

In late 2011, researchers from the University of Melbourne started work on a groundbreaking three-year project which will investigate the biodiversity value of golf courses. In this first of a series of updates, ATM looks at the goals of the project, while visiting PhD student Luis Mata looks at the initial insect surveys which have been conducted at the 13 Melbourne-based golf clubs involved in the project.

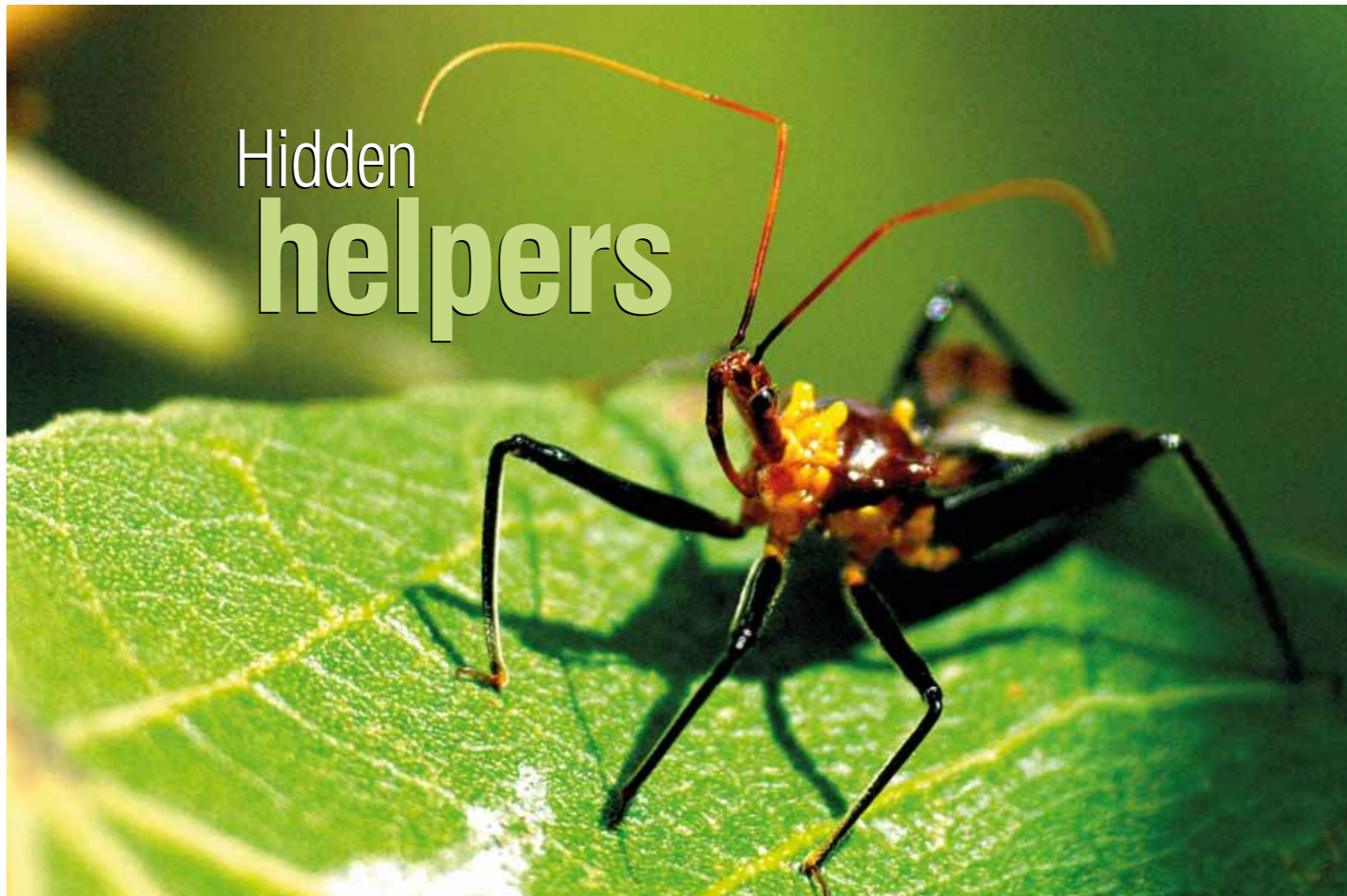


PHOTO BY LUIS MATA

Hidden helpers

In 2011 the Australian Golf Course Superintendents' Association (AGCSA), in conjunction with the University of Melbourne, announced that it was establishing a joint research project with the objective of improving the understanding of biodiversity conservation and carbon sequestration provided by urban green spaces, in particular golf courses.

