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CAPILLOSA HAS A NEW BEE SPECIES

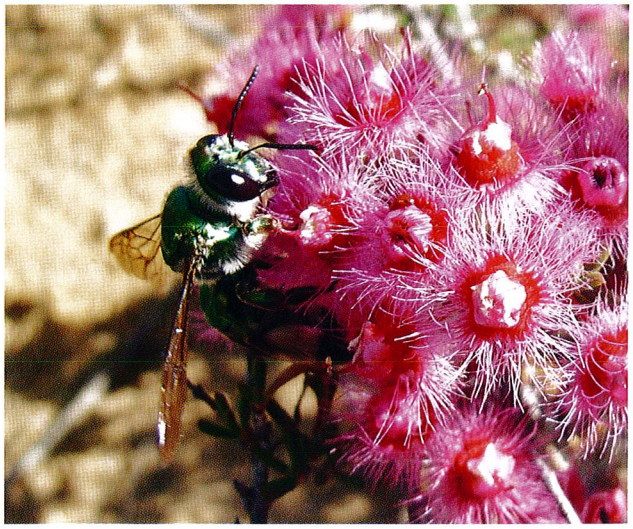
Michael Batley

When Michael and my sister Lesley Brooker bought their 1400 ha *LFW* property at Westonia, they named it *Capillosa* because it contains some magnificent stands of wheatbelt wandoo, *Eucalyptus capillosa*. The word *capillosa* refers to the hairy seedlings that the tree produces. Now, a newly named bee species has been called *Trichocolletes capillosus*, referring to both its hairy legs and its presence on the property.

The Brookers' interest in *Capillosa* is primarily the birds and flowers growing there. But where there are flowers, there are usually bees and frequently bees of many species. The Brookers did not realise how many or how beautiful native bees can be until, as a visitor with a special interest in native bee species, I saw more than 40 species there in a single three-day period and found nesting sites containing dozens of holes. Bees are easy to see but not always noticed.

There are some species at *Capillosa* that nobody could overlook, such as *Ctenocolletes smaragdinus* and *Ctenocolletes rufescens*. They are big, bright and beautiful. Females (about 18 mm long) are considerably larger than the introduced European honeybee and much noisier when they fly. They belong to a small group of about 20 species that are distinctive enough to be placed in a bee family of their own. Almost all of these species are restricted to Western Australia. Usually seen in September or October, they visit a wide range of flower types. At *Capillosa* they are frequently seen on *Verticordia*. There are two more species similar to *C. rufescens* that may be also be seen one day.

Ctenocolletes smaragdinus Ctenocolletes rufescens
Photos: Michael Batley



Ctenocolletes smaragdinus *on* Verticordia pritzelii
Photo: Lesley Brooker

Verticordia is also the flower on which to find bees at the other end of the size scale; bees that might easily be missed unless you are looking for them. In the late afternoon of a spring day, a quick survey of *Verticordia picta* usually reveals small, black bees curled up inside some of the flowers, one bee per flower. These are males of an unnamed *Euhesma* species. Unlike honeybees, 99% of Australian bee species have no division into queens and workers. All females build their own brood cells and hence there are as many, if not more, males than there are females. The males do not help with the construction and provisioning of the nests, and find their own places to roost overnight. Some cluster together on low shrubs or grass stems, but this species shelters in flowers.

In the middle of the day, the females can be seen moving between the flowers and holes in the ground

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EDITORIAL

Greetings all!

For the time being, Phil Worts, *LFW* Officer based at Kojonup, will only be working on a casual basis. He will still answer queries by phone or email, but will not be available to visit properties. Nevertheless, do still keep in touch, and if you have major *LFW* queries, please contact Avril Baxter, *LFWO* at Narrogin, or myself. Contacts are given in the table below.

In *LFW* we try to think about the interconnectedness of all living things in the bushland, that 'web of life' that we learnt about in school. That means consideration of all organisms, great and small, whether they are easy to see or not. Sometimes all it takes is a visitor with a special interest in one type of creature and, suddenly, we look at the bush through their eyes and a whole new world opens up. Such is the lead article in this issue, about native bees on a property in Westonia. Three days, 40 bee species, 18 of them not scientifically named! What an amazing diversity that accompanies the floral richness! And, as pollinators, many of these bees may be essential for survival of the plant species.

This spring, why not have a look for native bees on your block? Shrubby areas on granite outcrops are a good place to start, especially if you have waxes, feather flowers or similar. Take some good clear photos of flower and bee. There are lots of things to find out. What, for example, pollinates those glorious cream-coloured *Verticordia* species that are collectively called cauliflower bush? And what about finding a smokebush bee (see *WW* 10/1, January 2006)?

Two of the articles in this issue discuss the problem of giving names to hybrids. Our system of scientific nomenclature is based on the concept of a 'species', a recognisable and distinct unit that breeds true to type. Usually species do not interbreed, or hybridise, except under extraordinary circumstances. This may occur when species that normally grow in different areas are grown together in gardens. A well known example of this is *Eucalyptus 'torwood'* which arose as a seedling in the Kalgoorlie high school grounds, growing between specimens of its ornamental parents, *E. torquata* and *E. woodwardii*. In nature, however, sorting out the parentage can be very complex!

To all our readers, please try to take part in Citizen Science monitoring programmes whenever you can. There are a couple mentioned in this issue. With more observers, we can increase the accuracy of the data.

Penny Hussey

Please note, for anyone who may be searching for articles in back issues of *Western Wildlife*, all issues from Volume 1 (1997) to Volume 13 (2009) are now on the *LFW* website. We also have an up-to-date index to all volumes. If you would like a copy of this (by email only, please), contact Claire Hall.

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www.dec.wa.gov.au/landforwildlife

MEMBERS' PAGE

MASTERS OF DISGUISE - THE BIRD DROPPING SPIDER

Thelma Hill from East Pingelly noted this spider in an olive tree on her driveway. Thelma is a keen nature observer and has never seen anything like this before and wondered if it was unusual.

Thelma's spider is the bird dropping spider, *Celaenia excavata*. This common name is a result of it sitting motionless on a leaf during the day with its legs drawn up against its body, looking like a bird dropping. As it is often in an exposed position, this disguise prevents it from becoming prey.

