Clarence... a brighter place

swift chatter

Winter 2019

Meadow Argus butterfly. *Junoinia villida*.
Photography: S Johns

swift tips | Capturing carbon with your plantings

The amount of carbon captured by a plant is a complicated function of a bunch of things that can affect its growth.

Things like; habit, local climate, nutrient and water availability, aspect and shading, forest density, pests, fire history and atmospheric carbon dioxide concentration.

There has been lots written about this and the research is vigorous and ongoing. Even a little bit of internet research will quickly bury you in links and documents exploring everything from the effect of future atmospheric carbon concentrations to optimal tree spacing in plantations.

But don't fret, here are a few questions to ask yourself that will help you to select plants that should be good at capturing carbon from the atmosphere.

Is it woody?

Carbon captured as wood tends to stay out of the atmosphere for longer than carbon captured as blooms, fruits, leaves or pulp **The woodier the better.**

Does it get big?

The bigger the plant the more carbon is captured. **The bigger the better.**

How long does it live?

Longer lived plants also store carbon out of the atmosphere for longer. **The longer lived the better.**

Does it grow vigorously?

Carbon is mostly captured while a plant is growing. **The more it grows the more it captures.**

How much watering will it need?

Wet soils and damp rotting leaf litter and detritus at the base of plants can lead to emissions of greenhouse gases. **The wetter the worse.**

Will it produce a deep organic layer?

Much of the carbon captured from the atmosphere by a plant community ends up in the ground as soil carbon. Some plant communities, like salt marshes, break all the above guidelines but still store vast amounts of carbon in the ground. **It depends on what you plant where.**

Should I really be planting this thing here?

Just because a plant is a great carbon capturer doesn't trump the other reasons for choosing (or not choosing) species for plantings (reasons such as invasiveness, maintenance, associated pest species, urban or ecosystem suitability, etc., …). **Plant things that belong.**

So, assuming you've gone through the check list above and chosen to plant a silver wattle and a blue gum, just how much carbon would you expect to capture?

It is relatively simple fun maths to estimate the carbon content of a wattle or gum. Here is a link to an infographic and source documentation to help you if you want to understand the maths; ecometrica.com/webcomics/one-tonne-carbon-tree.

The assumptions I needed in order to do my own back-of-the-envelope calculation of the carbon content and capture rates are shown in the table below.

	Silver Wattle	Blue Gum
Age to maturity	20 years	50 years
Mature height	25 m	50 m
Mature diameter at base of stem	0.75 m	1.5 m
Density of dried wood	600 kg/m3	700 kg/m3
Carbon fraction of wood	50%	50%
Stem to total volume fraction	60%	60%

From the stem to total volume fraction, and by assuming that the stem is a cylinder two thirds the height of the tree, the total volume of the tree can be worked out. From the age to maturity and the calculated volume, the dry mass and carbon content of the mature tree and average carbon dioxide capture rate of the mature tree can be estimated.

Tabel 2	Silver Wattle	Blue Gum
Carbon content of mature tree	3.7 tonne	34 tonne
Carbon dioxide capture rate	0.54 tonne per year	2.5 tonne per year

If you can only plant one tree – a longer lived large gum tree will capture carbon dioxide at about five times the rate of a medium shorter lived tree or wattle and store about ten times as much carbon over its lifetime.

So, just to put this all in perspective, an ordinary Australian family car emits about 200gm of CO_2 per kilometre or, at 50km of car travel per day, about 3.7 tonne per year. You'd need to plant and maintain two growing blue gums (or 7 silver wattles) just to offset one cars annual carbon emissions.

Finally … a couple of things to remember!

Carbon capture in plantings only works if you never return the carbon dioxide to the atmosphere by cutting them down or burning them and at the end of the trees growing phase you'll need to turn the mature wood into something long lived and useful.

Also, carbon capture "per hectare" is a different thing again! In fact, the king and queen of carbon capture per hectare are salt marshes and sea grass bed communities. Called blue carbon, they capture and store many more times the amount of carbon than any forest. A little effort caring for your local salt marsh can also go a long way in mitigating anthropogenic greenhouse gas emissions.

Dr Fred Pribac

25 years on the Hill and Foreshore

The Rosny Montagu Bay Landcare and Coastcare Group recently celebrated 25 years of continuous volunteer work with an event at the lookout in the Rosny Hill Nature Recreation Area.

