

Primefact

Farm biosecurity for the macadamia industry

February 2026, Primefact PUB26/103, first edition

Dr Zac Hemmings, Plant Biosecurity and Product Integrity, NSW DPIRD

What is biosecurity and why is it important?

Biosecurity is a set of measures to protect crops and property from the negative effects of pests, diseases, and weeds. Australia is free from many major pests and diseases present elsewhere in the world. This pest-free status provides several benefits, including reduced cost of agricultural production, increased agricultural productivity, and access to international markets. A pest's effect is not limited to economic damage; it can also have negative effects on society, human health, and the environment.

Biosecurity risks can be managed by:

- preventing the entry of pests and diseases
- finding, detecting, and eradicating pests
- minimising the effect of those pests that cannot be eradicated.

These principles apply to government departments managing biosecurity (national or state) and growers who wish to prevent the spread of pests, diseases and weeds on their property. Biosecurity is a shared responsibility; everyone has a role in protecting our economy, environment, and community from biosecurity threats.

How can I protect my farm?

The best defence against pests, diseases, and weeds is to implement sound biosecurity practices. It is more cost-effective to prevent pests, diseases, and weeds from entering your farm than it is to eradicate or manage them once they are there. Anything that involves moving people, plant material, or other items that can carry pests, diseases, and weeds is a biosecurity risk.

People

Visitors can bring pests, diseases, and weeds to your property on clothing, footwear, and tools. Visitors who have recently travelled overseas and those who visit multiple properties, such as casual workers, tourists, and contractors, are particularly high risk. Measures to mitigate the risks associated with people movement include:

- Maintaining a visitor log and requiring all visitors to sign in. This can be achieved with a logbook in the farm office or digitally using QR codes.
- Establishing biosecurity zones to help manage where people move on and around the property. Fences or barriers can be used to minimise the movement of people and vehicles between zones, and signs can be used to direct visitors and staff.

- Ensuring that everyone understands their biosecurity obligations and what is expected of them. Conduct site inductions with visitors, provide training to employees, and place signs at key locations (e.g. footbath stations).
- Clothing can transmit diseases such as fungal spores, weeds, and pests such as lace bugs and cobbler's peg. All visitors should thoroughly wash their hands on arrival. Travellers from overseas should shower and wash their clothing before entering the property. Workers and contractors should use clean gloves when in production areas.
- Everyone entering the property should ensure their footwear is clean and free from soil and plant material. There are several ways to achieve this. For instance, you could provide disinfecting footbaths that visitors and employees are required to use. Alternatively, you could require them to exchange their footwear for footwear provided by you, which is to be worn only in certain areas of the farm.
- Consider purchasing a sturdy plastic tub to use as a footbath or make your own from on-farm materials, such as leftover intermediate bulk containers (IBCs).
 - Disinfectants cannot penetrate dirt and mud. Stiff brushes, screwdrivers, hoof picks, or high- pressure hoses can be used to remove all soil and plant material before using the footbath.
 - Footbaths should have a hard surface or tarpaulin at the entry and exit to reduce the amount of soil going into them.
 - The footbath solution should be changed regularly to prevent it from becoming excessively dirty. The dirty water should be disposed of safely and away from crops.
 - Footbaths should be undercover or have a lid to prevent them from filling or overflowing during rain.
 - Several disinfectants are available for use in footbaths and to clean equipment. Bleach is readily available and effective against a wide range of pests and pathogens. When used in a footbath, bleach should be diluted to 1% active sodium hypochlorite (the active ingredient in bleach). If you are concerned about more resilient pathogens, consider disinfectants such as Virkon S, Powerquat, or F10SC. Note that some disinfectants are caustic and might damage clothing and equipment. Always use products as directed on the label.

Vehicles, equipment, and machinery

Vehicles pose a significant biosecurity risk, as they can transport soil and plant material that can carry pests, diseases, and weeds. There are several ways to minimise the risk of vehicles introducing pests to your property, such as:

- Arrange for visitors' vehicles to be inspected before they enter the farm. If the vehicle is contaminated, send it away to be cleaned.
- Always practice '**come clean, go clean**'. All vehicles and machinery entering and exiting production and packing areas should be free from mud, dirt, and plant material. When cleaning vehicles:
 - park the vehicle on a hard surface
 - use high-pressure water to remove gross matter: target areas frequently exposed to dirt and plant material, such as wheel arches, tyres, side steps, and the underbody of the vehicle
 - apply a suitable disinfectant to the outside of the vehicles and any interior parts exposed to dirt, such as floor mats and footwells
 - rinse the disinfectant from all surfaces
 - passengers should disinfect their footwear in a footbath.
- Have designated parking areas for visitors' vehicles and ensure they only travel along marked roads. A vehicle should only enter a production area if it is necessary.
- Transfer passengers to dedicated farm vehicles that only operate within production areas.