Other common names include the orchard spider, as it is found on fruit trees in the south west, or the death's head spider, as its markings resemble that of a skull.

This spider belongs to the Araneidae or orb-weaving family. Whilst the young spiders will make a web, adult females only use a web to group their egg sacs together.

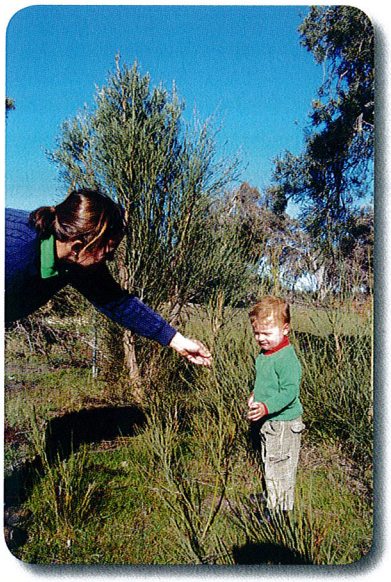
At night the adult female will hang on a short thread below a leaf or the egg sacs with her forelegs outstretched and release a pheromone similar to the sex pheromone released by female moths to attract their mates. The male moth circling in on the scent ends up in the arms of a spider rather than a mate!

So not unusual, but very interesting.

After photographing the spider and her egg sacs, Thelma returned them to where she found them and is pleased to report that lots of young have hatched.

Avril Baxter

WA CHRISTMAS TREES START TO SPREAD OUT



Bindi Murray and her son John inspect small plants of the WA Christmas Tree (*Nuytsia floribunda*) on their property at Beaufort River. This is a good example of how this plant spreads by rhizomes, to increase the size of the clump. If given the chance, they will grow into full sized trees (see page 8 of the last issue of *Western Wildlife*).

HAIRY FLOWER WASP

After the note in the April issue of *Western Wildlife*, Margaret Pieroni sent in this photo of a hairy flower wasp taken last September south of Williams. The plant is an unusual yellow-flowered form of two-leaf hakea (*Hakea trifurcata*) whose flowers are usually white.

FAUNA

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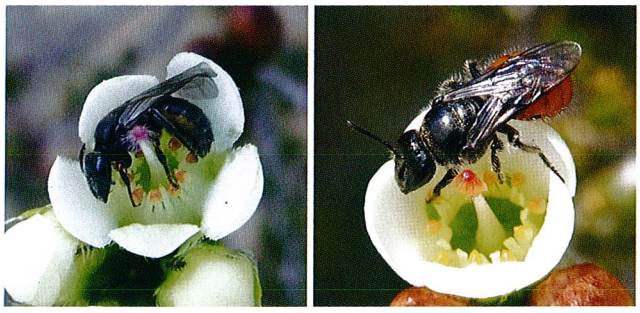
Capillosa bees

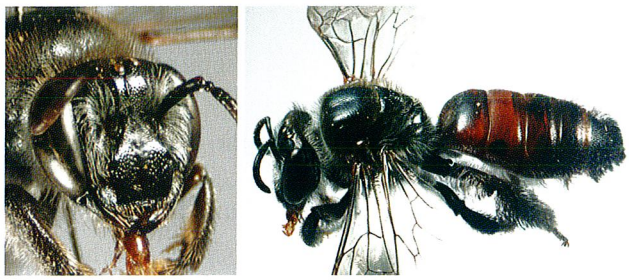
Euhesma sp. *(male) in* Verticordia picta
Photo: Lesley Brooker



Euhesma sp. *male (left) and female (right)*
Photos: Michael Batley

where they make their nesting chambers. (Yes, they are females of the same species, despite the colour difference.) It would be interesting to know if the female bees visit other flowers as well and whether they actually collect pollen from the verticordias. Two species of golden verticordia each depend entirely on a single *Euhesma* species for pollination. There is still a lot to be learnt about the behaviour of our native bees.

Such mutual dependence between a flower and its pollinator is very rare, except in the case of orchids. The majority of bee species probably visit a range of flower types, but where there is specialisation it is either one-sided or of the type illustrated by *Leioproctus ignicolor*, which was found on *Persoonia saundersiana* at *Capillosa*. This bee has a flat, polished face, which helps it to push against the tepals of the flower in order to reach nectar. There are about a dozen such bee species that demonstrate a preference for persoonia flowers, but they do not seem to discriminate between the different *Persoonia* species. Observation of the bees while foraging indicates that they are very efficient pollinators of the flowers, but other types of bee also visit *Persoonia* species. Hence there is a degree of mutual dependence between the 200 *Persoonia* species and a dozen bee species, but either group could probably survive, perhaps less successfully, without the other.



Leioproctus ignicolor
Photos: Michael Batley

There are also masked bees at *Capillosa*. Many are tiny, but others are in the middle of the size range with body lengths near eight mm. They get their common name from the yellow or white marks on the faces of most species. Some have yellow collars and, sometimes, yellow patches on the back. Members of this group are often seen on eucalypts, bottlebrushes and many other flowers, though a few species apparently specialise. At least six species have been seen, though there may be more. The one shown, which does not yet have even a scientific name, is squeezing open the buds of *Hakea minyma* to get fresh pollen. Other bees do similar things to banksias, grevilleas and other flowers in the Proteaceae family. The list of examples is growing steadily as more people are watching and photographing our native species.

Hylaeus sp. *on* Hakea minyma
Photo: Lesley Brooker

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FAUNA

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Capillosa bees

The bee is also interesting to entomologists because it is the only Australian masked bee to have what look like kneepads on its hind legs (you need a hand lens to see them). It is rare for a masked bee to have these 'basitibial plates', as they are called, and their absence is thought to be a result of their nesting behaviour. Females of ground-nesting bees use such plates to brace themselves inside their tunnels while they shape the brood cells. Masked bees, however, mostly nest in plant stems and only a few New Guinea species that nest in the ground have basitibial plates. But the *Capillosa* bee lacks other features that would be expected of a ground-nesting species. So it is a scientific puzzle. Where does it nest? How is it related to other masked bees and can it tell us anything about how the group evolved? It is a reminder that there is still a mountain of scientific work needing to be done before we understand our native bees. Of the 40 species I saw on *Capillosa*, 18 had not even been named.