The Rosny Montagu Bay Landcare and Coastcare Group recently celebrated 25 years of continuous volunteer work with an event at the lookout in the Rosny Hill Nature Recreation Area. In magnificent spring weather, present and past group members were joined by neighbours, friends, Clarence City Council Aldermen and staff as well as elected representatives from state and federal government and Landcare Tasmania. Guided walks to view endangered plants, a photo display and sausage sizzle provided the lead up to a cake cutting ceremony with the cake decorated to represent the Rosny Hill Reserve.

The group was formed following a meeting at the Rosny Hill Lookout on 6 June 1993. The meeting was initiated by new local resident Carole Edwards who, upon moving to Rosny the previous year, was captivated by the diversity of this urban bushland with its many flowering native plants, trees, walking tracks and expansive views. Carole was however also dismayed by the rubbish and total neglect beside the bitumen road to the summit and the area surrounding the lookout. She contacted Clarence City Council and was put in touch with Clarence City Council employee, Phil Watson. Carole and Phil together organised the 1993 meeting. Around forty people attended to collect rubbish and learn about identifying native plants and weed species.

Since the first meeting the group has held regular working bees, initially within The Rosny Hill Nature Recreation Area. Several years later it was recognised that the Rosny Montagu Bay Foreshore Reserve was another nearby area containing remnant bushland worth conserving and working bees were subsequently held in this reserve also.

Over the 25 years the group has worked with Clarence City Council, The Parks and Wildlife Service, council contractors and other organisations such as Conservation Volunteers Australia and Green Corp on conservation and rehabilitation projects. In recent years the bulk of group funds have been obtained through Clarence City Council's annual grants program to Landcare and Coastcare Groups.

Some of the group's achievements include:

- Sourcing funding to engage consultants to develop a management strategy for Rosny Hill and the foreshore.
- Assisting with the development of a "Tool Kit" for all landcare groups. This included health and safety advice and how to plan and manage projects on site.
- Almost total elimination of blackberry infestation in the foreshore reserve through working with contractors and ongoing monitoring.
- Removing rubbish and dumped garden waste from the "Old Quarry" on Rosny Hill and planting with endemic grasses, shrubs, and trees.
- The group won the Tasmanian State Urban Landcare Award in 2009 with two members travelling to Canberra to receive the award and represent Clarence and the State.
- Carole Edwards, the founding convenor of the group, held the position for the first 17 years and remains a member of the group. In 2015, Carole and former local resident and long term group member the late Graeme Short, were given Certificates of Appreciation by Clarence City Council for their nominations for Citizenship Awards for their voluntary environmental work.

The group continues to value, conserve and protect the urban bushland in Rosny and Montagu Bay.

By John Counsell, Convenor

Clean Up Australia Day
The facts and figures

Above: Tas Uni Dive Club with some of the rubbish pulled out of Kangaroo Bay, Bellerive. Photo by John Keane. Inset: Some of the 75 participants from one of the Mission Australia Housing Clean Ups. Photo by Kathryn Cranny.

The business, school, youth and community groups participating in the 2019 Clean Up Australia Day within the Clarence City Council municipality were once again outstanding in their efforts on Clean Up Australia Day.

The clean up results were as follows:

Total tonnes of waste collected: 9.02 *(last year 11.08)*

Car tyres collected: 479 recycled, 19 on rim recycled, 58 to Mornington Waste Transfer Station (MWTS) **Total 556** *(last year 344)*

Truck tyres collected: 2 *(last year 19)*

Light truck/4x4 tyres collected: 36 recycled, 1 on rim recycled, 6 to MWTS **Total 43** *(last year 14)*

Motorcycle tyres collected: 32 recycled. **Total 32** *(last year nil)*

Total number of estimated participants: 2,500

Total number of registered sites: 36

Total number of community groups participating: 16

Total number of school/youth groups participating: 17

Total number of business groups participating: 3

Veolia were again were very generous with their resources and provided six skip bins around key sites within the Clarence City Council municipality (these skips were provided at the request of participating groups). Two 20 m^3 skip bins were hired by Mission Australia Housing for two sites, one at Clarendon Vale and one at Rokeby. Council paid for the disposal of the litter.

Twelve groups, businesses and schools requested litter pick-ups. This was added to skips or taken to the MWTS.

Some groups took their litter to MWTS by prior arrangement.

