

# Fact sheet

## MANAGING STORM DAMAGE

An unfortunate fact is that it is likely your orchard will be affected by storm damage at some time. It is also a fact that growers who actively prepare for this reality recover more quickly than growers who don't.

Storms can damage trees, the crop and orchard floor as a result of severe winds, erosive rain or hail and flooding. In many cases damage is not limited to the orchard, it affects farm infrastructure as well. This fact sheet summarises ways growers can build storm resilience and recover more quickly from storm damage.



Significant damage from severe winds, which has snapped trunks and defoliated trees.

Increasing temperatures, changing ocean dynamics and shifting weather patterns are creating more intense weather events and a more southerly path of tropical storms and cyclones. Growers with a storm recovery plan and who have farm infrastructure in place and suitable machinery can restore orchards to productivity sooner.

### What's in a storm plan?

Items to consider or have prepared in any resilience and recovery plan include:

- weather monitoring and active alerts systems
- emergency contact information such as SES, energy providers and other essential services
- orchard maps showing key infrastructure, access routes, irrigation and watercourses
- any farm drainage management maps or plans
- inventory of tools, machinery and PPE required for cleaning up (i.e., gloves, chainsaws, chains, chippers)
- list of appropriate staff certifications (i.e., chainsaw and tree felling certifications)
- site on the farm to relocate broken trees/branches.

### A sustainable orchard builds storm resilience

While damage can't always be avoided, in most cases it can be mitigated with proactive orchard systems. An essential resource is the Macadamia Integrated Orchard Management Guide, which summarises key elements of a sustainable orchard, including:

#### Orchard floor management

- Healthy and extensive ground cover to stabilise soil, slow water flows and improve infiltration
- Orchard floor shape and surface that protects trees, ensures a harvestable surface and year-round access.

#### Canopy management

- Healthy canopies that allow enough light through trees and down to the orchard floor
- Clear machinery access and inter row alleyways.

#### Drainage management

- Orchard drainage systems that prevent run on and easily dispose of run-off water.
- Drainage lines free of trees, with adequate ground cover and draining to disposal areas.

### Triaging storm damage

Regardless of the damage, prioritising recovery actions is essential. To help do this, ask yourself:

1

What actions will have the greatest impact on short-term (six-month) viability?

2

What actions will have the greatest impact on medium-term (12-month) viability?

3

Which are the most profitable blocks on the farm?

Can I perform the recovery safely?

Do I have the cash flow for recovery activities?

What is the environmental impact of each action or inaction?

### Dealing with tree damage in the orchard

Storm damage can affect trees, the orchard floor and infrastructure. The most common storm effects are trees being blown over or losing limbs and damage to the orchard floor because of water flow.

**Standing trees back up.** Trees being blown over or falling over because of orchard floor damage is common and deciding whether to stand them back up or remove them is complex. In general, trees that are stood up do not perform as well as undamaged trees, but they can still be productive.

When deciding how to respond, consider the age and size of the tree and whether it can be righted and then staked and whether it has enough undamaged roots to survive. Standing trees up is a big job and if time and finances are limited, you may be better off protecting orchard income by focusing on the remaining trees.



Single picket staking with irrigation tape to prevent damage by the wire tie.

Before standing trees up, it might be necessary to cut back the canopy to rebalance the root to shoot ratio because of probable root damage. Think about the tree's new centre of gravity, especially if large limbs have been broken off.

Stakes are almost always required to stabilise trees. When choosing stakes and ties, think about their longevity and position them not to interfere with orchard operations and/or tree growth. Stakes tied too low down on the tree will be less robust.

**Damaged small trees.** Replacing young trees (less than three years old) is more practical than staking. When making this decision look at the extent of the damage. If there are any signs of disease such as trunk canker or if the tree is unthrifty, it is worth replacing. Before replacing trees in the same spot, it might be necessary to treat for

## Grower experience: Greg O'Neil

"You have to remove limbs from storm damaged trees to compensate for the loss of roots. If too much canopy is left, the tree is more liable to fall over in the next storm. Trees are much easier to handle with a lot of weight taken off. My experience is that where I have pruned heavier initially, recovery is faster and better. When removing limbs, try to open up the tree so wind gets through it.