Trichocolletes nitens *(female)*
Photo: Michael Batley

Trichocolletes capillosus *(male)*
Photo: Michael Batley

Now two of them have been named. *Trichocolletes nitens* (Latin for 'brilliant' or 'beautiful') and *Trichocolletes capillosus* (Latin for 'hairy') emerge in spring to forage from pea flowers. They are a little smaller than feral bees, but fly faster. They dart and hover around the bushes and their metallic bands and the orange face hair of the males gleam in the sunlight. This year, for the first time, they will have names.

Michael Batley is a Research Associate in Entomology at the Australian Museum, Sydney, an honorary position which allows him to persue his interest in native bees which he took up on retirement from the Chemistry Department of Macquarie University.

Want to find out more about native bees?
www.padil.gov.au/pollinators/Search?queryType=all#
Here the user can find images of most Australian native bee species along with distribution maps.

Did you know ...?

... that the suppressants used in water to help control bushfires actually break seed dormancy and promote emergence of bridal creeper? This is another good reason to do weed control immediately following a fire!

David Leech, Kings Park and Botanic Gardens

... that the rate of spread of bushfires in the shrublands around Eneabba is not related to fuel age or fire intensity. Thus standard models used to predict fire behaviour do not work in this type of vegetation community. It is important to take this into account if planning to use fire for regeneration.

Joe Fontaine, Murdoch University

... that there is a genus of orb-weaving spiders, the desert orb-weavers, whose generic name is *Backobourkia*? Someacrachnologist had a sense of humour!

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FLORA

HYBRIDISATION IN NATURE

Margaret Pieroni

As an amateur botanist with a special interest in the genus *Dryandra*, I have spent a great deal of time in the field, since the early 1980s, collecting, photographing and illustrating these plants. The result was *The Dryandras*, published in 2006 by the Wildflower Society of Western Australia and The Australian Plants Society, Victoria, co-authored with Tony Cavanagh.

Over the years, usually with willing friends from the Wildflower Society and members of the Australian Native Plants Society (Australia) Dryandra Study Group, I visited the locations of all of the *Dryandra* taxa and re-visited most sites many times. When I began the project, building on the information generously provided by botanists and friends on properties in the south-west of the state where they occur in the wild, from north of the Murchison River to Israelite Bay, more than twice the number of taxa were still to be described and named. Several new taxa were discovered, subsequently. Alex George published his revision of the genus in *The Flora of Australia* vol. 17B (1999).

It was apparent, as time went on, that we were seeing more and more hybrids. Sometimes, there would be just one plant in a population that was obviously a cross between two *Dryandra* species growing in the vicinity but there are also many hybrid swarms as well. In these, the parents are usually present but most other plants have more or fewer characters of one or the other parent, manifested in the leaf shapes.

Hybrids always seem to occur where there has been soil disturbance such as roadside or drain clearing and frequent fires. I have speculated that, following disturbance, re-sprouting or seedling plants appear to flower at the first opportunity after good rainfall, whether or not it is their usual flowering time. This means that several different species could be flowering simultaneously and so cross pollination could occur.

I became aware that hybridization can be a problem for the continuing existence of rare plants in 1993, when Val Crowley from Darkan took me to see a dryandra she had discovered that had two populations, at Boolading

Dryandra subpinnatifida *var.* imberbis. *Cultivated, Mount Barker. L-R: plant, flowering display, single inflorescence.*

Above: Dryandra subpinnatifida *x* D. squarrosa, *plant showing growth habit*
Centre: Dryandra subpinnatifida *x* D. squarrosa, *inflorescences*
Left: Dryandra squarrosa, *inflorescences.*

All photos: Margaret Pieroni

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FLORA

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Hybridisation in nature

and Bowelling. In each population, there was just one 'pure' plant of the dryandra, subsequently named *D. subpinnatifida* var. *imberbis*. Nearby, there was a thicket of *D. squarrosa*, a species that sheds its seeds annually and re-grows thickly after disturbance. In between, there was a hybrid swarm with some mounded plants with only a few lobes on the blades of the leaves up to taller plants with shorter, lobed leaves, typical of *D. squarrosa*. Both of these taxa are killed by fire, regenerating from seed. The 'pure' *D. subpinnatifida* var. *imberbis* at Boolading died soon after our first visit.

D. subpinnatifida var. *imberbis* differs from *D. subpinnatifida* var. *subpinnatifida* in that it has a mounded habit with the flowers at the base of the leaves and no lignotuber.

D. subpinnatifida var. *subpinnatifida* is an upright plant with flowers in the axils of the leaves along the stems. Intermediate forms also occur. I have also observed some hybridization in plants of the latter, for instance, at Dryandra Woodland where *D. squarrosa* is also present.

D. subpinnatifida var. *imberbis* is a rare plant in the wild – it may even already be extinct in its pure form. The magnificent plant pictured was grown at *The Banksia Farm* at Mount Barker but, unfortunately, it has died without producing much seed. Attempts to propagate it have, to date, not been successful.

This 'extinction by hybridization' appears to be a real problem and, no doubt, it is happening to others of our wonderful rare plants. I think we should be aware of the consequences of burning and of soil disturbance where rare plants are present and that the possibility of hybridization exists.

Species that do not re-sprout often appear in large numbers after fire but, given the decreasing rainfall, the seedlings that germinate die from lack of water and this also leads to local extinctions.

[Note that the WA Herbarium has now placed all *Dryandra* species into the genus *Banksia* see *WW* 12/3 (July 2008) and 12/4 (October 2008). Ed.]

Margaret Pieroni is an amateur botanist and talented artist, with a special interest in verticordias as well as dryandras.

MORE ABOUT THE SCARLET PIMPERNEL

Roy Butler

I recently read two articles about the scarlet pimpernel, in the July issues of the *Australian Veterinary Journal* (AJV) and *Western Wildlife*. The AVJ article was about the toxicity of the plant to cattle, and the *WW* article was about the botany and history of the Primrose family, including the pimpernels. As a veterinarian and *LFW* member I found both articles very interesting.

