Streamlines

Newsletter of the Pullen Pullen Catchments Group Inc.

May 2017

Welcome to the May issue of Streamlines which announces the recognition of Ray Krafft's contribution over many years to the health and beauty of our environment.

Our first article is an alert provided by our Creek Catchment Officer, Leah Hattendorff, for Badhara Bush (Gmelina elliptica). *This weed was only known from a few locations around Rockhampton but a bush has recently been found in Bellbowrie. Please report any sightings of this weed to Biosecurity Queensland, the Queensland Herbarium or Leah (Leah.Hattendorff@brisbane.qld.gov.au*

Most of us learnt something about photosynthesis at school but in the last decade or so, techniques have developed that allow the photosynthesis process to be analysed to extraordinary degrees of accuracy. John Ness has summarised this new information and points out that by understanding this process a little better one can make information-based decisions about questions such as what type/colour of tree guard should be used, when herbicide should be applied, what time it is best to plant seedlings, why weeds grow so well etc which he will pursue in later issues.

Graham Stirling continues his series of articles on soil health. This time he emphasizes the role of organic matter in maintaining soil health, describes how farming practices and urban development have negatively impacted soil health and how soil health can be restored.

The final article about Noisy Miners is very heavily based on one prepared by Joan Dillon for subTropical Gardening issue 42. I thank The Editor and Joan for permission to use the information. SubTropical Gardening, voted Queensland's Most Popular Gardening Publication by the Queensland Council of Garden Clubs, is available from the website www.stgmagazine.com.au.

All members are welcome to submit articles to Streamlines via helian@pretirementresorts.com.au. The deadline for the next issue is August 15.

Very best wishes,
Helen Ogle
Editor

Contents

Pullen Pullen Catchments Group

A Landcare Group

Meetings

Meetings are held at 7pm on the first Wednesday of each month at Pullenvale Environmental Education Centre, 250 Grandview Road, Pullenvale.

Website

www.pullenpullencatchments.org.au

Working Bees

Pullenvale Forest Park – 2nd Sunday of the month, 8.30 – 11 am
Anstead Bushland Reserve – 4th Sunday of the month, 8.30 - 11 am.

Tools, gloves, etc are provided at Working Bees. Just wear sturdy boots, tough clothes and bring water and a hat!

Committee Members 2017

President:	John Ness	3202 7556	president@pullenpullencatchments.org.au
Vice President:	Richard Ponsonby	3202 9484	members@pullenpullencatchments.org.au
Treasurer:	Kaaren Ness	3202 7556	
Secretary:	Liz Dominguez	3202 7967	contactus@pullenpullencatchments.org.au
Committee Members:	Brian Dean	3202 8553	*Bushcare Coordinator, Anstead*
	Irene Darlington	0409 026 883	wildlife@pullenpullencatchments.org.au
	Ron Tooth	3374 1002 (W)	
	Ray Krafft	3202 6470	
	Lynn Brown	0417 648 050	*Bushcare Coordinator, Pullenvale*
Website Coordinator:	Nola Dean	3202 8553	contactus@pullenpullencatchments.org.au
Streamlines Editor:	Helen Ogle	3323 7407	editor@pullenpullencatchments.org.au
Creek Catchment Officer	Leah Hattendorff		

Membership Options

Membership fees are:

- Annual Membership – $10 per person payable on March 1 each year
- Life Membership – $100 per person

We are delighted to accept donations.

a) Send a cheque payable to PPCG to PO Box 1390, Kenmore, 4069 or
b) Transfer the funds electronically to BSB 064 152, Account No.10107038 Ref: your name.

BRISBANE CITY

Dedicated to a better Brisbane

"The Pullen Pullen Catchments Group acknowledges the support of the Brisbane City Council for costs associated with the website, the printing of Streamlines and with running the working bee mornings in Anstead Bushland Reserve and Pullenvale Forest Park."