If you have irrigation, use it in the blocks to keep soil wet while pulling trees up, but if there is too much root damage, it is a waste of time standing trees up.

It is paramount to sacrifice crop now for a better tree in the future. You will be sick in the guts for ages at the look of your once-nice orchard, so hang tough! Time is a great healer."

disease. Talk to your consultant about options.

When replacing with new nursery trees, consider whether they have enough light to thrive. Replants often cannot compete for resources with their older neighbours, and the resources (space, light, soil) may be better used by the remaining trees.



Some trees are not worth recovering.

One of the best ways to prevent damage is to buy high quality nursery trees with a well-structured and well-developed root system. Sometimes storms damaging young trees can be a blessing as a macadamia can mask suboptimal growth.

**Damaged large trees.** It is hard to recover large trees and you may need to be cruel to be kind by pruning. The rule of thumb with pruning is that if you want the branch to regrow, cut it back leaving a stump from the trunk. If you don't want regrowth, cut the branch flush with the trunk. If trees are healthy and have enough light they will regrow, even if they look odd. With significant canopy damage some growers stump trees and topwork (regraft) with a different, potentially new cultivar.

Pruning trees to neaten jagged edges or pockets that could hold water is important. They pose a safety hazard or harbour water causing trees to rot.

With any damage there is a greater risk of pest and disease invasion. Stressed trees have reduced sap flow and release stress chemicals, making them more susceptible to pests such as boring beetles and less able to overcome diseases such as *Phytophthora*.



Jagged edges are a safety hazard and can hold water.

It is essential to monitor damaged trees. Damage opens wounds which become opportunities for diseases and pests to enter, even on nuts as is the case with husk rot following storm damage. While no product is registered for storm damage, wounds can be sealed with non-toxic paint and canopy areas not usually exposed to the sun can have products like kaolin clay applied. If disease infection occurs, trees can be appropriately treated with a registered option.





*Trees don't need to look pretty to still be productive. Rebalancing weight and letting light in is more important.*

## Orchard floor remediation following storms

The orchard floor houses the engine of the tree, i.e. its roots. This means that damage to the soil around the tree will have a big impact on recovery and future productivity. Storm recovery that focusses on restoring roots and a thriving root-growing environment will speed recovery.

Storms can remove topsoil, damage soil structure, expose roots, remove vital organic matter and leach nutrients. Much of this damage can be unseen but this is not an area of recovery you should try to save money on. Your nutrition consultant can advise on remedial fertiliser applications to suit your orchard.

Sometimes the damage to the orchard floor after storms can be from the recovery operation. When rushing to save nuts, think about potential compaction and rutting, particularly in wet conditions and with clay soils.

*Recovery efforts need to be well thought through so as not to make the situation worse which wet soil and high traffic can lead to.*



## Dealing with debris

Ensure you have a site on farm not too far from the damage to take fallen and pruned trees and branches to if you cannot chip them in situ.

The removed material is a great orchard resource if you can chip it and return it to the orchard floor, particularly if organic matter has been washed away. This can be an expensive operation and if you choose to pile debris



*Choose a disposal site within close range of storm damage.*

for later chipping, monitor the piles as they can harbour boring beetles and other pests such as rats.

## Safety is a priority

Safe recovery operations are also a priority. Don't take on a task that you or staff are unsure about or unqualified to do. Personal protection equipment such as safety boots, safety glasses and gloves will prevent injury. Think through the safety considerations of each aspect of the recovery operation, taking particular care with dangerous machinery such as chippers and earthmoving equipment.

Storm damage recovery and the physical nature of the tasks can stretch out the day, making them tiring. Ensure you and all staff or contractors on farm remain alert and have breaks. It is not advised to work alone; pairing workers up improves safety considerably.

Keep track of operator certifications required, e.g. every worker operating a chainsaw has valid accreditation.

## Grower experience: John Vaughan

"Every day we're working with a chipper, the crew first start it up and bump the trips bars and emergency button, ensuring the machine clicks into neutral. Every time it is operated, trip switches are checked. At a minimum with smaller machines, we operate with at least two people, and no one works alone. We train staff to safely operate all day, managing fatigue as tired workers can easily be distracted.

Training the workers feeding into the chute is really important – letting the rollers do the work. Workers should never lean in to push branches into the chute as they could lose balance. And obviously never feed short branches where your hands are near the chute.