It is not uncommon that plants with a long history of medicinal use, including scarlet pimpernel, may cause poisoning, especially with excessive or prolonged use. Scarlet pimpernel can cause gastrointestinal irritation in many species, including sheep, horses, cattle, dogs, rabbits and birds. In humans, gastrointestinal ill effects have not been reported but the plant hairs may cause skin irritation. In the AVJ article, the first case of poisoning in Australian (Victorian) cattle is reported. Eighteen of 120 heifers died or were humanely killed and six aborted, after grazing for approximately six weeks on a wheat stubble paddock heavily infested with scarlet pimpernel. In the cattle autopsied, severe kidney damage was the predominant finding.

It seems that the risk for livestock of poisoning by this plant is very small, because it is apparently quite unpalatable and therefore only consumed by hungry animals with no other choice. Where field cases of livestock poisoning have occurred there has been plenty of scarlet pimpernel present and practically nothing else.

In contrast to livestock, humans sometimes over-consume herbal remedies (and other things) for reasons other than hunger, and we are not necessarily repelled by an unpleasant flavour (what's unpleasant to you may be highly desirable to me). Anyone tempted to consume scarlet pimpernel should be aware that it could be toxic.

Ref: Roche MJ, McCowan CI and Kelly JC. Suspected poisoning of cattle by scarlet pimpernel *(Lysimachia arvensis* L.) *Australian Veterinary Journal* 2012;90:269-271

[One of the things I leant from this is that the scarlet pimpernel is no longer in the genus *Anagallis*, but has been changed to the genus *Lysimachia*. (Bad person for not checking!) But, I can't help thinking - somewhat heretically - why does a name that has been good enough for 2,000 years, need to be changed *now*? Ed.]

FLORA

A PUZZLE FOR THE EUCALYPT BUFFS

Sylvia Leighton and Nathan McQuoid

There is a clump of eucalypt trees along the access driveway through the road reserve out the front of my parents' farm in Wellstead. My mother and I have driven past here for 47 years. This year something strange happened with the flowering on some of those trees causing us to stop the car and take another look. The problem was that the fruit and the buds did not seem to match up to a specific species and the flowering time was all wrong. After lots of photos and descriptions sent through to eucalypt expert, Nathan McQuoid, we think we resolved the issue of their identification.

This eucalypt site sits on a typical south coast laterite gravel area above a flat-topped yate swamp. There is *Eucalyptus preissiana* on the laterite slope basin coming up out of the swamp and the eucalypts surrounding our sample tree are *E. bupestrium*, *E. grossifolia*, *E. goniantha*, *E. uncinata*, *E. marginata*(?), *E. kalgenensis* and *E. decurva*.

Some of the details we needed to look at were the size, shape and length of the nuts, leaves and the flower buds, also the flower colour and time of flowering.

The leaves and nuts on our sample looked a little bit like *E. staerii* (the cup-shaped fruit was large but didn't seem to get wider than 1.5cm which leans us toward *E. marginata*). The buds were in clusters of eight or more, with a tapering conical top having a distinctly red-orange coloured cap and a green bud base (this didn't match *E. staerii* at all). The large size of the buds didn't really match anything in the book. Around 50 metres away was an *E. bupestrium* tree that had similar-looking buds but they were more egg shaped with a small spike on the end. Our tree was in flower with light lemon flowers and the nearby *E. bupestrium* was not. Nor did it have much fruit although the nearby *E. bupestrium* was loaded with nuts. Confusion plus!

Nathan's response:

It looks to me like a cross with *E. buprestium* and either *E. marginata* or *staeri*, and possibly an F2 cross at that (I will explain shortly). It's unlikely to be a cross involving *E. goniantha notactites*, reason being is their un-relatedness. The *E. marginata* group is the subgenus Monocalyptus, which includes (in WA) *E. marginata, patens, staeri, jacksonii, brevistylis, preissiana, lobata, coronata, sepulcralis, calcicola, acies, aquilina, pachyloma, ligulata, platydisca, todtiana, lateritica, megacarpa, kalganensis*, and a few others. *E. goniantha* is in the larger subgenus Symphyomyrtus, which on the south coast includes all the others except *E. pleurocarpa* and *extrica* (subgenus Eudesmia), and *E. calophylla* and *ficifolia* (subgenus Corymbia). Hybrids between subgenera are not known. Hybrids within the groups are in some cases rampant, except in the forests, why? There's a question!

The F2 thing is to do with segregation, F1 hybrids being 50/50 share between parents F2 25/75 one way, F3 75/25 the other, 12.5/87.5, and so on. Hybrids happen when the seeds of a cross-fertilised flower mature and get to the ground and grow. Most wild hybrids are F1s. I have seen a few F2s (*E. brandiana x arborella x brandiana* at Fitz Inlet, and *E. retusa x cornuta x retusa* at Cape Knob). Hybrid swarms are where hybrids themselves are breeding eg *E. calyerup* (although this is now almost solid as a species), *E. tetragona* (=*pleurocarpa x extrica*) around Condingup, *E. retusa x angulosa* at Hood Point, and that crazy *E. macrandra/sinuosa* swarm south of Short Rd in FRNP.

The Wellstead area is full of monocalypt group hybrids, and there's a lot more to learn about them. Its a fun place for eucalypts!

Wow! Do we really want to delve into the complexity of eucalypt hybrids!

Sylvia Leighton is the LFWO based at Albany. Nathan McQuoid is a botanical consultant in the south coast region of WA. His favourite speciality is eucalypt identification.

FERAL FAUNA

PLEASE HELP - ADOPT A EUROPEAN WASP TRAP

Oonagh Byrne

European wasps are a declared pest in Western Australia, although they are established in the eastern states. European wasps are considered the world's worst wasp pest and pose a health risk to the public, their pets and livestock. Horticulture, viticulture, tourism and apiculture industries would suffer with establishment of this pest in WA.

*European wasp (*Vespula germanica*) with a surveillance trap. Photo: DAFWA*

Native fauna, such as nectar-feeding birds, small mammals and certain invertebrates, face adversity through direct competition with this wasp if established. The cost to the community, in terms of money spent on direct treatment of nests, would also be substantial. Members of the public are asked to report any sightings of suspicious wasps to the Department of Agriculture and Food (DAFWA) or their local shire office.

WA has been battling the European wasp for 35 years, and remains the only place in the world to successfully keep this pest from establishing for so long.