NEWS

Honorary Life Member: Ray Krafft

Pullen Pullen Catchments Group began right at the end of the last century, and over the years has attracted many people who have a respect and affection for "The Bush" – however you care to define it – and many have had, and still do have, a working bond with this "Green and Pleasant Land" (as PPCG's first president, Ian Cameron described this terrain that lies in a great loop of the Brisbane River). PPCG's "population" has varied in the last two decades; new faces, new residents, arrivals and departures. There's a relatively small number of "permanent residents" – bushcarers who have been with the Group for most or all of its history.

Ray Krafft is such a one, and he's devoted large amounts of his time and energy, for many years, to carrying out the programs of regeneration and conservation set up by PPCG within its large and varied catchment area. Ray is very much a "hands-on" on-site bushcarer, not only getting his hands dirty, but since 2005 taking on the coordination of the newly formed Anstead Bushcare Group and overseeing the replanting and maintenance of extensive areas of highly visible land. Photographic records of all of PPCG's sites (not just Anstead) show Ray planting, trailblazing, excavating, recording – in short, a multitude of tasks, often "behind the scenes" *(ever asked: Who made that track? Installed that seat? Highlighted that rare plant?).*

It's only recently that health issues have caused Ray to reluctantly hand over the coordinator's baton, and Pullen Pullen Catchments Group, in recognition of his dedication and devotion to the care of our environment, have determined to make Ray Krafft an Honorary Life Member of PPCG.

Cyclone Debbie caused considerable damage to the walking tracks at **Anstead Bushland Reserve** where Cobblers Pegs continue to be a sticky problem. John Ness reported that $40,000 of the "What's Your Nature' grant will be used for weed removal in the reserve. If there is any excess, it will be used for weed removal in Pullenvale Forest Park. Working Bees will be held on June 25, July23 and August 27.

After recent rains, many fungi appeared at Anstead Bushland Reserve prompting the suggestion that a fungal section could be introduced into the website. Margaret O'Grady is happy to do some photographs. Do we have any other members interested in photographing and/or identifying our local fungi? If so, please contact the Editor (helian@pretirementresort.com.au)

Airlie Road Park lost some plantings along the creek banks and some of the wire anti-goat cages were washed away. Brisbane City Council contractors will soon start planting there using an experimental jute mesh cover as a stabiliser. It is hoped that a SEQ Catchment grant will enable removal of Leucaena from this site.

NEWS continues on page 9.

Invasive Weed Alert – Badhara Bush (*Gmelina elliptica*)

Badhara bush infestation

Badhara bush leaves and stems with paired spines

Badhara bush flower

Badhara bush leaves and fruit

Native to Asia, badhara bush, also known as Asiatic beechberry and oval-leafed gmelina, has been introduced as a cultivated ornamental to the world's warmer regions.

It forms dense thickets, reducing biodiversity, shading out useful pasture species and impeding stock movement.

Badhara bush is a highly variable, thorny shrub or small tree, 2-4m tall (occasionally up to 10m). Its stems are yellowish or brownish white and the branches are armed with pairs of spines.

Leaves are dark green above, paler below, in opposite pairs, usually with 1 of the pair smaller than the other. They are generally ovate, 1-10cm long, 1.5-6cm wide and pointed at the apex. Younger leaves are 3-lobed, older leaves not lobed, with sparse hairs on undersides.

Flowers are yellow, tubular and generally around 5cm long. The fruit is yellow when ripe, pear-shaped, about 1.5cm across with 4 chambers in which seed can be found, though usually only 2 chambers have fully developed seeds.

Badhara bush prefers subtropical forests and occurs in dry, intermittently flowing water courses. The only known infestations (until now) are near Rockhampton. It is spread mainly by bird-dispersed seeds. Woody taproots can produce suckers, particularly after disturbance.

Badhara bush is a Class 1 declared pest plant under Queensland legislation. Class 1 pests are not commonly present or established in Queensland and have the potential to cause impacts to whole or part of the State. The introduction, keeping, releasing and supplying of a Class 1 pest is not possible without a permit, for scientific research about the pest, issued by Biosecurity Queensland.