We have been through several storms and have found that dragging trees is impractical as it damages the orchard floor, sweeps away nuts and involves double handling. We chip on site and place it straight under trees, then it's a single pass.

So often when using the chipper, it's an urgent situation and we need more capacity, not less. At the same time, everyone else is using the few contractors and gear that is available for hire."

## Key susceptibilities, likely damage and recovery strategies and considerations

	Key susceptibility	Likely damage	Recovery strategies/considerations
<b>Hail</b>	<ul style="list-style-type: none"> <li>Flowers and maturing nuts</li> <li>Sunburn (with defoliation)</li> </ul>	<ul style="list-style-type: none"> <li>Flowers and maturing nuts knocked off trees</li> <li>Tree hail wounds increase disease risk</li> <li>Nut hail wounds increase pest damage risk</li> <li>Defoliation</li> </ul>	<ul style="list-style-type: none"> <li>Physical wound protection such as paint</li> <li>Fungicide spray for wounds (if ongoing weather is conducive to disease infection)</li> <li>Sun protection such as kaolin clay</li> <li>Stress amelioration products such as kelp</li> <li>Nutrition to stimulate regrowth, particularly promoting root flush</li> </ul>
<b>Wind</b>	<ul style="list-style-type: none"> <li>Exposed sites</li> <li>Young orchards</li> <li>Wind susceptible cultivars: A4, A38, A203, A268, 842 and Daddow</li> <li>Susceptible to being blown over: 344, 741, A268</li> <li>Fine clay soils</li> <li>Sunburn (with defoliation)</li> </ul>	<ul style="list-style-type: none"> <li>Trees blown over (in clay soils trees often have shallower root systems and some clays lose structure when wet)</li> <li>Broken branches</li> <li>Defoliation</li> </ul>	<ul style="list-style-type: none"> <li>Pruning young trees to allow wind through the canopy reduces risk of damage</li> <li>Standing trees back up and staking if blown over. They will likely always struggle</li> <li>Prune broken branches to neat wounds, not jagged as these hold water and increase disease risk</li> <li>Pruning too much can deplete carbohydrates stored in tree structures</li> <li>Sun protection such as kaolin clay</li> <li>Stress amelioration products such as kelp</li> <li>Nutrition to stimulate regrowth, particularly promoting root flush</li> </ul>
<b>Heavy rain</b>	<ul style="list-style-type: none"> <li>Poorly drained orchards</li> <li>Over canopied orchards</li> <li>Low groundcover sites</li> <li>Steep orchards</li> </ul>	<ul style="list-style-type: none"> <li>Erosive soil loss</li> <li>Erosive organic matter loss</li> <li>Exposed roots</li> <li>Waterlogging and increased disease risk</li> <li>Flower drenching, potential reduction in pollination</li> </ul>	<ul style="list-style-type: none"> <li>Excavators to reclaim displaced soil</li> <li>Reapply organic matter, possibly material that breaks down more rapidly (depending on how close to harvest)</li> <li>Orchard profiling in following dry season</li> <li>Monitor for signs of <i>Phytophthora</i> and apply phos acid if required</li> <li>Stress amelioration products such as kelp</li> <li>Nutrition to stimulate regrowth, particularly promoting root flush</li> </ul>
<b>Flooding/inundation</b>	<ul style="list-style-type: none"> <li>Low-lying areas</li> <li>Poorly drained orchards</li> <li>Unmounded sites</li> </ul>	<ul style="list-style-type: none"> <li>Erosion</li> <li>Prolonged waterlogging and increased disease risk</li> <li>Lack of oxygen to roots and leaves if water is stagnant</li> <li>Potential salinity</li> </ul>	<ul style="list-style-type: none"> <li>Excavators to reclaim displaced soil</li> <li>Orchard profiling in following dry season</li> <li>Deep irrigation can reduce salinity, or apply gypsum</li> <li>Stress amelioration products such as kelp</li> <li>Nutrition to stimulate regrowth, particularly promoting root flush</li> </ul>

It is invaluable to learn from the experience of others. Talk to growers who have experienced storm damage and ask what they have found to be useful in preparation and recovery.

For more information on this topic, please contact the AMS Industry Development Manager and/or your consultant/grower liaison officer.



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