



Key risks for Australian macadamia growers and potential insurance options to manage financial losses

Who and What is this Report for?

This report is for the Australian Macadamia industry and growers. It outlines key risks and their importance, as identified by Macadamia growers across numerous areas. The report is intended to highlight the key risks for Macadamia growers and show prototype index insurance products that have been developed for Macadamia growers to manage climate risks.

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This project is funded by the Queensland Government's Drought and Climate Adaption Program (DCAP) that aims to improve drought preparedness and resilience for Queensland producers.

Summary & key findings

The Australian Macadamia industry has a farm gate of ~ 280 million dollars and is the world's leading producer macadamia kernels, accounting for 30% of global supply (AMS, 2017). However, the macadamia industry faces major challenges from extreme climate and weather events, which are projected to increase in the future under climate change. In 2017 extreme climate events, such as cyclone, drought and extreme rainfall were attributed to yield losses by many macadamia growing growers (ABC report, 2017). While the industry and farmers can adapt and manage some climate variability some losses from extreme climate events are inevitable. For losses that cannot be avoided, then risk-transfer options, such as insurance, are often the best option.

This report explores the potential for the development of weather-index policies to address climate risks. Using information from farmer surveys the report identifies the key risks to Macadamia growers and outlines prototype index insurance products that have been developed to manage the financial consequences of climate risks.

Based on preliminary surveys of Macadamia growers there is the potential to manage yield losses in the following ways:

- Drought index insurance to manage low rainfall losses for Macadamia growers in Bundaberg, Kempsey and Marburg.
- Remote sensing index insurance to manage hail (and other risks) losses for Macadamia growers in Bangalow, Byron Bay and Lismore.
- Remote sensing index insurance to manage pest and disease losses for Macadamia growers in Wollongbar and Nashua respectively.
- Excess rainfall and heat were also identified as important risks for which index insurance options could be developed.

Based on survey findings three prototype insurance products were developed for the macadamia industry:

- Drought index insurance: rainfall deficit (e.g. below 100 mm) for the critical period between April to September rainfall below 100 mm from
- Excess rainfall index insurance: Excessive rainfall (e.g. below 100 mm), especially during harvesting periods, between October to March

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- Heat day index insurance: Extreme temperatures $>36^{\circ}\text{C}$ for more than 2 days in a year

Indexed based insurance worked examples were also developed for growers to better appreciate the insurance mechanisms.

Large parts of the agricultural sector are unaware of the potential benefits of agricultural insurance and its use as a risk management tool. Therefore, there is a need to educate farmers about the value of insurance, through shed meetings, workshops and one on one facilitated meetings.

Background

The Australian Macadamia industry has a farm gate of ~ 280 million dollars and is the world's leading producer macadamia kernels, accounting for 30% of global supply (AMS, 2017). However, the macadamia industry faces major challenges from extreme climate and weather events, which are projected to increase in the future under climate change. In 2017 extreme climate events, such as cyclone, drought and extreme rainfall were attributed to yield losses by many macadamia growing growers (ABC report, 2017). While the industry and farmers can adapt and manage some climate variability some losses from extreme climate events are inevitable. For losses that cannot be avoided, then risk-transfer options, such as insurance, are often the best option.

Farm characteristics of surveyed macadamia growers

Twenty-six macadamia growers provided responses about what their key risks to production are. Average farm size was approximately 30 ha, although farm size varied substantially with some farms less than 10 ha and others greater than 50 ha. Survey data is available from the DCAP project team as an excel sheet. A map of macadamia growing areas in central and southern Queensland, alongside nearby weather stations that could be used in the design of insurance products is shown in Figure 1 below.