- Use signs to inform visitors about property access points and parking areas.
- Request that any contractor vehicles or earth-moving equipment be cleaned, and inspect them before they enter your property to ensure they are free from soil, mud, and other plant material.
- If your operation requires frequent movement of off-farm vehicles into production areas, consider establishing dedicated vehicle wash-down facilities at entrances and exits. Wash-down facilities should be on a hard surface and have disinfectant. Wastewater should be contained in the sump or collection area.

Tools and equipment are a common vector for plant diseases, posing a significant biosecurity risk. Tools that come into contact with the plant, such as pruning equipment, can transmit plant diseases.

- If contractors or workers bring their own tools or machinery, ensure they are disinfected before being used on your property, especially if they have previously been on other farms. Inspect them after cleaning.
- If possible, keep tools on the farm rather than having them move off-site. Depending on the scale and nature of the business, it might be possible to provide workers with dedicated, clean, on-farm tools.
- Ensure that tools are regularly cleaned and disinfected.

Farm inputs

Plant and propagation material can introduce pests, diseases and weeds to your farm. To reduce this risk:

- Maintain planting records, including how many plants of each variety were purchased, the supplier, purchase date, planting date, and where on the farm they were planted.
- Only purchase propagation material from reputable sources and check the plants before they are delivered. Use clean planting material that has been tested for pathogens. Ask the supplier for information on any pathogen testing or other plant health documentation that might be required. The supplier should have a biosecurity management plan in place to manage biosecurity risks on their property.

Always ensure any plant material is from a reputable nursery and check the plants before delivery.

- Propagation material should be inspected for pests and diseases before bringing it into production areas. Many diseases cannot be detected until symptoms appear, so new plants should be kept separate from established plants and regularly monitored for signs of pests or diseases.
- Have a quarantine area where farm inputs are isolated from production areas. This includes materials such as pallets and packaging, which could contain endemic and exotic pests. Regularly monitor this area for pests, diseases and weeds.
- Ensure fertilisers and growing media are free from pests and comply with relevant standards and certifications.
- Bees can act as vectors for pests and diseases. The hives themselves can carry mud and plant material that might spread disease and weeds. Ask where hives have been before coming onto your property. Bees themselves are at risk from pests and diseases.
- Water can transmit diseases. Treat water to reduce the risk of spreading diseases. Only use new irrigation equipment. Run-off can transfer disease into your irrigation source. Divert run-off from production areas away from dams.

- Ensure that water in designated parking and visitors' areas does not run into production areas.

This is not an exhaustive list of plant biosecurity practices. Biosecurity is not a one-size-fits-all approach; what is suitable for one property might not be appropriate for another. The best approach is to assess the specific biosecurity risks associated with your operation and determine how you can feasibly manage these risks. Remember, there might be multiple ways to manage risks; consider what works for your property.

Biosecurity management plans

A biosecurity management plan is a document that outlines the measures taken to mitigate the risks of pests, diseases and weeds on a property. It is a tool to help you manage the biosecurity risks associated with your operations. Biosecurity management plans are enforceable under NSW law, and people entering areas where a plan applies must comply with the measures outlined in the plan.

Biosecurity management plans apply to a property, not a business. If your business operates on multiple properties, you will need a plan for each. A plan does not need to apply to an entire property; it might only apply to specific areas on a property where production, processing, or movement of biosecurity material takes place.

Biosecurity management plans are:

Not a compliance tool for the government. They are not audited, and there is no legal requirement for a property to have a biosecurity management plan in place. However, some industry certification and accreditation schemes might require participants to have a plan to acquire or maintain accreditation.

Not a tool to restrict access by police, emergency services, authorised inspectors, or utility service providers. However, they should follow the measures outlined in the biosecurity management plan where practical.

What does a biosecurity management plan look like?