Be on the lookout for Badhara bush and report it to Biosecurity Queensland on 13 25 23.

Early detection and reporting are the key elements in controlling Badhara bush

Information summarised from Queensland Government websites. Images copyright of the Queensland Government

Photosynthesis – an Introduction

Photosynthesis takes place mainly in leaves and is the process by which plants, some bacteria and some protistans (one-celled organisms) use the energy from sunlight to produce glucose (a carbohydrate) from carbon dioxide and water.

The basic equation for photosynthesis is given below. It represents the starting point and the end point. There are many intermediate steps as carbon dioxide and water are broken down into their component parts and re-assembled into other compounds.

Carbon dioxide gas from the atmosphere	+	**Water** from the soil	→ in the presence of **light** (photons) and **chlorophyll**	**Carbohydrates** the basic building blocks of plants	+	**Oxygen** gas which is released into the atmosphere	+	**Energy**

Chlorophyll is a pigment that absorbs light most strongly in the blue portion of the spectrum, followed by the red portion. Conversely, it is a poor absorber of green and near-green portions of the spectrum, which it reflects, producing the green color of chlorophyll-containing tissues. Other pigments, such as chlorophyll b (green), xanthophylls (yellowish), and carotenoids (yellow/orange/red) absorb energy that chlorophyll a does not absorb.

Phacts on Photosynthesis

John Ness

Overview

Everyone knows the equation $E = mc^2$ which states the relationship between a lump of matter m and an amount of energy E if all the matter could be converted into electromagnetic energy or vice versa. The “c” term is the velocity of that energy which is a very large number and so c^2 is a very much larger number. There are about 7 billion people on earth and it would take 13 million earthsful of people, to get the number of people to equal the numerical value of c^2 in standard units.

Another equation of equal importance, but hardly known at all, is $E = hF$ which says how much energy there is in a single photon of frequency F. A photon is the smallest amount of energy possible. The Planck constant h is an incredibly small number such that if you multiplied h by the very large number c^2 you would still get a very small number.

A photon of course is the miniscule unit of energy that kick starts photosynthesis and thus underpins the whole of life on earth. It is a very small thing to rely on for your existence but don’t despair, there are an enormous number of them. On a sunny day about 2 million billion photons from the sun pass through each square mm of a leaf in every second. Some of these photons are sure to hit a water molecule and start the photosynthesis process.

Leaf Factory

A leaf is a small factory or actually an assembly of many small factories configured to get these photons to collide with water molecules and then to organise the consequent flow of liberated electrons and protons (hydrogen nuclei) to interact with carbon dioxide to make the carbohydrates that form plant structures.

As well as making the carbohydrates which only require three inputs – water, carbon dioxide and photons – the leaf factory has to make more copies of itself if the plant is to grow. Plants therefore require nutrients (calcium, nitrogen, manganese etc) for this replication step. These nutrients are sourced from the soil for terrestrial plants or from dissolved material in water in the case of aquatic plants.

It is only in the last decade or so that X ray techniques with the necessary speed and resolution have been developed that allow the structures of a leaf factory and the operations therein to be determined with sufficient accuracy to understand the details of the photosynthesis process.

The leaf factory has various departments to handle the production of carbohydrates and cope with external variations in the supply of energy (photons), materials (water and carbon dioxide) and nutrients (nitrogen, phosphorus, minerals). The factory requires considerable infrastructure and a way to get rid of the waste product, namely oxygen.

1. Photon (Light) Harvesting Department

The first department in this factory is the antenna or light harvesting section which preferentially collects photons of a certain energy (frequency range or colour) and reflects or transmits the rest straight through.

For some curious reason, lower energy photons at the bottom of the visible light range (red colours) or the higher energy ones at the top of the visible light range (blue colours) are preferred for this process. The ones in the middle (orange, yellow, green) are reflected or go straight through and this is why leaves mainly appear green. It is rather odd that the terms 'green' and 'greenies' have taken on the current meanings in an environmental context because green is exactly the colour, in most cases, that is <u>not</u> used in photosynthesis.