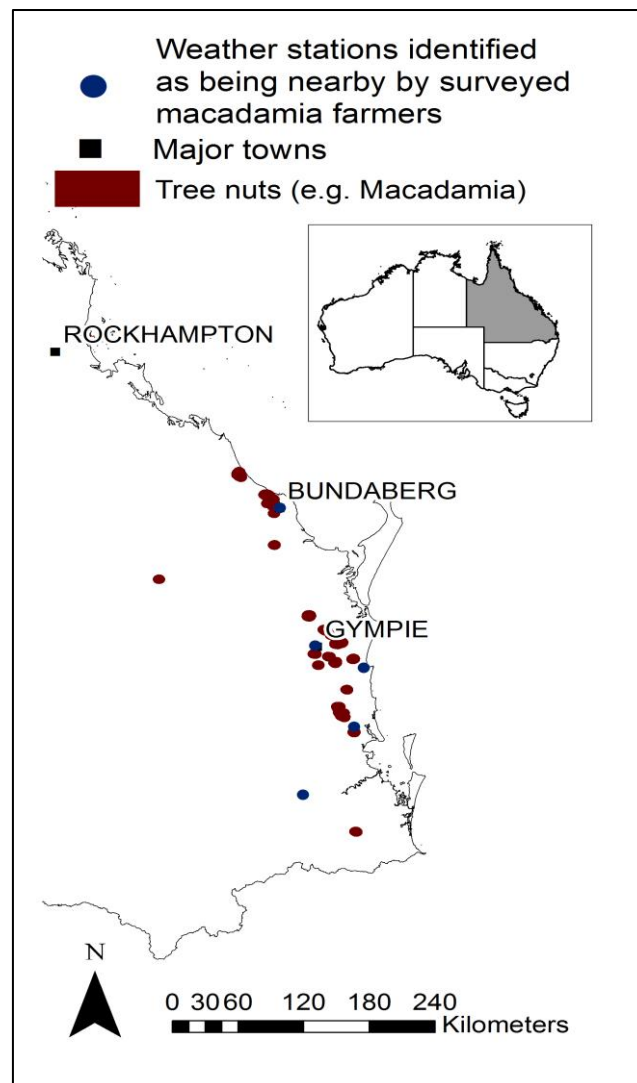


Figure 1 Location of tree nut crops in central and southern Queensland showing station identified as nearby by Macadamia growers.

Key risks identified by macadamia growers

Risk assessment

Macadamia growers were asked to assess the severity, likelihood and losses from a range of risk factors. Risks were assessed by area. Note in some areas there were no responses or only responses from one farmer and the findings will reflect this one farmer's response. In areas with multiple farmers the figures show the average responses from all farmers in that area.

Severity of risks

The severity of risks was ranked differently amongst growers in the different areas surveyed. Pests were ranked as one of the most severe risks in Ballina, Lismore, Byron Bay, Smoky Cape and Wollongbar. Drought was scored as most severe in Bundaberg, Marburg and Kempsey, while excess rain / flood were ranked as severe in Bundaberg, Smokey Cape and Wollongbar. Disease was ranked as one of the most severe risks in Nashua and Kempsey. The average severity scores of all risks for each area are shown in Figure 2.

Likelihood of risks

The most likely risks, as scored by surveyed macadamia growers, were excess rainfall, drought, hail and pests. Excess rain was scored as one of the most likely risks to occur in Ballina, Bangalow, Beerburrum, Bundaberg, Lismore, Kempsey, Nashua and Smoky Cape. Hail was also ranked as highly likely in Bangalow and Smoky Cape. Drought was ranked as highly likely in Beerburrum, Bundaberg, Marburg and Smoky Cape. Pests were ranked as a high likelihood risk in Wollongbar, Byron Bay, Bundaberg, Smoky Cape and Nashua. The average likelihood scores of all risks for each area are shown in Figure 3.

Losses from risks

The risks associated with the greatest estimated losses varied between areas. Hail was associated with the highest estimated losses in Bangalow, Byron Bay and Lismore. Drought was associated with the highest losses in Bundaberg (where losses from flood

were estimate to be equally high), Marburg and Kempsey. Pests were linked with the highest estimate losses in Wollongbar and disease in Nashua. The average estimated losses from all risks for each area are shown in Figure 4.

Ranking of risks (losses x likelihood)

The importance of risks was ranked by calculating the likelihood of loss multiplied by the losses associated with that risk. Using this measure hail was the highest ranked risk in Bangalow, Byron Bay and Lismore. Drought was most the highest ranked risk in Bundaberg, Kempsey and Marburg. Disease was most important in Nashua and Pests in Wollongbar. Table 1 shows the ranking of all risks for each surveyed area.