Groups greatly appreciated the support provided by Clarence City Council, especially for the high-risk roadside clean ups that volunteers are discouraged to do.

by Sally Johns Clean Up Australia Day coordinator

On the Rocks

It was a fresh start to a lovely sunny clear day, and with a gratefully NRM South sponsored bus, the Grade 4 students from Howrah Primary School arrived and greeted our two geologists Grace Cumming (from Mineral Resources Tasmania – Department of State Growth) and Peter Manchester, retired Geologist teacher who is still quite active in school excursions of all ages across the state and country.

When gathered and sitting on the pebbly foreshore, Peter asked the students to pick up their closest light and dark coloured rocks and describe them. He went on to explain the dark one was igneous and the lighter one was sedimentary. With further discussion of what that meant and examples of larger strata of these rock types evident either side of the group, the students split into two groups, each with a geologist, and went to study these formations more closely.

Peter brought along hand lenses for the students to use for the excursion which ignited their interest straight away, especially with the partnering title of 'Cadet Geologists'.

They found evidence of glacial drop stones, iron oxide seams, concretions (creating rimmed rock pools), baked sedimentary rock (where the dolerite had intruded) and many tiny crystal components within the rocks including feldspar.

Grace completed the excursion with an explanation of geological mapping, fossil formation (handing out fossil examples) and local volcanic activity; handing out examples of volcanic rocks/cool lava that she had collected from all over the world, including a large example from Madagascar.

The students were exited to be allowed to take the samples back to the classroom where they will use them and their collected photos to commence their drawings for our Clarence City Council sponsored Interpretation Trail-Head signs at the Glebe Hill Reserve.

We are looking forward to arranging another trip next year with the geologists and Grade 4 students to the volcanic capped vent at Skillion Hill.

By Adam Holmstrom, Glebe Hill Reserve Landcare.

Glebe Hill Reserve Trailhead Opening

Howrah Primary + Glebe Hill Landcare Partnership Project

With the foundational work of local historian and landcarer Wendy Andrew as inspiration, the Glebe Hill Bushland Reserve, as a part of the greater Clarence Plains catchment, has become not just a place for protecting local vulnerable species; but has grown to become a place for sharing the cultural and natural values of the wider region.

Glebe hill landcare have partnered with Howrah Primary over the past two years to establish a network of creative panels, thanks to The Understorey graphic design and generous grants from Clarence City Council, to share the stories of the resident species through the students' drawings, poetic words and partnering research by local specialists.

The grade four students have shown their keen interest and talent through the various excursions that have been co-arranged with nita education's Trish Hodge, wildlife specialist Nick Mooney, natural resource officers Phil and Chris from Clarence City Council and more recently a grateful partnership with local specialists Grace, Mike, Ralph and Peter from the Geological Society of Australia.

While last year's classes focused on the individual flora and fauna species found in the reserve, the students focused on a broader set of themes. From the gradual to rapid shift of land and climate, first nation's sustainable connection to land and fostering care for vulnerable species to help them flourish against the mounting odds (such as urban growth and free-roaming cats and dogs).

The interpretation trail runs between the Howrah Merindah Street and Watton Place entries to the Glebe Hill community playground. For a labelled map of the reserve, video footage of local wildlife and up to date information on events lookup www.glebehilllandcare.org.au

Clockwise from top left: Clarence City Council Mayor Doug Chipman with Glebe Hill Landcare, specialists and community at the public opening of the trailhead project on Saturday.

Mayor Doug Chipman formally opening the trailhead project. The connenction to land trailhead sign located at Wendy Andrew Entry. The geoglical sign located at the Watton Place/Howrah entry.

WORLD WETLANDS *day*

On February2, 2019, World Wetlands Day was held for the first time in the southern beaches, at the Dodges Ferry school hall. Approximately 250 people attended the free family-friendly event, with many declaring it 'a magical day'. While the sunny weather certainly played a part, the program offered a smorgasbord of science, art, and activities, with information stalls, live music and guided tours.

Coordinator Sharon Kent said that the day really exceeded expectations. "I was constantly approached by people remarking on the overall high quality of everything that was offered. I know of a few 'non-sciency' people that were blown away, by not just the information, but how it was presented, from hands on activities to top notch science talks."

Inside the hall, stalls featured everything from frogs to waterbugs, alongside an artist's area, where participants learned how to weave with weeds, draw Saltmarsh plants and screen print calico bags. A program of 'fast and funky' science talks and an artists discussion panel, provided plenty of food for thought, while outside the free barbeque lunch and food vans proved popular, with patrons enjoying the live music and festive atmosphere.