Jointly funded by the Australian Research Council (ARC), the Australian Research Centre for Urban Ecology (ARCUE) and the AGCSA, the three-year project got underway in late 2011 and has three specific aims:

- To quantify the carbon stored and sequestered in the vegetation biomass and soils of urban golf courses according to management intensity and age;
- To quantify the biodiversity benefit of urban golf courses in comparison to the adjacent residential urban areas; and
- To develop, or apply, spatially-explicit models to predict the carbon and biodiversity benefit of urban golf courses, parks and gardens, and to then validate the predictive capacity of these models.

Thirteen golf courses throughout south-east Melbourne agreed to take part in the study, ranging from newly established courses through to golf courses that have been on their existing site for more than 100 years. The courses are located from Brighton down to Frankston and include:

Brighton GC	Spring Valley GC
Victoria GC	Kingswood GC
Woodlands GC	Rossdale GC
Sandhurst Club	Amstel GC
Ranfurlie GC	Centenary Park GC
Peninsula Country GC	Settlers Run G&CC
Frankston GC	

To date researchers have surveyed:

- **Bat biodiversity:** Researchers installed devices to record night-time activity of insect-eating bats;
- **Insect biodiversity:** Researchers used three methods to capture diurnal and nocturnal insects, including pan trapping, sweep netting and light trapping (see more on this below).

Over the spring and summer of 2012-2013, researchers will continue with the above surveys as well as look at:

- **Bird biodiversity:** Researchers will visit each golf course 4-6 times a year to record birds observed based on sightings and song;
- **Vegetation:** Researchers will visit each golf course to map and record plant species and vegetation communities present;
- **Soil sampling:** The research team will collect soil samples from throughout the golf course from wooded areas, roughs, fairways and greens.

This extensive project aims to provide the golf course industry with a detailed and predictive understanding of the biodiversity value their urban green spaces provide. The research team is led by University of Melbourne's Dr. Stephen Livesley and also includes Dr. Amy Hahs, Dr. Caragh Threlfall, Dr. Nick Williams and Prof. Nigel Stork. Results of the insect surveys undertaken so far are presented below by Luis Mata, a visiting PhD student from the University of Barcelona, Spain.

PLAYING A ROLE IN INSECT CONSERVATION

Australia is a continent that has fascinated biologists for centuries. For many, this is directly related to the

uniqueness of its plants, mammals and birds. Where else can you be amazed by the beauty of gum-trees, paperbarks and banksias? Where else can you see wallabies, enjoy the laughing calls of kookaburras, or the sulphur-crest of the cockatoo? However, despite sharing a fascination for Australia's unique animals, my true fascination and research interests are for the diversity of Australian insects!

In late 2011, I was lucky to join the University of Melbourne research team, as a visiting insect ecology PhD student, and be a part of this major scientific study into the biodiversity and carbon benefits provided by golf courses and other urban green spaces within our cities.

For me, one of the most interesting aspects of this project is the investigation of the link between golf course structure and management and insect biodiversity. This means that we will have an opportunity to learn more about how the management decisions related to golf course vegetation structure and vegetation elements may influence the biodiversity values within golf courses. This knowledge can then be used to guide management decisions that promote higher biodiversity values within golf courses.

But what do we mean by the value of biodiversity? And how does this relate to insects? Furthermore, how does insect biodiversity relate to 'ecosystem services' provided to the wider environment and community by golf courses?

The first thing to realise about insects is that some of them are herbivores and some are carnivores. Herbivorous insects can become 'pests' of valued trees, shrubs, crops, herbs and turf under favourable conditions. These insect pests are the ones we try to fight off with expensive and often ecologically unfriendly pesticides.

But many insect groups, such as assassin bugs, damsel bugs, ladybugs, mantidflies and praying mantis, are carnivorous, feeding principally upon other insects. This is fortunate as they are

Main photo: Assassin bugs, which are part of the heteropteran bug family, are predatory species characterised by their stout beaks. During the first collection season of the golf course biodiversity project, 80 different species of heteropteran bugs were found on the 13 courses involved in the project

Damsel bugs are economically important predatory species that act as natural pest control agents



PHOTO BY CHRISTOPHE QUINTIN





An example of an open grassland-type rough at the Peninsula Country Golf Club, one of the 13 courses that are part of the project. Predatory heteropteran bugs, including the damsel bug, were found predominantly in open rough areas such as these

PHOTO BY LUIS MATA

in fact performing a service for us by keeping potential insect herbivore pests in check. This can be considered to be an 'ecosystem service', as it is one of the benefits people obtain from the environment. The common ecosystem services that insects can provide are derived from processes such as pollination, predation and parasitoidism.