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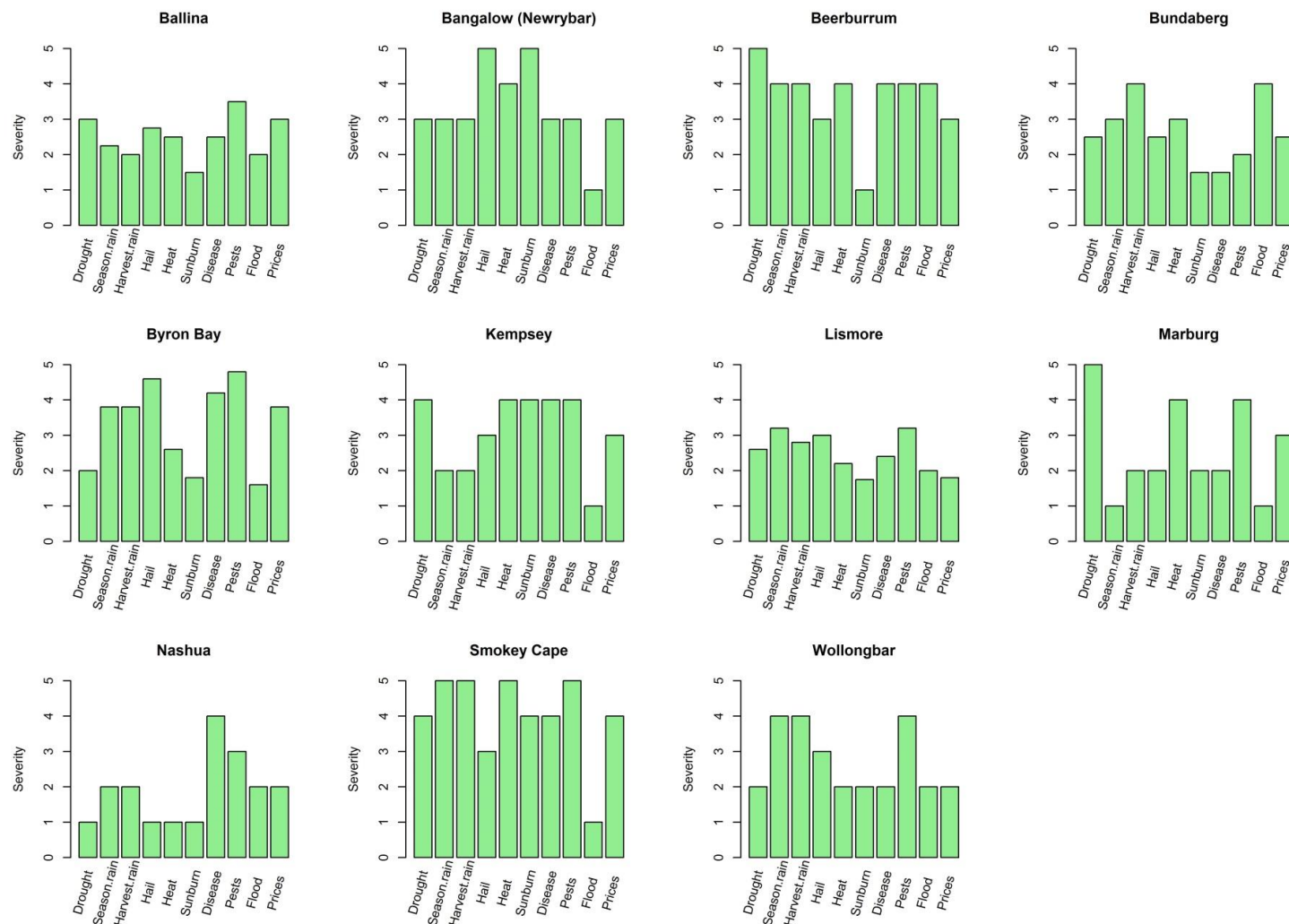