While some of the children enjoyed having their face painted with a wetland creature and joining in with the Parks and Wildlife Service discovery ranger's activities, whole families stepped onto the courtesy bus to enjoy a tour around Steeles Island, with expert saltmarsh, bird and Aboriginal cultural guides scheduled throughout the day.

A highlight of the day for many was the Welcome to Country, by local elder Aunty Colleen Mundy, followed by Aunty Cheryl Mundy, whose heart-felt song and speech in palawa kani touched everyone.

The final tour of the day was a terrific walk with distinguished professor Jamie Kirkpatrick, along the eroded shores of Okines Beach - a fitting place to discuss coastal vegetation dynamics and climate change.

The event, supported by both Clarence and Sorell Councils and also Bendigo Bank, was a wonderful opportunity to learn more about the local wetlands and, as Sorell Mayor Kerry Vincent emphasised, a chance to appreciate what we have, right on our doorstep.

Sharon Kent, World Wetlands Day coordinator

This is the pasture day-flying moth, *Apina callisto*. It is native to Tasmania but also extends to South Australia, New South Wales and Victoria. This pretty moth flies for a few weeks in mid autumn until the first frosts of the year. Males are more commonly seen as they are active fliers as they search for the more sedentary females. The colourful caterpillars feed on low growing non-woody plants in open habitats such as grasslands and the fringes of saltmarshes. When fully grown in the early summer they dig a hole in the soil and pupate underground where they spend the summer before emerging as moths at the end of March.

Photography: S Johns

Hoverflies are a key pollinators of avocados: Courtesy: Brian Cutting 'Plant and Food Research'

Flies in the pollen

by Phil Watson

What do chocolate, coffee, mangos and avocados have in common with many of our brightly coloured and alluringly scented wildflowers? You probably guessed from the heading that they all have flowers which depend on fly pollination.

In fact, chocolate cravings would never be satisfied, and worst of all Easter would never be the same without the services from tiny specialised flies or midges (gnat-like flies). The flowers on the tropical cacao trees (*Theobroma cacao*) are wholly reliant on midges for pollination! Most importantly, it is crucial that midges also have access to pristine jungle adjoining cacao plantations, as their life cycle is dependent on healthy jungle habitat.

Imagine life from a hoverfly's perspective: we are distinguished amongst other fly species by our typical bee or wasp-like appearance. Our bodies feature bright colourations such as yellow and black or red and black. My hoverfly family *Syrphidae* are mostly harmless flies which rarely interact with people and like most flies do not deserve to be sprayed, swatted or inadvertently trapped on flypaper. Although as adults we seek out nectar and pollen, our maggots help both gardeners and agriculturalists by munching aphids and other sap-sucking insects. We have also gained a well-earned reputation as one of the most important flower pollinators.

We are from the Insect Order, *Diptera* which also includes our mosquito cousins. We differ from all other adult insects by possessing just one pair of wings rather than two pairs. Our second pair have been reduced to balance organs (stalked buttons), known as balancers or halters. This design gives us impressive flying skills exceeding most other insects except for dragonflies that boast the fastest wing beats of any creature. Our name 'hoverfly' is derived from our ability to remain stationary above flowers. This affords us strict aerial control when seeking nectar from difficult to access floral nectaries. We stay safe from predators by cleverly mimicking native bees and wasps as they think we have similar fearsome stings! This allows us to use our superior flying agility to buzz around the garden or wildflower woodlands like 'little helicopters'.

Meet some of my fly cousins!

Worldwide there are over 150,000 fly species with around 12,000 in Australia and over 1,000 in Tasmania[1]. Flies are split into two key groups, namely the *Nematcera* and the *Brachycera*. Characteristic of our *Brachycera* group are our stout, rounded bodies and short antennae. Many of my fly cousins also have important flower pollination capabilities including the ubiquitous houseflies (*Muscidae*) and blowflies (*Calliphoridae*), blood sucking march flies and horse flies (*Tabanidae*) as well as the manure decomposing, dung flies (*Sepsidae*). Additionally there are lesser known fly pollinators such as the colourful metallic flies, the long-legged flies (*Dolichopodidae*), predatory robber flies (*Asilidae*), hairy bristle flies (*Tachinidae*), parasitizing wasp-mimicking flies (*Stylogaster*) and meat eating fleshflies (*Sarcophagidae*). The other *Nematcera* group have long thin bodies and mostly feathery antennae which include biting mosquitoes, long bodied, spindly-legged craneflies (*Tipulidae*) and tiny moisture-loving midges or buzzers (*Chironomidae*). These have less prominence as pollinators (except of course for cacao-chocolate tree) due to their small size and little mouth parts.

