WESTERN SYDNEY
UNIVERSITY

Hawkesbury Institute
for the Environment

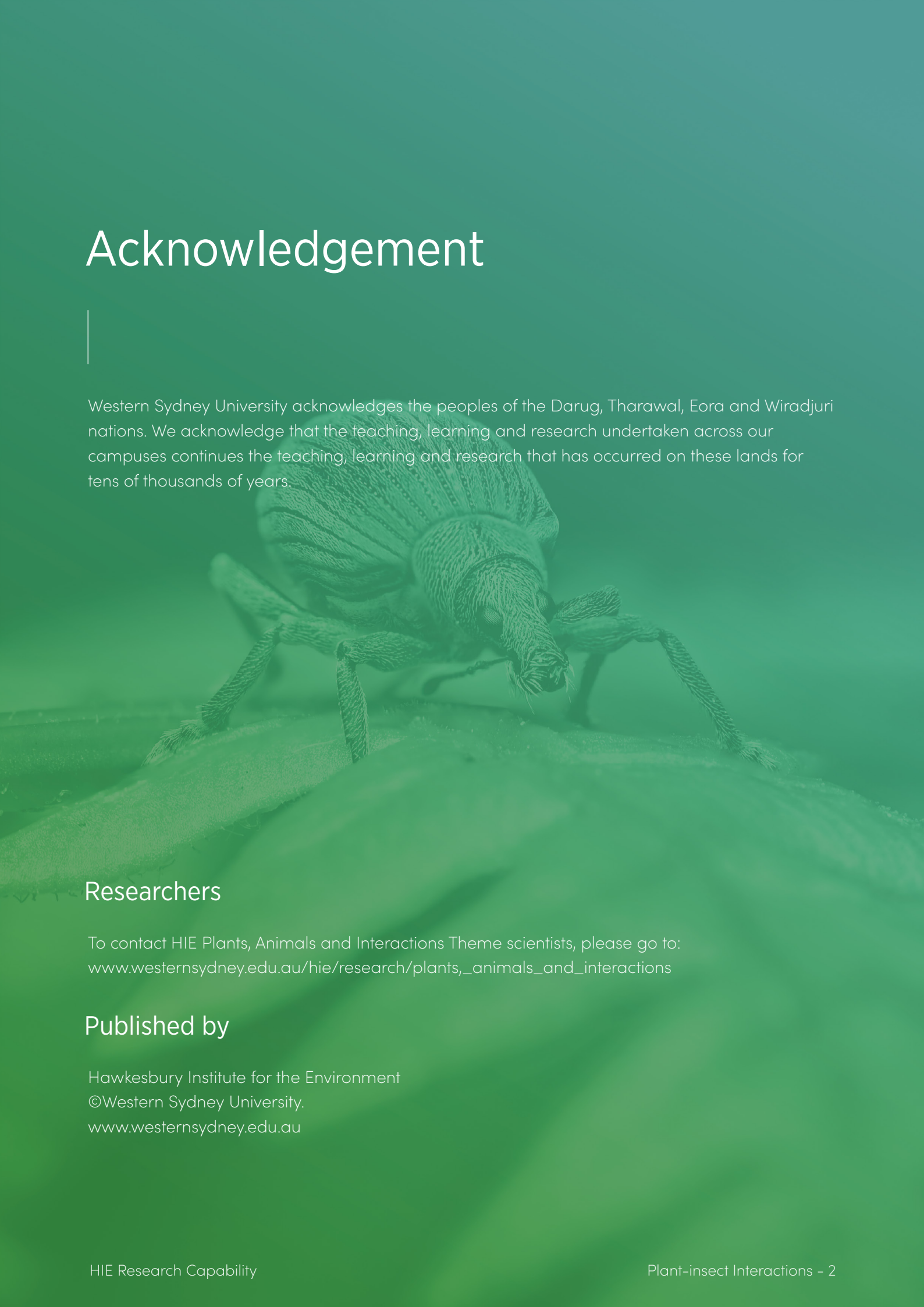
RESEARCH CAPABILITY

Plant-insect interactions

The science of pollination and pest control

Acknowledgement

Western Sydney University acknowledges the peoples of the Darug, Tharawal, Eora and Wiradjuri nations. We acknowledge that the teaching, learning and research undertaken across our campuses continues the teaching, learning and research that has occurred on these lands for tens of thousands of years.