Figure 2 Scored severity of risks from surveyed macadamia growers

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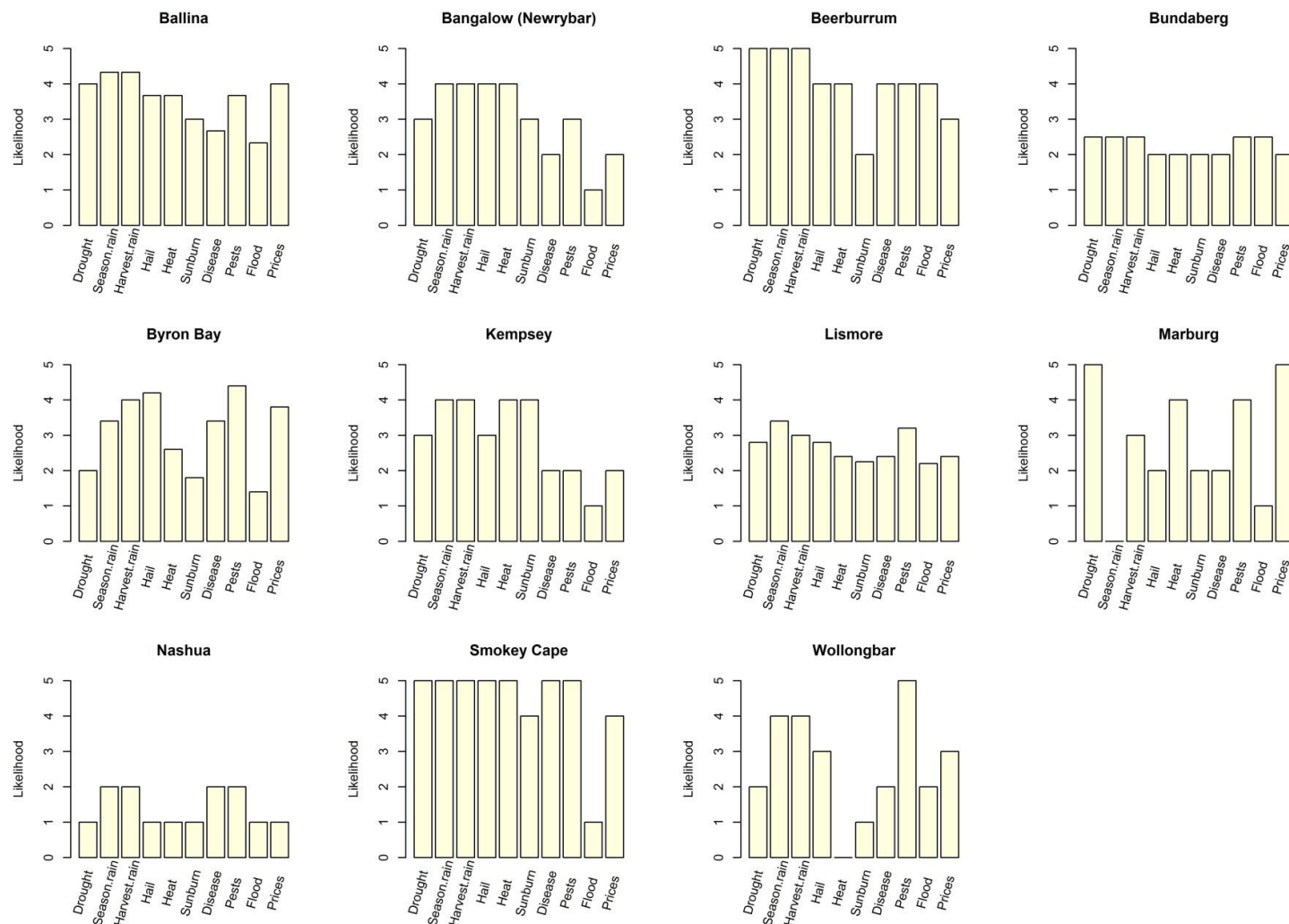