Our existence depends on our eggs and maggots

Although our 6,000 species of hoverflies are found on all continents except Antarctica, the time to complete the lifecycle of our diverse range of species only varies from one to eight weeks. The lifecycle begins with eggs laid in moist situations such as soil, ponds, manures, decaying forest litter or even in exposed flesh. These hatch into hoverfly maggots (or grubs) which wield biting mandibles allowing them to feed

ravenously on a variety of foods such as fungi, decaying plant or animal matter or plant-sucking insects such as aphids, thrips or caterpillars. The maggots grow rapidly by molting approximately four times before pupating and emerging as a winged hoverfly capable of laying hundreds of eggs.

While some of our maggots are found in stagnant water; those of us which prey upon aphids and other plant pests commonly live on leaves. Although most of our young are often found near flowers, there are some exceptions such as a few preferring to live in decomposing vegetation or even in the nests of bumblebee, ants or termites[2].

As adults we are able to locate nectar bearing flowers by either using our large eyes or our antennae to detect flower scents. By making use of sensitive taste organs which are curiously located both at the end parts of our legs (tarsi) or in our mouths, we are able to extend our short tongues to suck or sponge up nectar fluids or small solid pollen grains.

Some of our predatory cousins such as the robber flies and long-legged flies have piercing mouth parts that penetrate into soft bodied invertebrate victims such as spiders and worms. Using their salvia they then dissolve their internal parts before sucking up the body fluids.

Unlike bees, we can fly on cool, windy and overcast days and are happy to gather nectar from flowering plants in the damp and shady understories of woodlands and forests. Inadvertently we play a vital role to ensure these hidden forest floor dwellers are pollinated. However, to be honest, like bees and wasps, most of us do favor sunny places!

We prefer flowers from the daisy, buttercup and carrot families.

Due the shortness of our tongues we select the easy to reach nectaries of open cup-shaped flowers or small tubular flowers. Our accentuated ultra violet vision endows us with a natural preference for flowers which are mainly yellows, whites, browns and purples. Daisy (*Asteraceae*) and carrot (*Apiaceae*) family flowers with their broad composite heads not only provide pollen and nectar but also shield us from predators and bad weather.

Favorite flowers which we habitually visit include the dainty white grassland woodsorrel *Oxalis perennans* along with the many weedy woodsorrels, the delicate white-mountain anemone *Anemone crassifolia,* the weedy and native buttercups including the yellow woodland and rare midlands buttercup *Ranunculus lappaceus* and *R. prasinus,* the brilliant yellow guineaflowers including the spreading and erect guineaflowers, *Hibbertia procumbens* and *H. riparia*.

When the woodland wildflowers and grasslands are at their peak and our mating urge is strong, we frequently hover around various daisies, which have broad flowering heads such as the prominent rounded golden flower heads of billy buttons *Craspedia glaucus,* the bright yellow everlasting bush, *Ozothamnus obcordatum,* the many groundsels and fire weeds, *Senecio sp* as well as long lasting paper daisies, *Leucochrysum albicans spp.,* and numerous weeds such as thistles, *Cirsium sp.* and dandelions, *Taraxacum sp.* When we can settle down on these daisies we also aim to attract mates and lay our eggs amongst these floral assemblages.

Alternatively as the nectar and pollen in the broad flower heads of the carrot family (*Apiaceae*) are easy to access, we regularly visit spring time favourites such as pennyworts, *Hydrocotyle sp.*, native carrots, *Daucus glochidatus*, crossherbs, *Xanthosia sp.,* laceflowers, *Trachymene sp.* and sea-celery *Apium prostratum.*

Unfortunately, some of our preferred shallow rooted flowering plants such as the yellow leek lilies *Bulbine sp*., and certain members of the boronia family (*Rutaceae*) including fairy waxflower *Philotheca verrucosa* and lemon-scented boronia, *Boronia citriodora* are so popular with our competitors such as native bees, wasps, beetles, butterflies and beeflies that they rarely allow us to gather nectar.

