entire plant, covering all leaves to the point of runoff
- splatter gun/gas gun – applying a few large drops of a stronger solution to very few leaves per plant
- stem injections (using drill and fill; tree spearing; and axe cut methods)
- cut stump/cut and paint – applying the herbicide within 15 seconds of cutting the trunk or stem off close to ground level
- cut and swab; similar to cut stump but for vines, where both ends of the cut must be swabbed with herbicide.
- scrape and paint/stem scraping - scraping away the top layer of bark to paint the exposed cell layer

Repeat applications, sometimes weeks apart, are required for some weeds. Rather like a course of antibiotics, the full course is required to kill the weed.

So, that's weeds and herbicides in a nutshell. Obviously this article is merely an introduction and there's lots to learn; but turning your back on weeds or putting off treating them because 'it's a big job' is not a realistic option.

"A few patches of lantana" that you believe are under control on your property will produce seeds that will be spread by birds and might be sufficient to infiltrate and destroy a nearby rainforest. So gird your loins, do the research now, and prepare to fight the good fight this spring! See you in the forest.



Broadleaf pepper tree, with colourful red berries.



Cats Claw creeper in tree canopies