Every year many fertilised queens arrive in freight from the eastern states to seed new nests. The fact that major freight depots are sited in Kewdale and Welshpool explains why these two suburbs are traditional hot-spots, but the queens can fly much further afield so nests may occur almost anywhere.

History in WA

Outside the Perth metropolitan area, European wasp nests have been found in Capel, Kalbarri, Geraldton, Donnybrook, Falcon and Eucla. Nests have also been periodically detected in suburban Kalgoorlie and Albany.

Last year DAFWA deployed more than 350 traps throughout the Perth metropolitan area, mostly in industrial zones and freight endpoints. The season ended with a total of 32 nests found and destroyed, bringing the number of nests found in WA to 751 since the first nest was reported in 1977.

Most nests were found in Welshpool, with a cluster in Kelmscott, several in Ashfield, Canning Vale, Kewdale, Lynwood, Osborne Park and one at a private residence in Kalgoorlie-Boulder.

DAFWA's surveillance program has been augmented by the establishment of a European Wasp Working Group (EWWG) with support from Local Government, WALGA and other stakeholders. With EWWG support, DAFWA has launched a new **'adopt a trap'** initiative whereby DAFWA provides traps to non-DAFWA groups to maintain and monitor.

Last season an additional 100 traps were adopted by local councils and others in Perth, Bunbury, Kalgoorlie, Albany and Bridgetown.

The trapping season is nearly upon us, please 'adopt-a-trap'!

This coming season, DAFWA is aiming to put out 400 surveillance traps in the Perth metropolitan area, targeting industrial hot-spots. A further 200 'adopt-a-traps' will target Albany and Kalgoorlie to augment DAFWA's trapping program, which runs from mid-November to the end of May each year.

It is imperative that all nests are found and destroyed, as they can each release thousands of queens which go on to seed new nests.

The adopted trap simply needs to be periodically checked and re-baited with a fresh lure. When a European wasp is caught, DAFWA is notified of the details so that its team can search the area.

This year most nests found have been subterranean structures in sandy ground. European wasps sometimes build above ground in places such as roofs or wall cavities, and the nests can be the size of a basketball or even larger.

In their northern hemisphere environment these wasps usually die every winter because of the cold weather, but WA's winters do not kill them. As a result colonies can over-winter, where they continue growing and can release thousands of new queens if they are not found and destroyed.

For details of how to identify these wasps, and to distinguish them from the introduced paper wasps, see DAFWA's Garden Note No 30, available on www.agric.wa.gov.au

Please help! Regional 'adopt-a-trap' participation would be of great assistance in ensuring WA remains European wasp-free. For more information on the 'adopt-a-trap' initiative, please email marc.widmer@agric.wa.gov.au or phone 9368 3759. Any sightings of suspicious wasps should be reported to the Pest and Disease Information Service on Freecall 1800 084 881.

FLORA RESEARCH

USING THE TIMING OF FLOWERING BY BANKSIAS TO MONITOR CLIMATE CHANGE

Caroline Canham

Banksias are well known and loved Australian plants, with their characteristic flower spikes making them easily recognisable. Slender banksia (*Banksia attenuata*) has bright yellow flowers and grows on sandy soils from Kalbarri in the north to Cape Leeuwin in the south. It is one of many banksia species each with its own specific flowering time. Staggered flowering helps maintain the genetic identity of each species and the mechanisms that plants use to initiate the timing of flowering may be linked to environmental cues.

The study of the timing of growth and the different reproductive stages of organisms is called phenology. There are phenological records for many species across the world but little is known for the large number of Western Australian plant species. Records that exist are patchy mostly because of the short-term nature of student projects which are often only run for two to four years. Phenological records are being used more and more to show the impacts of changes in climate, because processes, such as growth and reproduction, may shift to different times of the year as a response to changes in temperature and rainfall. Researchers Bell and Stephens showed in the early 1980s* that the timing of flowering for slender banksia is temperature dependent, with anthesis (the initiation of flowering) being initiated by temperatures increasing at the end of spring or the beginning of summer with a threshold of about 17°C. Leaf growth has also been linked to temperature, although the link does not appear to be as strong as for flowering. As part of a larger study, I measured the timing of flowering and leaf growth of slender banksia at Whiteman Park for two years from 2008 to 2010 using the same protocols as the earlier study. This provided the opportunity to compare phenological observations made on this species over two study periods spaced about 30 years apart.

There was generally strong agreement between the timing of anthesis and leaf growth and the associated temperatures observed in both studies (Table 1). In particular, the timing and the mean daily temperature when flowering first started was consistent between the study periods. Bell & Stephens found that an average air temperature of 17.8°C initiated flowering in slender banksia with only 3% variation over a four-year study period. In the more recent study, anthesis was first observed in week 48 in 2008 and week 44 in 2009 and the average temperatures for these weeks were 17.1°C and 18.5°C respectively (although it should be noted that in 2009 the mean temperature in the preceding week was 17.5°C and flowering could have started then as observations were made fortnightly). Rising temperatures in late spring thus trigger anthesis in slender banksia, with its flowering period occurring over late spring and early summer. The initiation of flowering by banksia species is likely to be linked to changes in temperature.

Leaf growth was restricted to late spring and early summer in both studies, a pattern previously observed in Mediterranean species in the south-west of WA. Temperature was again a significant factor in triggering leaf growth, although there was some variation between the study years (2008 and 2009). Also, the temperature at which leaf growth was initiated varied between this

Slender banksia in full flower. Photo: Caroline Canham

The beginning of new leaf growth, or 'bud break' by slender banksia. Photo: Caroline Canham

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Banksia flowering

FLORA

Table 1. Comparison of the timing of anthesis and beginning of leaf growth by slender banksia between Stephens 1985* and Canham 2012* and the mean values of daily average temperature (°C) and daily total solar radiation (MJ m^{-2}).