NSW legislation does not require biosecurity management plans to follow a specific structure or format; it can be as simple or complex as required. A biosecurity plan that outlines a few basic biosecurity practices might be a few pages with dot points, while a large business might have a plan that spans many pages. While biosecurity management plans can take many forms, they should include:

- a map of the property, with any zoning clearly marked
- identification of biosecurity risks and the specific actions to mitigate these risks
- any procedures or instructions visitors and staff must follow; this might include step-by-step instructions for washing vehicles or entering production areas.

The only requirements for a biosecurity management plan to be valid under NSW legislation are:

- It contains reasonable measures to prevent, eliminate, or minimise biosecurity risks.
- You must have adopted the plan and followed the requirements set out in it; you cannot expect visitors to follow the plan if you and your staff do not.
- It must be clear where the plan applies; this means there must be a sign at each entrance to the property to which the plan applies. These signs must:
 - advise that a plan is in place
 - outline that it might be an offence under the *NSW Biosecurity Act (2015)* for a person to fail to comply with the measures set out in the plan
 - state how a copy of the plan can be obtained
 - inform visitors how they can contact you; usually, this means having a clear and legible contact number on the sign (Figure 1).

Biosecurity signs placed around farms are **not** enforceable without a biosecurity plan.

For more information about biosecurity management plans in NSW, including templates for biosecurity signs, visit the [NSW DPIRD website](https://www.dpi.nsw.gov.au/biosecurity/your-role-in-biosecurity/primary-producers/biosecurity-management-plan) (<https://www.dpi.nsw.gov.au/biosecurity/your-role-in-biosecurity/primary-producers/biosecurity-management-plan>).

Reporting exotic pests

Early detection and reporting are essential for successfully eradicating or minimising the effects of exotic pests. If you suspect that an exotic pest is in your farm or garden, you can report it to NSW DPIRD by:

- Phoning the exotic plant pest hotline on **1800 084 881**. This is a national reporting hotline, and when calling from NSW, you will be directed to NSW DPIRD.
- Emailing report details directly to biosecurity@dpi.nsw.gov.au
- Submitting report details via the [online webform](https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease) on the NSW DPIRD website (<https://www.dpi.nsw.gov.au/dpi/biosecurity/report-a-pest-or-disease>).

All reports are taken seriously and are treated confidentially. When submitting a report, you will be asked to provide information, including:

- Your name and contact details.
- Location of the pest, disease or weed.
- Name of the affected plant, a description of the pest or disease, and the symptoms and/or the damage caused to the plant.
- Several clear photographs showing:
 - the affected plant and its wider environment
 - a close-up of the symptoms and/or pest, disease or weed.

High-priority exotic pests

Several pests and diseases not currently in Australia have been identified as high-priority threats to the macadamia industry. If these were to enter Australia, they could become established in most macadamia-growing regions, potentially having a significant effect on yields and production costs. Some exotic pests and diseases of macadamia include *Tropilaelaps* mites (*Tropilaelaps* sp.), tropical nut borer (*Hypothenemus obscurus*), bacterial leaf scorch (*Xylella fastidiosa*), and sudden oak death (*Phytophthora ramorum*).

This is not a comprehensive list of high-priority pests. If you see anything unusual, such as a strange insect causing damage, plants with new symptoms, or familiar symptoms on a new plant or variety, report it to NSW DPIRD via the exotic plant pest hotline on **1800 084 881**.

Tropilaelaps mites

Tropilaelaps is a genus of parasitic mites that threaten bees and the pollination services they provide. Their host range includes most species of bee belonging to the genus *Apis*, including the European honey bee (*Apis mellifera*). They have also been observed infesting carpenter bees in India, indicating they could potentially affect some Australian native bee species.



Figure 1. A biosecurity sign with space for the appropriate contact phone number to be displayed.

Their life history is similar to that of *Varroa* spp. mite (Figure 2), with both being external parasites feeding primarily on the brood stages (Figure 3). Feeding by *Tropilaelaps* spp. mites cause physical damage that can kill the brood or result in adult bees emerging with deformities, including distorted abdomens, missing legs, and stubby wings. They can also be a vector for serious pathogens, such as deformed wing virus and American foulbrood. *Tropilaelaps* spp. and *Varroa* spp. mites can coexist in the same hive. *Tropilaelaps* spp. are considered to be more damaging than *Varroa* spp., owing to their much higher reproductive rate, with some sources indicating 25 *Tropilaelaps* mites for each *Varroa* mite.