Interestingly amongst our family we have specialized pollen-eating hoverflies such the attractive marmalade hoverfly

Figure1: Melangyna hoverfly Image: courtesy of Toby Hudson

which enjoy less competition from our competitor's flowers as they have no nectar. Of particular interest to our pollen seeking hoverflies are the dazzling blooms of the golden guineaflowers, *Hibbertia sp.*, as well as agricultural poppies and garden poppies *Papaver somnifera* and *P.rhoeas.*

We can become gardener's and farmer's friends by replacing pesticides.

We are not only great flower pollinators in the garden but we can provide a biological pest-control service for farmers. Some of our black coloured hoverflies are particularly good pest munchers. They differ from most other hoverflies by possessing a "polished" body rather than the sticky furry bodies, commonly seen with bees. Curiously, in the summer of 2017 a north-western Tasmanian farmer gained major benefit from one of our black bodied hoverflies, the black *Melangyna* hoverfly, by achieving an Australian record canola harvest despite battling extreme seasonal conditions. In September this new-migrant to Tasmania, was blown across Bass Strait by strong NW winds. They not only munched up the diamond-back moths and aphids pests in yellow flowering canola field

Cocoa flowers.
Courtesy www.chocovic.es

but also systematically pollinated all the flowers, mutually benefiting both the farmer and hoverfly.[3]

Tiny Midges do their best to keep the chocolate on the shelves

Returning to our initial discussion on chocolate; the cacao trees (*Theobroma cacao*) are somewhat different to most trees by not only forming prolific numbers of white flowers and fruits on the trunks but also flowering and fruiting all year round. Unusually their flowers and fruits are on the tree at the same time, requiring up to eight months to progress from blossom bud to ripe fruit. Although hermaphroditic, cacao flowers cannot fertilize themselves (self-incompatible) and only live for 24 hours. This creates a much healthier stock in the wild, but is terribly frustrating to plantation owners who cultivate cacao, since only 3 out of 1000 flowers are pollinated, fertilized and progress to fruit in a plantation environment!

Surprisingly the cacao plantations themselves are the reason for the extremely low fertilization rate as plantations are alien habitats for the tiny midges. The native cocoa trees thrive in a natural rainforest habitat with its high humidity, shade, rich species diversity and a decaying humus forest floor.

Hence there is little incentive for midges to venture into the dry, sun drenched cultivated cocoa groves.

Additionally scientific research has revealed that cocoa growing in rainforest have over 400 chemically derived scents which are detectable to midges compared to just a few emitted by cultivated cocoa. Obviously the midges are confused by the much lower levels of scent emitted from plantation grown cocoa flowers and hence rarely visit them. It is interesting to note that research has detected 14 distinct

chemically derived scents in roses and 7 in the onion.

Cocoa fruit, pods, seeds and finally chocolate

Like most high production food plants, cacao's large colourful fruits were almost certainly cultured over millenniums by the native African people to produce large and plentiful fruit and more importantly plenty with the seeds used to make Cocoa.

The large pods vary significantly in size, shape and texture as well as in colour, starting as green pods and finally maturing into yellow, orange, red or purple pods when ripe.

A ripe pod can be left on the tree for 2 or 3 weeks without spoiling. However it is important that pods are fully ripened before harvested. Processing into chocolate products to derive the flavours we all appreciate relies totally on the fruit being fully ripe at harvest.

The good news for environmentally minded chocolate eaters is that the future is brighter regarding improving the pollination process. The 'Fair Trade' movement and organic cacao farmers are now working with the cocoa trees and the midges instead of against them by farming small, rainforest-based plantations.

Bee Flies – cryptic camouflages, long proboscis, specialised flower feeding

Our look alike cousins, the bee flies (*Bombyliidae*), have large, stout and hairy bodies allowing them to easily mimic wasps or bees. Many beeflies are out and about early in the season and in cold weather they are key pollinators of many spring wildflowers. Some are highly specialised feeders having coevolved with their plant partners. They employ astoundingly long proboscis permitting them to suck up nectar from flowers with deep floral tubes. Over the millenniums evolution has resulted in gradual proportional lengthening of the floral tubes and the bee fly proboscises. As the lengths of the flower tube and the bee fly's proboscis converge, it has produced a remarkable degree of specialization. The plants have come to being nearly fully reliant on these bee flies for pollination, as most other proboscis-bearing insects cannot reach the deep nectar pools.

Remarkably, as the bee flies' wings continue their high frequency buzz; their front legs grip the flower allowing their long rigid beaks to suck up the nectar. To avoid predator spiders or ambush bugs (cryptically hiding within the flowers), they do not actually land on the flower, but instead just barely touch the flower allowing small amounts of pollen to stick to their furry coats.