		1978-1979[1]	1979-1980[1]	1980-1981[1]	1981-1982[1]	2008[2]	2009[2]	2010[2]
Anthesis	Av. Temp.	17.8 (3% variation between years)				17.3	18.5	
	Solar Rad.	20.5 (31% variation between years)				22.7	17.2	
	Yr Week	45	5 42	10 45	4 38	48	16 44	11
Leaf Growth	Av. Temp.	16.5 (13% variation between years)				17.5	18.5	
	Solar Rad.	18.4 (28% variation between years)				14.8	17.2	
	Yr Week	41	6 43	9 40	2 41	43	6 44	11

study and that by Bell & Stephens (18°C c.f. 16.5°C). They showed that the temperature that triggers leaf growth varies, with 13% variation between years. The variations in temperatures that trigger leaf growth between years may be related to temperature not being the only significant variable that controls the timing of leaf growth. The dynamics between other factors, such as soil moisture, day length and endogenous cues may make it difficult to identify a single controlling parameter.

The link between timing of flowering by slender banksia and temperature may mean that the species can be used as a climate change indicator. This has been recognised by the ClimateWatch Initiative, and as such the species is one of the many that citizen scientists can record observations of on their website: http://www.climatewatch.org.au.

The initiative hopes to collect a phenological database that can be analysed for biological indications of climate change. It is significant as there is a paucity of data for the majority of southern hemisphere, including Mediterranean-type ecosystems such as the south-west of WA. Yet these areas are likely to be the bellwethers of change, due to their susceptibility to climate change.

Acknowledgements

I would like to acknowledge the assistance of my PhD supervisors, Will Stock and Ray Froend. This research was conducted under an Australian Postgraduate Award associated with an Australian Research Council Linkage Project and with the support of the Water Corporation of Western Australia.

[* for refs. contact Ed.]

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Congratulations!

To Prof. Steve Hopper, who was made a Companion in the Order of Australia (AC) for eminent service as a global science leader in the field of plant conservation biology, particularly in the delivery of world-class research programs contributing to the conservation of endangered species and ecosystems.

To Dr Alex George, who was made a Member of the Order of Australia (AM) for service to conservation and the environment as a botanist, historian and author, particularly in the area of Australian flora, and through roles with national and international professional organisations.

***Both of these gentlemen have shared their extensive knowledge of natural history with* Land for Wildlife *members by giving talks, leading excursions, or writing articles for this magazine. We are very appreciative of this help and offer our congratulations on behalf of all* Land for Wildlifers.**

WEEDS

SELECTION OF ADDITIONAL WEEDS OF NATIONAL SIGNIFICANCE

Shauna Potter

Weeds of National Significance (WoNS) are high impact, established weeds for which targeted, strategic co-investment in a nationally coordinated manner will deliver long-term benefits across Australia. They are causing major economic, environmental and/or social impacts in a number of states and territories with strong potential for further spread. Until recently, 20 species had been recognised, and an additional 12 were recently announced.

Successful nomination as a WoNS recognises a species as a priority current and future weed threat to Australia, requiring coordinated and strategic management along with shared stakeholder investment to develop and implement best practice to prevent, eradicate, contain and/or minimise its impacts in different parts of the nation. The selection of species is subject to technical and policy considerations in a complex and rigorous process managed by the Australian Weeds Committee (AWC), summarised as follows:

- The Bureau of Rural Sciences (now the Australian Bureau of Agricultural and Resource Economics and Sciences – ABARES) reviewed best practice weed risk assessment, resulting in a report which was endorsed by the AWC for use in assessing new WoNS candidates.
- In recognition of ongoing resource commitments to managing the inaugural 20 WoNS, the AWC elected to consider much fewer nominations for formal assessment than was originally done in 1999. AWC jurisdictions consulted with their respective weed experts and nominated a total of 16 species as candidates for new WoNS.
- AWC agreed that, where a genus or a number of species within a genus were nominated, then only one representative species was required to be comprehensively assessed with respect to that nomination.
- ABARES undertook the technical assessment of the 16 nominations, using scientific information and data provided by nominating jurisdictions.
- The assessments were peer reviewed at an ABARES workshop with weed risk assessment technical experts from each jurisdiction. Alternative approaches were developed by the experts to address problems identified with certain questions, with jurisdictions then providing follow-up assessment data.
- ABARES proposed several risk models for AWC consideration in the final report.
- AWC's selected model to rank species was (Invasiveness + Potential for Spread) × (Impacts + Socioeconomic and Environmental Values), with equal weighting of these four criteria. This model could essentially be translated as (local and national spread) × (local and national impacts), recognising the interaction between spread and impact in determining overall weed risk. The model aligned with the Standards Australia/ Standards New Zealand National Post-Border Weed Risk Management Protocol (HB 294:2006).
- AWC also subjected the 16 nominations to a further qualitative analysis of feasibility of control using criteria derived from the National Environmental Biosecurity Response Agreement (NEBRA), using ABARES data where applicable. Despite all of the WoNS candidates having particular challenges in management of infestations, control was found to be achievable for each species.

Having considered the technical basis for new WoNS through assessment of risk and feasibility of control, AWC then considered the candidates with regard to policy considerations. All nominations were judged to:

- o have support from multiple jurisdictions
- o meet the selection criteria for Category 3 - Established Invasive Species of National Significance of the National Categorisation System for Invasive Species
- o have potential to achieve cost-beneficial, cross-jurisdictional outcomes with regard to investments in actions for prevention of spread, protection of assets, improving awareness and capacity, and/or improving integrated weed management.

- Finally, AWC considered resource requirements for the WoNS initiative and potential for grouping to achieve efficiencies:
  - o It was agreed as beneficial to combine closely related taxa under the same WoNS declaration (for example, opuntioid cacti, brooms), consolidating to 14 nominations.
  - o A 'freeing up' of national coordination resources as the original 20 WoNS transitioned to Phase 3 (= lower priority for funding) enabled 12 additional WoNS to be declared.

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WEEDS

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WoNS

The 12 WoNS announced by AWC on 20 April 2012 are important new additions to Australia's WoNS list. The 32 WoNS affect southern and northern Australia, and impact on a diversity of primary industries, natural ecosystems, social amenity and cultural values.

For further vinformation visit: www.weeds.org.au/WoNS/index.