Tropilaelaps spp. mites are reddish brown, approximately 1 mm long and 0.5 mm wide, making them large enough to be seen by the naked eye against the white of broods (Figure 3). Symptoms of mite infestation include deformed bees, crawling bees, discarded brood at the hive entrance, and mites on the brood. Unlike *Varroa* mites, *Tropilaelaps* mites spend most of their time within brood cells and are unlikely to be observed on adult bees.



Figure 2. *Varroa* mite (left) next to a *Tropilaelaps* mite (right). Photo: Zachary Huang, cybertree.net.



Figure 3. *Tropilaelaps* sp. mites on European honey bee broods. Photo: Denis Anderson, CSIRO.

Tropical nut borer (Hypothenemus obscurus)

The tropical nut borer is an exotic species of bark beetle not known to be in Australia. It is among the most serious pests of macadamia overseas. If it was to become established in Australia, it would threaten our macadamia industry.

Unlike most other bark beetles, which infest the woody tissue of trees, tropical nut borer infests the nut, boring through the husk and shell to feed on the kernel. This renders the nut unmarketable, reducing saleable yield. The mechanical damage caused by the beetles also exposes the nut to secondary infection by fungi. The tropical nut borer has been observed to damage 22% of kernels within 5 weeks of nut drop, with damage potentially exceeding 50–60% of the crop if populations are left unmanaged.

Adult beetles are 1.0–1.5 mm long, dark brown and look similar to other bark beetles (Figure 4). It is unlikely they can be easily distinguished from endemic species outside of a laboratory. The best indicator of tropical nut borer is kernels infested with small bark beetles. Damage first presents as small holes, approximately 0.5 mm in diameter, in the husk. Removing the husk and shell reveals tunnelling throughout the kernel (Figure 5). Green nuts are rarely attacked, with sticktights and fallen nuts being more favourable for reproduction due to the lower water content. The presence of infested nuts alone is insufficient to diagnose tropical nut borer as the endemic species. , *Hypothenemus eruditus* and *H. seriatus* are also known to infest macadamia kernels.



Figure 4. Dorsal (left) and lateral (right) view of tropical nut borer. Photos: Ken Walker, Museums Victoria.



Figure 5. Tropical nut borer damage inside a macadamia nut. Photo: Craig Maddox, NSW DPIRD.

Xylella fastidiosa

Xylella fastidiosa is a bacterial pathogen capable of infecting more than 450 plant species, including macadamia. The bacterium inhabits the host's xylem, which is the vascular system responsible for transporting water and nutrients from the roots to the stems and leaves. It is an extremely destructive plant pathogen; there is no treatment, and many host species will inevitably die once infected.

The build-up of bacteria within the xylem inhibits the movement of water, causing a progression of symptoms. Initially, leaf edges become scorched (Figure 6), giving the disease its name, 'bacterial leaf scorch'. This scorching progresses towards the middle of the leaf (Figure 7), with infected leaves dying and dropping off the tree. In Costa Rica, young macadamia trees infected with *Xylella fastidiosa* had yellow and scorched leaves, shortened internodes, stunted growth, and small inflorescences. It is unclear whether these symptoms were caused solely by *Xylella fastidiosa* or by a combination of infection and poor growing conditions.

Xylella fastidiosa symptoms are similar to those caused by other diseases, nutrient deficiencies, and abiotic stressors, making it challenging to identify the disease in the early stages.

Xylella fastidiosa is spread when infected plant material is grafted onto healthy tissue or by xylem-feeding insects. The most notable insect vectors of *Xylella fastidiosa* are the glassy-winged sharpshooter (*Homalodisca vitripennis*; Figure 8) and the meadow spittlebug (*Philaenus spumarius*; Figure 9), both of which are exotic and not currently found in Australia.



Figure 6. A young macadamia plant with mild symptoms of *Xylella fastidiosa* infection. Photos: Lisela Moreira Carmona, CIBCM, Universidad de Costa Rica.



Figure 7. Leaf scorching in a shingle oak caused by *Xylella fastidiosa*. Photo: John Hartman, University of Kentucky, Bugwood.org.



Figure 8. Glassy-winged sharpshooter. Photo: Johnny N Dell, Auburn University, Bugwood.org.



Figure 9. Meadow spittlebug. Photo: Ryan Hodnett, [inaturalist.org/observations/7838025](https://www.inaturalist.org/observations/7838025).