Some of the deep floral tubed flowers include members of the geranium family, *Geraniaceae*, including storksbills *Pelargonium sp*., and cranesbills, *Geranium sp*., as well as the long floral tubed members of boronia and native heath families, such as long bell flowers of *Correa sp*. and *Epacris sp*. Additionally the long proboscises are ideal for reaching the nectaries of old garden favourites such as the eye-catching primroses *Primulaceae*, ubiquitous forget-me-nots, *Myosotis sp.,* honesty *Lunaria sp*. as well as the native iris wildflowers (*Iridaceae*) such as white flag iris *Diplarrena sp*., blue purpleflag *Patersonia sp*. & pretty grassflag, *Libertia sp*..

Many of South Africas floral gifts to the world including the highly scented *Freesia sp*., cape tulip *Homeria sp*., delightful *Ixia sp*. and the classic English perennial border plants of the *Gladiolus sp*. and *Iris sp*. are also keenly targeted by our long proboscis bee flies.

Scaringly for many insects our bee flies have gruesome larvae which survive by parasitising wasps and bees and other ground swelling insects. Once their pupae rise to the surface they sit on the ground while they expand their wings to emerge as big adult bee flies. At this time, because they are at high risk of predation by spiders, lizards and birds they employ various forms of camouflage.

One type of camouflage involves matching the colours of the background that they're sitting on. Often they develop

Figure 3: Long proboscis mega-nosed fly of South Africa: Image courtesy of Stephen D Johnston

Figure 4: Long tubular flowers accessed by very long, thin proboscis: Photo; Courtesy of Florian Karolyi University of Vienna Science of Nature

brownish colourations and commonly sit unobtrusively on sandy paths.

Others have slightly different types of camouflage where the outline of their body is broken up with disruptive colourations so that the outlines of their abdomens are very difficult to detect.

Mega-nosed flies use suction pumps to increase nectar flow.

Arguably our most amazing fly cousins are the South African, tangle-veined flies *(Prosoeca ganglbaueri)*. Like Pinocchio, they have a bizarre appearance brandishing the longest mouthparts of any known fly. They protrude prodigiously as much as five centimetres from their head, this being some five times the length of its bee-size body. In flight these ungainly appendages dangle between the flies legs and trails far behind their bodies.

To an airborne fly, a stretched out proboscis might seem a stark handicap (imagine wandering around with a ten metre straw dangling from your mouth). This handicap is well worth its aerodynamic impact. The bizarre proboscis gives the mega-nosed fly access to nectar pools in long, deep flowers that are simply out of reach mostly to all other insects. This ensures that the flowers pollinated by long-nosed flies benefit from a near-exclusive pollen carrier service. It also guarantees that pollen is carried to the right addresses. Fortunately, as long-nosed flies cannot survive on the nectar they get from servicing just one plant species, they visit a few other deep flowers to gather the energy they need (Johnson & Steiner)

Long tongued flies benefit from their own suction pump

Although it could be expected that our long tongued flies would be very slow to suck up the sticky nectar through their narrow straw-like tongues, surprisingly this is not the case. In fact, they easily out compete flies with just normal sized nectar-sipping mouth parts. Actually they can suck up most of the available nectar in just one go, due to their own highly effective suction pumps.

For example, the extremely long, thin proboscis of the South African *Prosoeca* (*Nemestrinidae*) flies, use their suction pumps to produce a pressure gradient along their proboscis, which enables sucking up of nectar. They can even slurp up the most viscous sugar-rich liquids using their highly efficient two-part suction pumps.

These pumps are powered by strong head muscles which have evolved to increase in size in proportion to their proboscis length. These flies are able to sip up more nectar in a single visit than other flies thereby gaining advantage over other flies with average length tubes.

Our biting March and stable fly's cousins give us a bad name!

Mostly in the summer months, our biting fly cousins are renowned for their painful bites and annoying habits. Within Australia, the biting flies of greatest significance are our horse flies or March flies (Family *Tabanidae*) and our stable flies (*Muscidae*), as well as our biting midges or sand flies (*Ceratopogonidae*) and the ubiquitous mosquitoes (*Culicidae*).

There are about 400 species of March fly (*Tabanids*) in Australia, and the name 'March' is not really to do with the seasons in the southern hemisphere, as they occur throughout the summer months. Rather it is more to do with their annoying arrival in northern hemisphere countries in early spring time (around March).