Insects lay eggs, and sometimes in large numbers. These eggs hatch into larvae which will often feed voraciously on plant material. Most of the time insect eggs are laid upon leaves, branches or soil surface litter, but there are a special group of insects that lay their eggs inside the larvae of other insect species.

When these eggs hatch inside the larval host they eat their way out and eventually consume their host. This group of insects also provide an ecosystem service to us by keeping potential larval pests in check. They are known as the parasitoid wasps.

Now that you know them, you might value them more, as they are out there in the tree and shrub canopies and the grassy rough.

HIDDEN GEMS

Shortly after arriving last October, I got my boots, fluro vest and sun hat and set off to gather evidence

for the presence of some of these important herbivorous and carnivorous insect species at the golf courses of Melbourne's sandbelt. In particular, I wanted to investigate their relationship to golf course vegetation structure and management.

Working with project research fellow Dr. Caragh Threlfall, we collected insects using three different methods on repeat visits to the 13 golf courses that had agreed to be part of this study. Insects were collected from areas of the golf course classed as 'rough' vegetation, sampling equally from rough areas below tree canopies and open rough areas. The three key methods we used to collect insects were:

- A sweep-net to gather insects from grasses, shrubs and low tree branches;
- Coloured bowls to attract and trap bees;
- Light traps set at dusk and dawn to attract nocturnal bugs and moths.

The first group of insects that we looked at, and that are the focus of my research, are the heteropteran bugs or 'true bugs'. The diversity, endemism and evolution of heteropteran bugs have been thoroughly reviewed in a recent report by leading Australian entomologists (Austin et al, 2004). Many heteropteran bug species are already well recognised as natural pest control agents.

Both parkland style golf courses (such as Centenary Park, pictured left) and bushland style courses (like Frankston Golf Club, pictured right) are involved in the three-year biodiversity and carbon benefit project



PHOTO BY LUIS MATA



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PHOTO BY CARLA KISHIMAMI



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Above: Visiting PhD student Luis Mata uses a sweep-net to sample insects from golf course rough vegetation

Above middle: Mantidflies are nocturnal predatory species whose wings are characterised by numerous branched veins

Above left: Ladybugs are predatory beetles characterised by their colourful and contrasting body pattern

Adult female parasitoid wasps (right) are known to lay their eggs inside insect larvae. When these eggs hatch into larvae themselves (middle) they grow by eating their host larvae

the values of biodiversity and the steps they can take to conserve and use it sustainably. Hopefully, an old game will start using a new angle, one in which golf courses play an important role in insect conservation.

ACKNOWLEDGMENTS

The AGCSA wishes to thank the University of Melbourne research team, in particular Dr Caragh Threlfall, for their assistance in putting this article together. Luis Mata is a PhD student at the Department of Animal Biology, University of Barcelona, Spain. His research focuses on the ecology, biodiversity and conservation of insects. He was first exposed to golf here in Victoria, and this last summer played his first 9-hole game at Burnley Golf Course.

Luis Mata is pleased to acknowledge the invaluable support of Frances Alexander, John Geary, Amy Hahs, Steve Livesley, Mick McCarthy, Mali Malipatil, Briony Norton, Nigel Stork, Caragh Threlfall and Nick Williams during his involvement in the project.

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In total we found 80 different species of heteropteran bugs in the 13 golf courses, which is a high number when you recognise that only 350 heteropteran bugs species have been collected in the whole of Victoria to date. Furthermore, this number of species was only found during one collecting season. We expect to repeat insect collection in the coming spring, so it is safe to speculate that the number of species will increase.

Of these 80 heteropteran bug species, nine were predatory species. The most frequent and abundant predator was the damsel bug, or according to the Finnish entomologist Odo Morannal Reuter, who named it back in the 19th century, *Nabis kinbergii* (see photo bottom right page 7). This predator bug species is a celebrity in Australia as it naturally controls the cotton bollworm, the most economically damaging pest of broad-leaf crops in Queensland and New South Wales.