Researchers

To contact HIE Plants, Animals and Interactions Theme scientists, please go to:
www.westernsydney.edu.au/hie/research/plants,_animals_and_interactions

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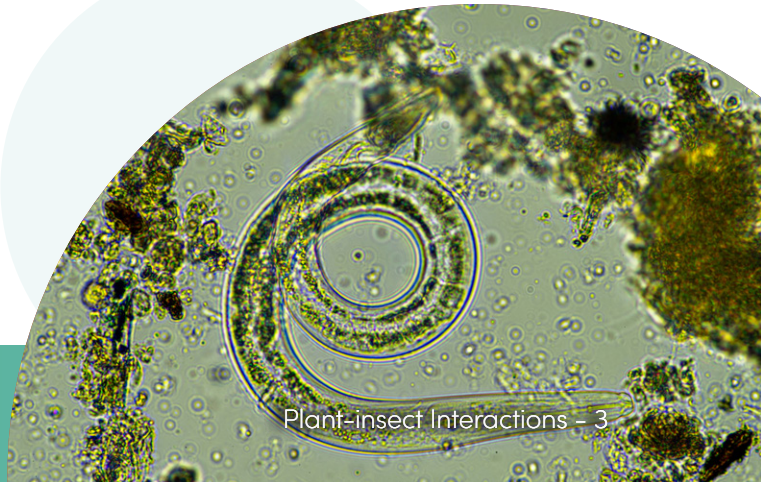
Innovative research for sustainable ecosystems

Insects create the biological foundation for all terrestrial ecosystems. They are crucial for plant pollination, decomposition and soil nutrient cycling, seed dispersal, control of pest species, and as a food source for other taxa.

Global climate change and habitat loss has seen a steep decline in insect numbers, causing ecosystem imbalances that increasingly risk human livelihood, food security and natural ecosystems.

Imbalances in natural ecosystems and agricultural production need to be understood to be successfully managed. Our researchers investigate the cause of insect declines to lessen greater loss of insect biodiversity in the future, find ways to manage changes in insect biomass, and safeguard the valuable ecosystem functions performed by insects that are critical to the future of our planet.



Australian native bees

Australia has around 2,000 species of native bee.

Native bees are vital for Australian ecosystems and agricultural productivity.

Most native bees are solitary. Other native species are semisocial and raise young in tiny hollows in timber or underground burrows. A few species of native bee, such as the stingless *Tetragonula*, are social and build their hives in trees or logs. These species are being investigated for their pollination potential on crops and in glasshouses.

The social *Tetragonula* species are effective pollinators of an estimated 6 million macadamia trees, producing around 35,000 tonnes of nuts in Australia each year. They are also effective pollinators of mango and lychee crops.

The solitary blue-banded bee is more efficient than the European honey bee at pollinating greenhouse tomatoes. Blue-banded bees 'buzz' pollinate, bursting the pollen capsules of flowers by vibrating their wings.

Main research topics

Our research focuses on understanding insect biology, ecology and the impact of climate change and human activities on their health and behaviour. This information will form a baseline for management of pest insects.

Insect communities

Biology and ecology of insect communities and populations

Insect dynamics

Altered insect dynamics with climate and environmental change

Pest insects

Management strategies for pest insects

Microbial partners

Microbial partners and their interactions with insect species

Pollination

Pollination in Australian ecosystems – both crops and native plants

RESEARCH DIRECTIONS

Impact of climate change on herbivores

Herbivorous insects account for 25% of the planet's species so their responses to environmental change are pivotal to how future ecosystems will function. Our researchers investigate how atmospheric change will affect sap-feeding herbivores under increased atmospheric carbon dioxide concentrations (eCO_2), to predict future susceptibility to and prevent pest insect outbreaks.