While the male March fly simply feeds on flower nectar and pollen, the majority of females prefer to pierce our skin at meal time but fortunately they do not transmit disease to humans. They use the proteins in their blood meals to basically develop eggs and

give rise to the next generation. That's why they're so insistent on getting at your blood.

After mating, the females disperse, travelling many kilometres in search of blood meals. March flies have a short life span but they have a long lifecycle. They lay their eggs in sheltered areas such as moist sand or twigs. Within a week the eggs hatch into larvae which feed on rotting vegetation or aquatic materials. The larval stages last for at least three months, during which time they go through between six and nine instars stages. Adult March flies usually emerge after rain and live for about one month and characteristically display two large prominent eyes.

Females are armed with two large blade-like mouthparts, which are used to pierce and slash skin. They inflict an annoyingly itchy and painful wound which will continue to ooze blood long after the mouthparts are extracted as a result of the anticoagulants in their saliva. Some animals can lose up to 300 ml of blood per day due to attacks by these flies, resulting in serious blood loss. Surprisingly it's not only the soft or furry animals that March flies pursue as they often feed on crocodiles in North Queensland.

In some places they're known as horse flies worrying horses to such a degree that horse riders may lose control of their steeds. March flies mostly get preyed upon by all the usual flying insect eaters, like birds and spiders, but a swift human hand can also strike the big, black flies.

Interestingly March flies have important cultural significance for the Wardaman Aboriginal Nation from north west of Western Australia. When the adult March Fly appears at the around the end of September it heralds the arrival of their wet season[4].

The stable fly, *(Stomoxys calcitrans)* is a vicious biter with piercing and sucking mouthparts that can easily penetrate socks and stockings. Stable flies are much smaller and less robust than March flies but have longer lives. Both sexes of the stable fly search for blood meals, often twice a day and can engorge on blood up to three times their own body weight. Fortunately these flies are seldom found in urban situations (except where horse stables or major composting areas are nearby) and are more often associated with rural properties and domestic animals; they are also common on some beaches where they breed in sea-weed.

Conclusion

Not only are we key pollinators of a rich diversity of species in our wildflower understories but we are now becoming more and more valued for our pollination services in a range of horticultural crops and ornamental landscapes and gardens.

Critically, pollination of tree orchards such as mangos and avocados have traditionally relied on the service of normal pollinating agents such as bees, beetles, wasps, moths and butterflies.[5] Unfortunately orchardists are reporting a noticeable decline in production levels as a consequence of distinct reduction in populations of honey bees and beetles. To mitigate this problem they are working towards attracting the pollination services of a rich diversity of flies[6].

They are aware that due to avocados unusual flowering physiology they are tricky to pollinate when relying completely on bees because the flowers not only open as male one day and female the next, but are also only open just a few hours a day and frequently during cold nights. Fortunately we are ideally suited as alternative pollinators because we are active at night and we can work in the cold and rain.

If gardeners, bush carers and orchardists understand our life cycles they can ensure we will help sustain wildflower understories and floral landscapes as well as boost orchardist's yields. Primarily we require the right breeding habitat and insect prey located either within the landscape or in close proximity to orchards so that our larval stage can flourish. Our larva love munching aphids and other pests found in grassy understories or on orchard trees thus delivering a double benefit of pollination and pest control[7].

References

1. CSIRO *The insects of Australia: A textbook for students and research workers*
2. https://en.wikipedia.org/wiki/Hoverfly
3. http://www.abc.net.au/news/rural/2017-01-16/canola-record/8185568
4. www.bom.au/iwk/calenders
5. https://phys.org/news/2015-03-flies-key-pollination.html#jCp
6. http://www.abc.net.au/news/rural/2016-08-30/flies-play-role-in-avocado-pollination/7796976
7. www.abc.net.au/news/rural/2015-06-12/new-study-shows-flies

Phil Watson – Natural Resource Management Planning Officer
03 6217 9713 pwatson@ccc.tas.gov.au

Justin Burgess – Natural Assets Officer
03 6217 9714 jburgess@ccc.tas.gov.au

Chris Johns – Natural areas Volunteer Coordinator
03 6217 9715 cjohns@ccc.tas.gov.au

Helen Peters – Climate Change Officer
03 6217 9719 hpeters@ccc.tas.gov.au

Alister Hazeldine – Weeds Planning Officer
03 6217 9727 ahazeldine@ccc.tas.gov.au

Clarence... a brighter place

swift chatter

Natural Resource Management Committee