Interestingly, predatory heteropteran bugs, including the damsel bug, were found predominantly in open rough areas, with a tall grassland-type vegetation structure, like that of Peninsula Country Golf Club pictured top on page 8). Therefore, from an ecosystem service perspective it might be beneficial to maintain and incorporate more of these grassland-type roughs into golf courses.

Globally, land-managers and decision-makers, including golf course superintendents, are showing an increased interest in, and understanding of, the values of biodiversity. By actively collaborating with the scientific community, these groups are taking the first steps towards a key target of the latest Convention on Biological Diversity which stated that by 2020, at the latest, people will be aware of



PHOTO BY RICHARD TAYLOR



CARBON CONNECTIONS TO TEE OFF AT SYDNEY GOLF COURSES

Among the more than 100 NSW projects to receive grants in the first round is an environmental initiative driven by the Sydney Metropolitan Catchment Management Authority (SMCMA) which aims to link 'corridors of green' through some of Australia's most urbanised suburbs.

The project, titled Teeing-off Carbon Connections which will get underway in July 2012, has received more than \$1.8 million over four years and aims to facilitate the rehabilitation of select ecologically important habitats that connect regional and subregional biodiversity corridors.

Integrated revegetation, habitat protection and invasive species control projects will be undertaken on golf courses, public open space and in natural areas not actively managed for conservation to build resilience and safeguard Sydney's biodiverse carbon stores. A research partnership will also be established to audit and prioritise biodiverse carbon stores on golf course sites in the region.

SMCMA chairman Mark Bethwaite AM says the project has huge potential for golf clubs and the authority itself to realise the significant benefits golf clubs provide to the biodiversity of the urban environment.

"There are more than 50 golf courses covering some 3000 hectares within our catchment," says Bethwaite. "This provides an exceptional opportunity for the SMCMA and golf courses to work together to protect native vegetation and reduce the impact of weeds and invasive pests.

"What is also interesting is the opportunity for the SMCMA to find out more about the role of golf courses as carbon sinks and how they may be able to participate in the Australian Government's Carbon Farming Initiative. Golf courses are already considering this and the SMCMA project includes an important research component which will assist golf courses, among others, to understand the best way to proceed.

"What makes the SMCMA unique among the 13 NSW catchment management authorities is our focus on urban landscape issues. We work to build connections both between landscapes and between landholders. This project will allow us to offer training to golf course managers and ground maintenance staff on how to increase native biodiversity on their land.

"By working with a number of golf courses and councils we hope to build and link vegetation corridors extending right across Sydney. Birds and animals can use these corridors to move to new places to breed and feed, which helps the species to thrive."

Bethwaite says the SMCMA has already received expressions of interest for 13 project sites across Sydney, including five golf courses. Announcements of the successful golf course project sites will be made within the first six months of the project.

Golf to benefit from Biodiversity Fund

ATM looks at the first round of grants handed out by the Federal Government's Clean Energy Future Biodiversity Fund which were announced in early May.

An ecological rehabilitation and biodiversity study of Sydney golf courses and improvement works at Katherine Country Club in the Northern Territory to assist in the regenerating of the Katherine River flood plain were among more than 300 projects to receive funding from the first round of the Federal Government's Clean Energy Future Biodiversity Fund.

More than \$271 million in grants to 317 successful projects around Australia was announced on 4 May by Federal MPs Greg Combet (Minister for Climate Change and Energy Efficiency) and Tony Burke (Minister for Sustainability, Environment, Water, Population and Communities), with golf-related projects securing more than \$3.1 million of that amount.

The Biodiversity Fund is set to invest around \$946m over the next six years to help land managers store carbon, enhance biodiversity and build greater environmental resilience across the Australian landscape.

To do this, it will fund eligible land managers for activities in three main areas:

- **Biodiverse plantings:** Funding will help land managers expand native habitat on their property through planting mixed vegetation species appropriate to the region. This will help build landscape resilience and connectivity.
- **Protecting and enhancing existing native vegetation:** Funding will support land managers to protect, manage and enhance existing native vegetation in high conservation areas on their land for its carbon storage and biodiversity benefits.
- **Managing threats to biodiversity:** Funding will control the threat of invasive pests and weeds in a connected landscape.

A grant of \$1.329 million over a period of four years will enable the restoration of several areas within and adjacent to the Katherine CBD and the Katherine River flood plain. These areas will be linked creating green corridors from the river with the town's golf club and showgrounds.