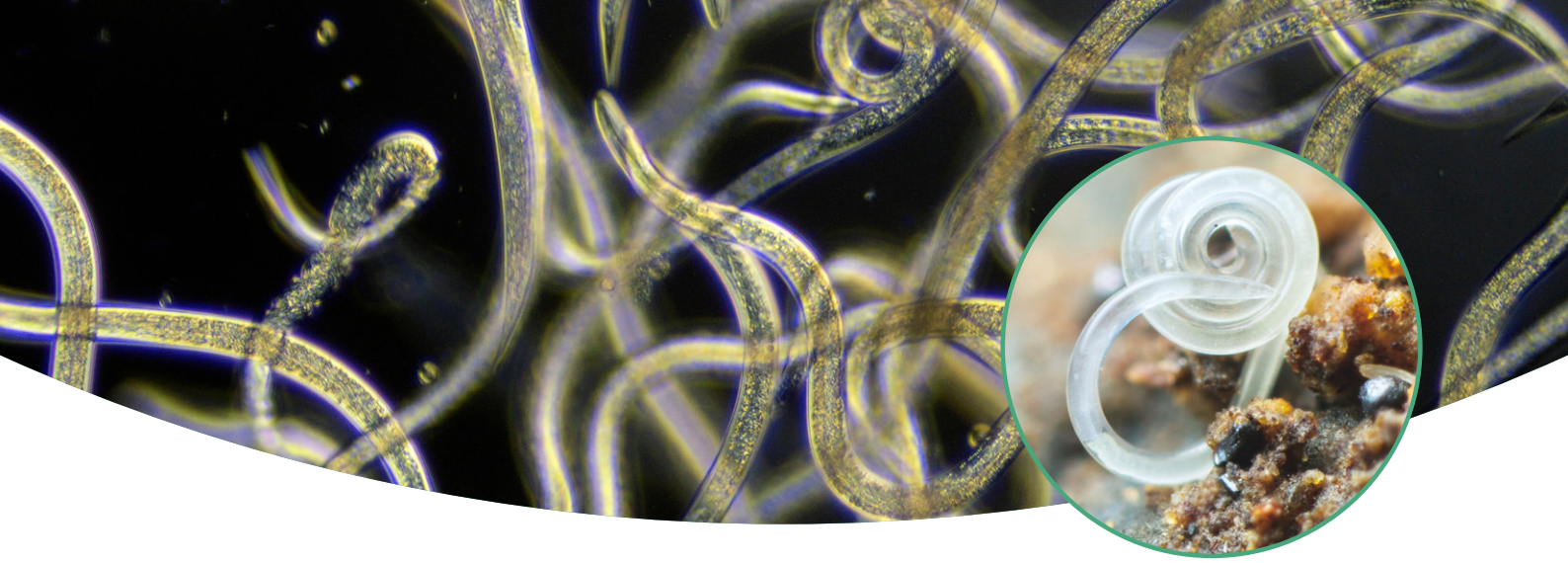
Environmentally induced changes in the nutritional ecology of herbivores like aphids, has the capacity to change life-history strategies of these insects and their direct and indirect interactions with many other organisms, including mutualists and antagonists.

RESEARCH DIRECTIONS

Queensland fruit fly sterile insect technique pilot operation

Queensland Fruit Fly (Qfly) presents a complex problem. A coordinated, strategic approach to management is needed. The sterile insect technique (SIT) is an environmentally friendly and effective insect control strategy that is applied successfully in the control of many fruit fly species and other pests of economic significance. Our researchers are developing a proof-of-concept that supports a business case for future wide-spread implementation of the SIT by industry. Flies will be made available to investigate their impact on controlling pests.

Tephritid fruit flies include the most destructive pests attacking fruit and vegetables. Australia's Plant Biosecurity Cooperative Research Centre in 2015 estimated the cost of fruit fly in Australia at A$300 million a year in loss of production, control costs and lost markets. Fruit fly pests are also a barrier for the potential growth of horticultural industries.



RESEARCH DIRECTIONS

Entomopathogenic nematodes for controlling honey bee insect pests

European honey bee is Australia's most significant crop pollinator and is fundamentally important to Australian horticultural industries. However, Australia's honey bee colonies suffer from a large number of pests and pathogens which reduce the health and fitness of bees, as well as their performance in pollination.

The overall objective of our research team is to test the efficacy of a large set of recently isolated entomopathogenic nematodes (EPNs) as biological control agents against two major pests of honey bees in Australia, the small hive beetle and the wax moth, and to develop novel biological control options for honey bee pests.

RESEARCH DIRECTIONS

Delivering defences: Using fungi to enhance plant resistance to herbivory

Our researchers will identify how the diversity of beneficial fungi in the soil is affected by agricultural management, and will examine how these fungi govern the ability of plants to defend themselves from insect herbivores. Through innovative field surveys and experimentation, we will generate new knowledge in soil ecology and plant defence.

Results from this research will allow us to exploit soil fungi to enhance crop protection while simultaneously conserving soil ecosystems. Effectively boosting plant defence in this way will reduce reliance on ecologically damaging pesticides, promote soil biodiversity, and ensure the sustainability of crop production into the future.

RESEARCH DIRECTIONS

Creative ways to secure our food supply

Our researchers are targeting fly species to determine their pollinator effectiveness in avocado, berries, hybrid carrot seeds and brassica seed crops. The advantages are that different species of flies are present all year round, they have high sugar demand and visit flowers for nectar, and they are hairy, and hence pick up and move pollen. In addition, they can be readily mass reared with reasonably minimal inputs.

Our pollination research focuses on understanding insect pollinator biology and ecology and the impact of climate change and human activities on their health and behaviour.

Researchers at the Institute are interested in unveiling the symbiotic relationships that can guarantee the productivity of crops and natural ecosystems.

RESEARCH DIRECTIONS

Native buzz pollinators

We are developing a range of management techniques that will enhance the potential for the use of blue-banded bees as alternative pollinators in commercial greenhouses.
Our researchers are conducting research to overcome current limitations in the use of blue-banded bees in greenhouses, reviewing common diseases of blue-banded bees and trialling control methods, and developing procedures for mass rearing.

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We invite researchers and investors to explore future opportunities to work with the **Hawkesbury Institute for the Environment.**

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