Why is this so? Well if you could talk to the trees they might listen to you but they would probably prefer not to answer as plants pinched the photosynthesis patent from cyanobacteria (*a group of bacteria that obtain their energy through photosynthesis, sometimes incorrectly referred to as blue-green algae because of their colour)* a half billion years or so after the cyanobacteria had spent around one and a half to two billion years working on the concept. This might be the largest Intellectual Property theft in the history of the Universe.

Plants have evolved to have different ways of capturing photons (which is why leaves can be colours other than green) and a couple of different ways of subsequently binding carbon dioxide with water to make carbohydrates but the critical central operating core has not changed from that developed by the cyanobacteria.

Blue-leafed Begonia

Red leaves are not all that uncommon which means the plant is using photons from the top end (blue) of the visible spectrum for photosynthesis. Blue leaves are less common but some Begonias that have evolved to use the low intensity levels of green light on forest floors have brilliant iridescent blue leaves. Their antennas have evolved to make as much use as possible of what green and red light is available so reflect only a narrow spectrum of blue.

A photon needs enough energy to knock an electron out of orbit from the a hydrogen atom in a water molecule and red photons at the lower energy end of visible light have, with a bit of help, just enough energy to do this. Blue photons have about 1.5 times as much energy as red photons whereas violet and especially ultra violet being even higher in frequency and thus energy can knock out electrons from lots of atoms as well as hydrogen and so cause havoc.

Plants have evolved ways to get rid of the extra heat caused by absorbing photons that do not contribute to photosynthesis but, like animals, rely on ozone and other trace gases in the atmosphere to get rid of most of the ultraviolet photons which would otherwise destroy them.

2. Energy Department

After the antenna department has captured a photon, well four photons virtually simultaneously to get the complete process underway which it does in a very short time, it directs the photons to the energy department.

The energy department is the same in all plants and in cyanobacteria, diatoms, phytoplankton and even the occasional insect. Here, the photons separate the water molecules into hydrogen atoms (protons), electrons and oxygen. There is a very special molecule in this department made up of four atoms of

manganese, one of calcium and one of oxygen and it is the physical layout of this molecule which facilitates the breakdown of water molecules by photons and the separation of the electrons, protons and oxygen components.

If you imagine a dog lying on its back with its legs in the air then the calcium atom is the body of the dog and the four manganese atoms are represented by each paw. Just like a real dog whose paws are not exactly symmetrically arranged with respect to the body and each other, the slight asymmetry in the manganese atoms seems to be what allows them to stop the hydrogen and oxygen from recombining to form water again. This molecule itself does not directly enter into the reaction but it is the working area where this reaction takes place and it has to be continually readjusted and repaired to function well. Like an upside down dog juggling balls between its paws, this molecule keeps the constituents of the broken up water molecule from recombining while allowing pairs of liberated oxygen atoms to form an oxygen molecule and it then flick passes the protons (hydrogen atoms), electrons and oxygen molecules along to the next department

3. Carbohydrate Production Department

The raw materials from the energy department are fed very quickly into the next department, the carbohydrate assembly unit, where the protons and electrons are combined with carbon dioxide to make carbohydrates. It was discovered only 50 years ago that this department can operate in two ways.

Most plants, including all trees, use the C_3 process which combines three carbon atoms in the first step to make more complex carbohydrates. Some grasses and most notably corn combine four carbon atoms, the C_4 process, to make carbohydrates. This is faster and about double the efficiency so these plants not only grow faster but use less water for that growth as the stomata which let the carbon dioxide in and the water and oxygen out can be open for shorter periods. These plants will tend to outcompete those that use the conventional C_3 pathway.