According to a news release on the Katherine Country Club website, the grant money will enable the nine-hole course to undertake civil works to expand the size of the lakes and increase water collection, plant a range of native trees and bushes, remove exotic tree species, install a new automatic irrigation system to sections of the golf course and undertake major plantings in out of play areas.

KCC president Alden McCue and general manager Frank Dalton say the grant provides a fantastic opportunity for the club to reduce its water bill, install new irrigation and improve landscaping, as well as providing an opportunity to develop future carbon credit offsets.

Editor's Note: For more information about the Biodiversity Fund, visit www.environment.gov.au/cleanenergyfuture/biodiversity-fund.

Opposite page: A number of golf-related projects have secured significant funding in the first handout of grants by the Federal Government's Biodiversity Fund

The SMCMA is no stranger to working with golf clubs in the area and has just finished a project with Eastlakes Golf Club and is currently working with the NSW Golf Club (course superintendent Gary Dempsey) as part of earlier biodiversity/native vegetation programmes.

"We hope to work with about 10 organisations in this first stage of the project and continue to include additional sites over the next few years as funding becomes available," says Bethwaite. "We are also talking to Golf NSW so that the lessons we learn can be shared by courses across NSW.

"For grounds maintenance staff at golf courses, the project will be very direct and hands-on, with the focus on preserving existing native vegetation along with fostering regeneration and revegetation where required."

GREEN WITH ENVY IN KATHERINE

Katherine Country Club (KCC) in the Northern Territory, in conjunction with the Katherine Town Council and Green Australia, was another to benefit from the opening round of Biodiversity Fund grants.

REPORT LOOKS AT CARBON TAX IMPLICATIONS FOR GOLF CLUBS

Golf Australia, Golf Management Australia (GMA) and the AGCSA have released a report which looks at the introduction of the Federal Government's carbon tax and its likely implications for golf clubs. With the new carbon tax legislation coming into effect from 1 July 2012, the report, titled 'The Impact of the Carbon Pricing Mechanism on Golf Club Operations', aims to provide golf clubs with detail of the carbon pricing mechanism and its likely impact on club operations.

The carbon pricing mechanism, or 'carbon tax' as it is often referred, is central to the Federal Government's Clean Energy Future programme to reduce carbon emissions (carbon pollution) and encourage investment in clean energy via four key initiatives – carbon pricing, renewable energy, energy efficiency and land management.

Under the carbon pricing mechanism, the biggest emitters in Australia will be required to pay for their emissions, or offset their usage via the purchase of carbon credits. This represents approximately 60 per cent of Australia's total carbon emissions and includes emissions from electricity generation, some business transport, waste and industrial processes.

The carbon price will be fixed for the first three years and after that it will be determined by the market. Households, farmers and smaller businesses (including golf clubs) will have no direct obligations under the carbon price mechanism. However, golf clubs will be indirectly affected as the impact of the carbon pricing mechanism filters through the supply chain of goods and services that a club typically purchases.

The report also discusses the eligibility for golf clubs to generate carbon credits via the golf course landscape. Land management is one of the four components of the Clean Energy Future plan to reduce carbon emissions by providing farmers and landholders the

opportunity to earn carbon credits via the Carbon Farming Initiative scheme as established by the Government.

The scheme provides a framework for compliant and non-compliant carbon credits to be generated by reducing emissions or storing carbon on the land. Compliant carbon credits can be earned by farmers and landholders from approved activities, including reforestation and avoided deforestation. In turn, compliant carbon credits can then be purchased by business to offset their emissions.

Non-compliant carbon credits can be earned by farmers and landholders from other activities, including soil carbon, improved forest management and non-forest revegetation. Non-compliant carbon credits can be made available to the voluntary carbon market, and some will also be purchased by the Government.

Components of a typical golf course landscape relevant to storing carbon are the existing tree population (non-forest vegetation) and soil. At present there is no activity recognised by the Carbon Farming Initiative relating to these golf course landscape components and therefore no present opportunity for a golf club to earn carbon credits.

However, Golf Australia, together with GMA and the AGCSA, will be considering whether to jointly explore this issue further with a view to identifying an industry-based opportunity that could benefit golf clubs by allowing them to generate carbon credits via an eligible activity, or activities.

The joint GA/GMA/AGCSA report was sent to all golf clubs in May and AGCSA members can download a copy through the member's area of the AGCSA website (HR and Best Practice-Carbon Tax).