Top: Water hyacinth.
Photo: Penny Hussey

Lower: Cylindropuntia fulgida
Photo: Eric Boon

Additional WoNS

African boxthorn *Lycium ferocissimum*
Asparagus weeds *Asparagus* spp. excluding *A. officinalis* and *A. racemosus*
Bellyache bush *Jatropha gossypiifolia*
Brooms *Genista monspessulana*, *G. linifolia*, *Cytisus scoparius*
Cat's claw creeper *Dolichandra ungulis-cati*
Fireweed *Senecio madagascariensis*
Gamba grass *Andropogon gayanus*
Madeira vine *Anredera cordifolia*
Opuntoid cacti *Opuntia* spp., *Cylindropuntia* spp., *Austrocylindropuntia* spp.
Sagittaria *Sagittaria platyphylla*
Silver leaf nightshade *Solanum elaeagnifolium*
Water hyacinth *Eichornia crassipes*

Original WoNS

Alligator weed *Alternanthera philoxeroides*
Athel pine *Tamarix aphylla*
Bitou bush *Chrysanthemoides monilifera* subsp. *rotunda*
Boneseed *Chrysanthemoides monilifera* subsp. *monilifera*
Blackberry *Rubus* spp. (*R. fruiticosus* agg.)
Cabomba *Cabomba caroliniana*
Chilean needle grass *Nassella neesiana*
Gorse *Ulex europaeus*
Hymenachne *Hymenachne amplexicaulis*
Lantana *Lantana camera*
Mesquite *Prosopis* spp. and hybrids
Mimosa *Mimosa pigra*
Parkinsonia *Parkinsonia aculeata*
Parthenium weed *Parthenium hysterophorus*
Pond apple *Annona glabra*
Prickly acacia *Acacia nilotica*
Rubber vine *Cryptostegia grandiflora*
Salvinia *Salvinea molesta*
Serrated tussock *Nassella trichotoma*
Willows *Salix* spp. and hybrids

What does this mean for people seeking funding for weed management?

Essentially, it will be harder to obtain large amounts of funding, especially for survey and research, for the original WoNS, although small grants to contain outbreaks should still be available. However, large projects involving any of the new WoNS will be encouraged - see, for example, the article about African boxthorn in the July issue of *Western Wildlife*.

IN BRIEF

ACACIA SALIGNA – GENETICS AND INVASIVENESS

Acacia saligna is native to WA, but it has been introduced outside its natural range and now occurs in at least 20 countries worldwide. It has been planted as an ornamental, for erosion control, or for timber, fodder, fuel, fibre or tannin. In some places it has escaped and gone feral, notably in South Africa. There, it was first introduced in 1833 for ornamental and dune stabilisation purposes, and during the next 57 years over 50 million seeds were distributed. Now it covers more than 1.8 million ha of natural and semi-natural land in South Africa and is a major invasive plant.

A recent study* has looked at the genetics of South African (and a few worldwide) populations of *Acacia saligna*, comparing them with natural populations in WA. It seems that the South African populations are now a bit different from those in WA, but that the closest match is to a population in Busselton – which appears to have been planted, not natural.

The authors argue that the process of cultivation actively selects for characteristics that may enhance weediness, such as fast growth rates and robustness to adverse environmental conditions. And when can an introduced species be regarded as fundamentally different from its native counterpart?

Many of WA's bulb weeds from South Africa underwent cultivation elsewhere before they arrived here (in the Netherlands, even) and so this factor could affect why they are so weedy here. Papers such as this highlight how much humans are changing the world's vegetation.

[*for ref, contact Ed.]

MARRI HEALTH

Many *LFWers* have expressed concern about the declining health of Marri trees. It is therefore pleasing to hear that the Centre of Excellence for Climate Change, Woodland and for Forest Health (based at Murdoch University) has been awarded a grant of $275,000 from the Australian Research Council to explore the underlying causes of Marri decline in the south-west, and to help formulate management solutions. If you want to keep up with what Giles Hardy and his team are doing, you can visit their website at www.foresthealth.com.au.

PROFITABLE FARMING, PERENNIALS AND CLIMATE CHANGE – A NEW STUDY

Farming systems that include perennials (for example oil mallees) are being assessed for their resilience to climate change in a new Future Farm Industries Cooperative Research Centre project, EverFarm. Researchers will use models to compare data from four properties (one each in Victoria and NSW and two in WA) to see whether or not, in a changed climate, perennial plants are likely to improve farm profit, compared with current benchmarks in the industry. At this stage, they are not looking at environmental impact or other outcomes, only profit. For more information, visit the website: www.futurefarmcrc.com.au.

COMMON HELIOTROPE KILLING WOMBATS IN SOUTH AUSTRALIA

Common Heliotrope (*Heliotropium europaeum*) is a summer-growing annual from the Mediterranean region, locally abundant in paddocks and disturbed sites in the south-west and the eastern Goldfields. It is known to be toxic to stock, but wildlife managers in Murraylands, South Australia, have been horrified to find up to 85% (± 2,800) of the region's southern hairy-nosed wombats (*Lasiorhinus latifrons*) sick or dying, apparently after eating this plant. In their area, the native grasses the wombats should be eating have been replaced by weeds, including this one.

Common Heliotrope contains pyrrolizidine alkaloids – a deterrent against insect attack – and it has long been known that it is poisonous to stock. This report describes a very worrying effect on native animals, which show signs of skin disease and liver failure.

So, if you have this plant on your place, it is definitely a good idea to get rid of it.

SUPPORT A PROJECT IN YOUR BACKYARD!

The Black Cockatoo Preservation Society is raising funds to distribute DVDs about black cockatoos to schools in Perth.
You can help create the opportunity for future education and support the rehabilitation and release of endangered Australian wildlife.
Please visit the project: http://bit.ly/2000BlackCockatoos

Lesley Dewar

ABOUT GROUPS

THIS IS NUMBAT COUNTRY

Vicki Power and Daniel Scarparolo

The authors are committee members of the community group 'Project Numbat'. Here, they describe their activities and how you might like to contribute.

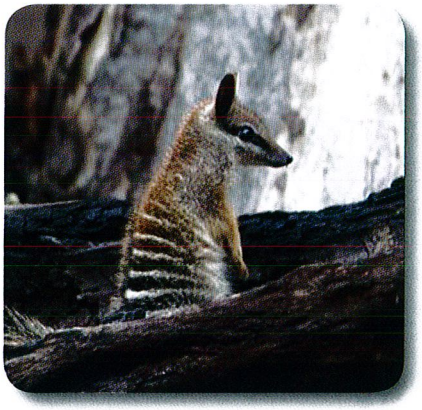
Landowners in the south-west of Western Australia, particularly around Narrogin and Manjimup, have probably heard of the state's mammal emblem, the numbat. Actually seeing one in the wild, however, is another story.