It takes roughly 10 square metres of leaf area to build 1kg of solid plant matter per day and this requires billions upon billions of photons to pass through the leaves. The leaf factories also have control mechanisms to deal with the large variation in photon supply and to avoid overheating. When the photon flow ceases, that is, at night then the leaf factories go into reverse and consume oxygen and some carbohydrate material and expel carbon dioxide and water so leaves requires a sophisticated material flow control and waste management.

4. Waste Management Department

The final unit is the waste removal one. Essentially this has to get the oxygen out of the factory as soon as possible and also make sure that water continues to flow through the factory and that heating due to excess photons is minimized.

Oxygen is essential for animal life but for plants can be a noxious waste product. If an oxygen molecule gets confused with a carbon dioxide molecule in the carbohydrate building step, then carbohydrate production stops. Some plants and most ocean phytoplankton have evolved a way to concentrate the carbon dioxide to feed into the carbohydrate manufacturing unit and so force out the oxygen molecules. Plants that have added this carbon concentrating variant will typically outcompete plants that do not have it as very little energy is wasted on inadvertently capturing oxygen.

Conclusion

What humans regard as weeds are very likely to be the clever plants that use the more efficient C_4 process and the carbon concentrating refinement and so outcompete the floral plodders. Humans, of course, are making it easier for plants by putting a lot more carbon dioxide in the atmosphere so the main thing plants now have to worry about is where to get moisture and nutrients and how to cope with increased heat.

With the basis of photosynthesis understood, it is possible to make respectable guesses about how to organise external affairs to promote desired plant growth based on the simple theory of constraints. That is, the constraints to growth are evaluated and sequentially removed or adjusted and this process repeated to maximise the growth required. This will be looked at in a future article.

.

Healthy Soils and the Pivotal Role of Organic Matter

Graham Stirling

A huge array of microorganisms and small animals live in soil and in the last issue of Streamlines, their role in improving the health of a soil was discussed. This article explains why continuous inputs of organic matter are the key to maintaining this vitally important community of organisms. It also discusses the role that organic matter plays in improving a soil's physical and chemical properties.

Soil organic matter is derived from plants, the primary producers in all ecosystems. They convert energy from the sun and carbon from the atmosphere into organic molecules and living tissues. Thus, the primary organic inputs into soil are leaves and twigs that fall to the ground; dead roots; cells that are sloughed from roots; carbohydrates, proteins and other substances that are exuded from roots; and carcasses and wastes from the animals that feed on plants.

This detritus plays a vital role in soil, as it sustains all the organisms in the soil food web. Bacteria and fungi multiply rapidly when organic matter is added to soil and they begin the decomposition process. A myriad of litter transformers and ecosystem engineers (arthropods, earthworms and enchytraeids) then break up this material and incorporate it into soil, increasing the rate at which it decomposes.

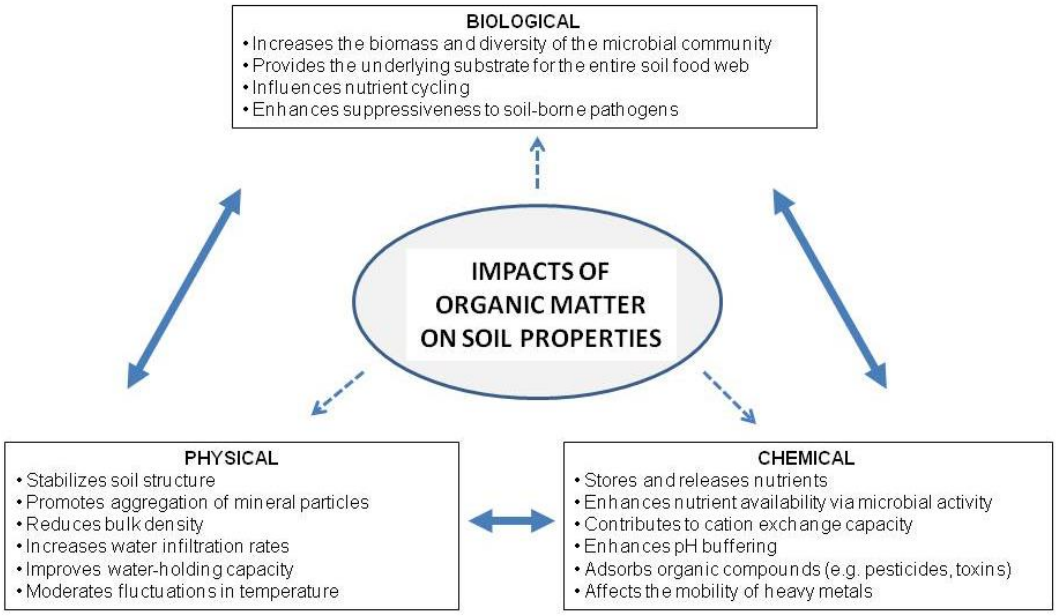
Labile compounds (e.g. sugars and proteins) are the first organic compounds to decompose. More resilient materials such as cellulose and lignin are then converted into a wide range of polysaccharides, polypeptides and organic acids. As this process continues, detritus is progressively transformed into complex and relatively recalcitrant molecules known as humus. Thus, soil organic matter consists of a number of components that vary in physical size, chemical composition and extent of decomposition:

- Living biomass (e.g. microorganisms, larger soil organisms, and intact plant and animal tissues)
- Organic materials in the soil solution
- Particulates such as roots and other recognisable plant residues
- Humus, a largely amorphous and colloidal mixture of organic substances that are no longer identifiable as plant or animal tissues
- Inert organic materials such as charcoal.

The particulate organic matter fraction, together with the living organisms it sustains, has a huge impact on a soil's physical, chemical and biological properties and those effects are summarised in the accompanying figure. Some of the more important effects are aerating and loosening the soil, improving its water-holding capacity, mineralising nutrients so they can be taken up by plants, storing nutrients so they are not lost to the environment, and suppressing the pests and pathogens that damage or destroy root systems.

In natural environments, the soil is always healthy because the plants that cover the landscape are continually shedding leaves and other above-ground materials, and that organic matter is then decomposed by the soil biological community. However, in managed environments, soil health problems always occur because humans do not replicate what happens in nature. Whether the soil is growing a crop, is under a grazed pasture or is in an urban environment, most of the carbon that was originally in the soil will have been lost to the atmosphere as CO_2. Practices such as tillage and overgrazing have had disastrous effects on agricultural soils while in cities and towns, the practices used to build roads and houses have completely changed the physical and chemical properties of our soils and destroyed the organisms they contained.

Over the last few decades, many Australian farmers have learnt from past mistakes and begun to improve the health of their soils. Management practices such as stubble retention, minimum tillage, cover cropping and rotational grazing have reduced carbon losses to the atmosphere and have also ensured that some organic matter is being returned to the soil. Home gardeners are also beginning to understand the linkage between organic matter and soil health. Some are adding compost and other organic materials to their soils while others are obtaining additional benefits by ensuring that the soil that supports their vegetables, trees and garden plants is always covered with a thick layer of mulch.



Organic matter has a major impact on many soil properties (dotted arrows). The solid arrows indicate that each soil property is also affected by other soil properties.

It is up to all of us to continue to spread the message that organic matter is a valuable resource. Enormous quantities of organic wastes are available in urban areas and they should be better utilised. When added to soil or used as mulch, organic materials improve soil health; reduce CO_2 losses to the atmosphere; protect soil from wind and water erosion; and store nutrients that might otherwise be leached into our waterways.

NEWS (continued from p. 3)

Pullenvale Forest Park was not that affected by cyclone Debbie. The latest plantings have coped very well with the inundation. The jute matting and mulch was mostly washed away, but the majority of the plants survived doing what they were meant to – stabilising the creek bank. We lost some big trees in the area, and wonder if the illegal cutting of the older established vines was partly to blame? The latest roadworks prevented any major damage to the roads and paths which was great. We are now working on the next section of Creekside planting. Working Bees will be held on June 11, July 9 and August 13.