Sudden oak death (*Phytophthora ramorum*)

Phytophthora ramorum is an exotic species of *Phytophthora* not currently found in Australia. Globally it has caused serious damage to the nursery and forestry industries, as well as the natural environment. It is known to infect over 135 plant species, including wild, commercial, and amenity trees and shrubs. If it was to reach Australia, it could have a significant effect on our horticultural and nursery industries, as well as the natural and urban environment.

There are several endemic species of *Phytophthora* already in Australia, including *P. cinnamomi*, which causes *Phytophthora* root rot and is an ongoing issue for macadamia growers. *Phytophthora ramorum* differs from many other *Phytophthora* species because it is an aerial pathogen that is readily spread by wind, water, and mechanically on clothes and soil. There is no cure for the diseases it causes and no effective chemical treatments. Common fungicides will prevent symptoms from showing but will not destroy the pathogen; once treatment stops, symptoms will return. Infection with *P. ramorum* makes the host susceptible to secondary infection by other pests, such as ambrosia and bark beetles.

Hosts of *P. ramorum* can be categorised into 2 types: trunk hosts and foliar hosts. Trunk hosts get infections in the bark, causing the disease sudden oak death, which is often fatal. Foliar hosts get infection in the leaves (Figure 10), causing the disease ramorum blight, which is rarely fatal. Symptoms of *P. ramorum* are host-specific but can include:

- Branch dieback (Figure 11).
- Brown or black discoloured bark that oozes a red sap on the trunk (Figure 12) from the root crown to the top of the tree (up to 20 m above the ground), but not on the

roots. Removing the outer layer of bark reveals mottled areas of necrotic inner bark tissue delimited by thin dark lines (Figure 13).

- Stem lesions
- Localised necrotic leaf spots and leaf blight.

Symptoms of *P. ramorum* are similar to those caused by other species of *Phytophthora*, and confirming *P. ramorum* requires samples to be sent to a laboratory for testing.



Figure 10. Foliar symptoms of *Phytophthora ramorum* in Rhododendron (left) and California laurel (right). Photos: Joseph O'Brien, USDA Forest Service.

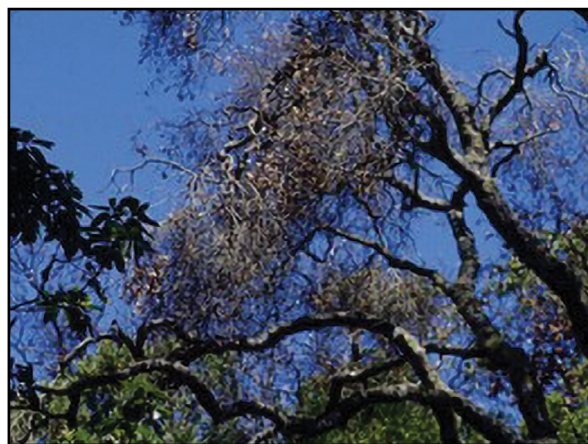


Figure 11. Severe *Phytophthora ramorum* symptoms in coast live oak. Photo: Joseph O'Brien, USDA Forest Service.



Figure 12. Bleeding and discolouration on the outer bark of an oak. Photo: Bruce Moltzan, USDA Forest Service.



Figure 13. Necrotic lesions on the inner bark of coast live oak. Photo: Joseph O'Brien, USDA Forest Service.

Acknowledgement

Thank you to Lisela Moreira Carmona for providing photographs of *Xylella fastidiosa* in macadamia along with a description of symptoms observed in the field.

© State of New South Wales through Department of Primary Industries and Regional Development 2026. You may copy, distribute, display, download and otherwise freely deal with this publication for any purpose, provided that you attribute the Department of Primary Industries and Regional Development as the owner. However, you must obtain permission if you wish to charge others for access to the publication (other than at cost); include the publication in advertising or a product for sale; modify the publication; or republish the publication on a website. You may freely link to the publication on a departmental website.

ISSN: 1832-6668

Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (February 2026) and may not be accurate, current or complete. The State of New South Wales (including Department of Primary Industries and Regional Development), the author and the publisher take no responsibility, and will accept no liability, for the accuracy, currency, reliability or correctness of any information included in the document (including material provided by third parties). Readers should make their own inquiries and rely on their own advice when making decisions related to material contained in this publication.