The numbat is a medium-sized marsupial that was once found across southern Australia but now is found naturally in only small pockets of habitat. It feeds exclusively on termites – about 20,000 a day – and because of its diet, is only active during daylight hours, unlike many of Australia's marsupials which come out at night.

While it has developed strategies for avoiding its natural predators such as pythons and birds of prey, it isn't faring well against cats and foxes. Feral cats in particular are having a great impact on numbats in Dryandra Woodland. Once considered a sure-fire place to see numbats in the wild, it is now rare to see them there.

The decline of the numbat has accelerated over recent years until there are believed to be fewer than 1,000 left in the wild. They are now considered an endangered species and, without intervention, the numbat is facing extinction.

A Numbat Recovery Team was formed in 1994 to work towards reversing the declining trend. The team currently consists of DEC, Perth Zoo, Australian Wildlife Conservancy, Arid Recovery and Project Numbat. Actions include



Young numbat Photo: Luke Hoogenstein

feral predator baiting in habitat suitable for numbats, a breed-for-release program, establishing new populations, research, habitat restoration, building predator-free sanctuaries, raising community awareness and education programs.

Project Numbat was formed in 2005 to support the objectives of numbat recovery and raise awareness in the community of the plight of this little-known West Australian. Since it began, Project Numbat has made a significant contribution to numbat recovery. It has raised more than $26,000 which has funded the purchase of radio collars to track numbats, field and aerial monitoring, research and the purchase of camera traps.

In addition, Project Numbat has developed a free primary school education program, provided teams of volunteers to assist with field work and attended community, conservation and education events to raise the numbat's profile.

Of course, this work would not be possible without the support from the community and their desire to see something done for the conservation of this species. One way people can help the numbat is to report sightings of them to DEC. However, if you plan to go looking, be prepared to have a lot patience.

Numbats have large territories and they live solitary lives. Males have an average territory size of 50 hectares and they roam throughout it. Remember, as diurnal animals they're only out during the day. In winter this is in the middle of the day, while in summer it's in the early morning and the late afternoon.

Recent numbat sightings suggest that Boyagin Nature Reserve is a good location to see them, as are Perup Nature Reserve and the Greater Kingston National Park, and you could try your luck at Dryandra Woodland as well. If you take a photo, Project Numbat would love to see it and profile it online.

If you live in Wandoo country, you may be lucky enough to have a numbat on your property. Leaving a woodpile on the ground to attract termites might sound like a crazy idea but that's exactly what happened to Boyagin neighbour, Chris Murphy, with excellent results (see the April 2012 issue of *Western Wildlife*).

Whether or not you live in numbat country, you can still help native wildlife by keeping your cat inside. Domestic and feral cats are efficient predators of native animals so restricting their movements goes a long way to protecting wildlife. If you own a dog, it is also wise to keep them secured or ensure they don't have access to areas where wildlife live.

If you'd like to know more about the numbat, become a member of Project Numbat or make a contribution, visit our website at www.numbat.org.au.

IN BRIEF

REVEGETATION WORKSHOPS ALONG THE BLACKWOOD

Earlier this year, a series of free riparian revegetation workshops, jointly organised by Blackwood Waterwatch, *LFW* and the South West Catchments Council, were held in Bridgetown and Nannup. They focused on revegetation of waterways and farm dams, so as to create wildlife habitat.

The workshops were very well attended, and people were especially interested to learn how, by the use of local native plants combined with clever fencing, you could retrofit your farm dam to provide habitat for wildlife as well as having water storage and, if necessary, stock access.

CAN GREY KANGAROOS CARRY TWINS?

In *Western Wildlife* 14/1, January 2010, Mike Murphy of Walpole wrote a story about a grey kangaroo with two similar-aged joeys in her pouch – it turned out that one was just visiting. This is a very unusual occurrence, as a roo's arrangement of teats does not allow for twins. But last month, we heard of another example.

Dellis Venning sent in this photo, taken by a very excited Italian backpacker staying at her eco-cottages 'Soulhaven' on the Moore River near Regan's Ford. It really does look like two similar-aged joeys! Are there any kangaroo experts among the readership who can offer an explanation?

Dellis Venning can be contacted on: dellis@soul-haven.org.

MORE ABOUT CYANIDE

You may remember that in *WW* 15/4 (October 2011) we noted that, when stressed, marri millipedes release hydrogen cyanide and we wondered whether this gas might have a purpose in the soil/litter ecosystem. Well, it appears that it does – it stimulates the germination of kangaroo paw seeds!

Researchers at Kings Park were rightly pleased when they isolated the germination-stimulating molecule 'karrikinolide' from bushfire smoke (see *WW* 14/2, April 2010), however they were surprised to find that the red and green kangaroo paw (*Anigozanthos manglesii*) did not respond to it. Yet kangaroo paws are well known to respond to fire with mass germination, so what was the stimulant?

After five years of painstaking research, it was found that kangaroo paws are stimulated to germinate after fire by the compound glyceronitrile, found in bushfire smoke. With winter rainfall, the glyceronitrile molecule percolates through the soil, enters the seed and when inside, releases cyanide which is the active stimulant.

How many other astonishing stories are out there in our bushland, just waiting to be discovered! Don't we live in an amazing place? (But no-one has yet linked this story to marri millipedes and their cyanide!)

DON'T FORGET TO MONITOR WHITE-STRIPED BATS!

October through to April is the period for monitoring white-striped bats (see *WW* 14/4, October 2010 for the detail of the protocol - its very easy to do!).

This Citizen Science project is hoping to demonstrate whether this bat can be used to measure of the effect of climate change on fauna distribution.

If you haven't done so already, visit the Climate Watch website and register as a participant (www.climatewatch.org.au).

ON LINE 1080 TRAINING COURSE/LICENCE

DAFWA has created an on line training course for the use of 1080 for feral animal baits. After successful completion of the course, a licence to use baits is issued. Find out more at biotraining@agric.wa.gov.au.

This newsletter is a compendium of articles written by many different people. The views expressed are those of the authors, not necessarily those of the Department of Environment and Conservation.
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