The **PPCG Website** can now register the number of hits and their geographic origin revealing that it is being accessed from around the world. Toadshow will be asked to quote on providing keyword access to, for example, the birds and plants records.

Our **Wildlife** Officer, Irene, reports that with the lower temperatures, she was no longer receiving possums with burns on their feet (as opposed to about 10/week in the hotter weather) but after Cyclone Debbie there were many waterlogged birds, wallabies and reptiles coming in. There is a shortage of carers so if anyone is interested, please contact Irene at wildlife@pullenpullencatchments or on 0409 026 883. Irene is also looking for safe release sites for animals that have recovered. Once again, if you can help, please contact Irene.

Irene also reported that the **Moggill Wetlands** (an earlier PPCG project) are very overgrown, defeating their purpose of encouraging birdlife. Leah is investigating whether Land for Wildlife would be able to help improve the state of the Wetlands.

Birdwalks. The Cubberla-Witton Catchments Network has scheduled a walk at the University of Queensland Mine, Indooroopilly on June 10 and another at Biami Yumba Park, Fig Tree Pocket on June 24. Check their website for details.

What can we do about Noisy Miners?

Noisy Miners (*Manorina melanocephala*) are native birds, not to be confused with the introduced pest Indian Mynas. They are social birds that tend to live in large colonies. Many adults assist in nest building, feeding and rearing of young. They will attack and kill other birds and may attack people and animals. Their aggressive behaviour drives away smaller birds such as wrens, robins, small honeyeaters, spinebills and flycatchers.

Noisy Miners are naturally found in eucalypt woodlands where gum trees provide nesting perches and some food. However, their main foraging sites are the grassy areas surrounding the trees.

This is where we come in. Urban development and our garden styles have contributed to their proliferation. Our lawns and urban parks suit them very well. Land cleared for development, forest cleared of its understorey, road verges cleared of vegetation and traditional gardens with expanses of lawn are good habitats for Noisy Miners but not necessarily for our small native birds. Noisy Miner numbers will continue to increase while there is suitable food and habitat.

The good news is that we can help to restore some balance and potentially bring small birds back into our gardens. We should aim to create a layered garden. This simply means planting ground covers, small shrubs, larger shrubs and trees depending on available space, but selecting plants that will connect and overlap.

Native daisies fill spaces and attract butterflies. Low branches provide perches for robins. Ground cover grevilleas can be safe foraging areas for very small birds such as scrub wrens. Smaller, dense grevilleas with prickly foliage are preferable to the larger, more open hybrids. By selecting the right plants, these layers can provide seasonal flowers for creatures and for visual appeal. The layers contribute to density which discourages Noisy Miners.

Add some grasses for variety and seed as a food source for other birds. Shrubs such as the smaller baeckias and babingtonias with narrow, crowded leaves are useful. There are many shrubs and low plants to choose from including lomandras, dwarf bottlebrushes, mint bushes, Native Fuchsia (*Graptophyllum excelsum*) with its cerise flowers, leptospermums in a range of flower colours, Thyme Honey Myrtle (*Melaleuca thymifolia*) and hardy sedges.

Small native birds will adapt to non-native plant species when little else is available but a predominantly native garden with diverse plant species will ensure a diverse range of birds will be attracted.

Trees can be planted if room permits but a dense understorey is critical. Paths are best kept fairly narrow and covered with gravel or bark chips rather than planted with grass.

By modifying habitats over time, we have helped Noisy Miners to proliferate, but by planting gardens suited to smaller birds, we can reduce their numbers.

Summarised by Helen Ogle. The author of the original article, Joan Dillon, reported that Noisy Miners are absent from her property but present on a nearby property. They do not cross the wide expanse of natural forest with its diverse mix of trees and shrubs between the two properties. Her densely planted native garden is not suitable habitat either. Instead, a large number and a diverse species mix of small birds live and visit there.