Figure 3 Likelihood of risks occurring according to surveyed macadamia growers

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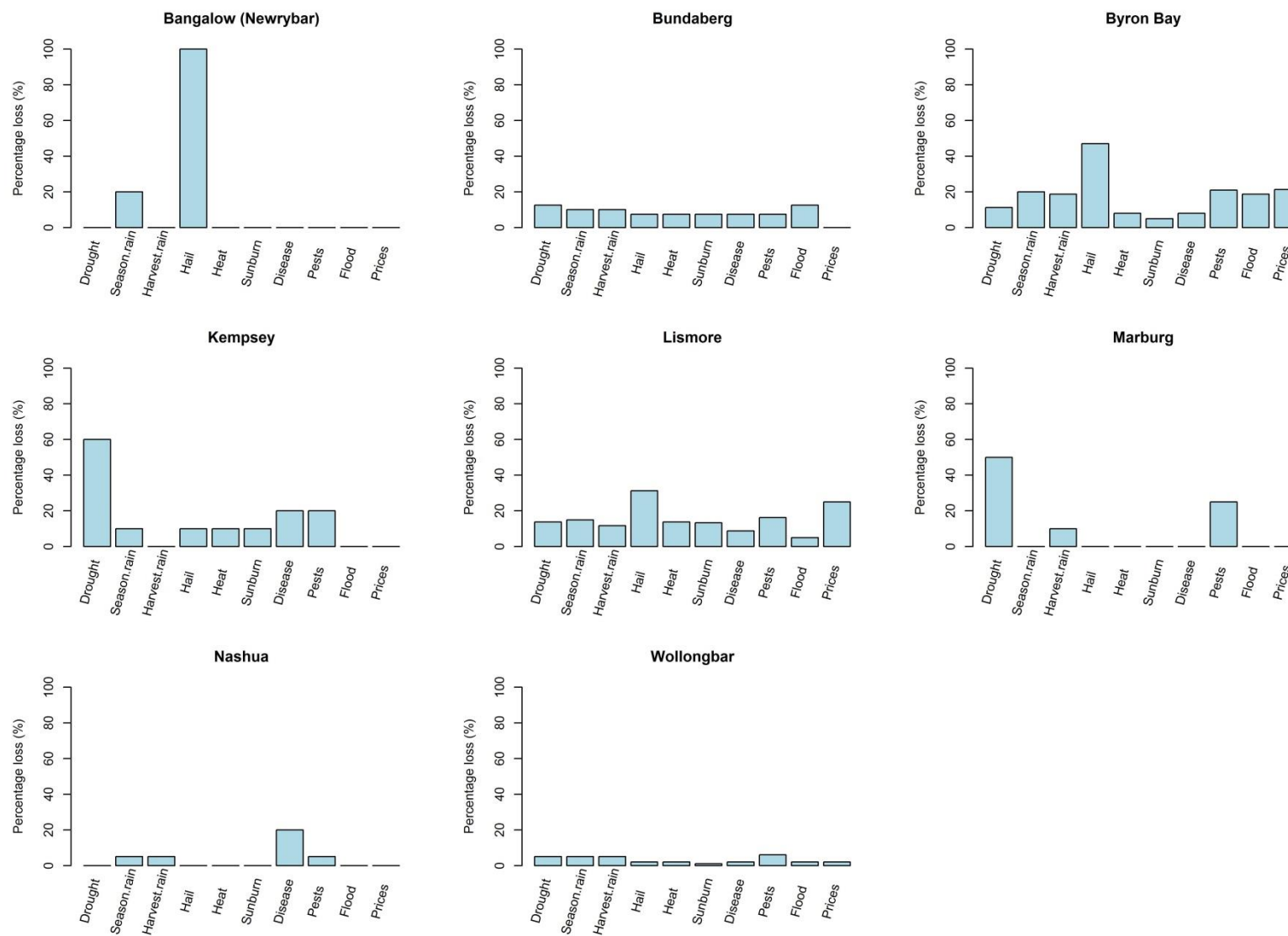


Figure 4 Estimated percentage losses attributable to different risks according to surveyed macadamia growers

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Table 1 Key risks (in bold blue) identified by macadamia growers. Here a key risk is the risk with the highest estimated expected losses which is calculated as the likelihood of occurring multiplied by the estimate percentage losses.

Area / Weather Station	Drought	Season rain	Harvest rain	Hail	Heat	Sunburn	Disease	Pests	Flood	Prices
Bangalow (Newrybar)	0.00	0.80	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00
Bundaberg	0.31	0.25	0.25	0.15	0.15	0.15	0.15	0.19	0.31	0.00
Byron Bay	0.23	0.68	0.75	1.97	0.21	0.09	0.27	0.92	0.26	0.81
Kempsey	1.80	0.40	0.00	0.30	0.40	0.40	0.40	0.40	0.00	0.00
Lismore	0.39	0.51	0.35	0.88	0.33	0.30	0.21	0.52	0.11	0.60
Marburg	2.50	0.00	0.30	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Nashua	0.00	0.10	0.10	0.00	0.00	0.00	0.40	0.10	0.00	0.00
Wollongbar	0.10	0.20	0.20	0.06	0.00	0.01	0.04	0.30	0.04	0.06

Risk transfer options

How can Macadamia growers manage the financial losses of climate and other risks?

The Australian Macadamia industry and farmers can adapt and manage climate variability up to a point, but some losses from extreme climate events are still inevitable or losses that can't be avoided then risk-transfer options, such as insurance, are often the best option.

What are current insurance options for Macadamia growers?

There is limited appetite by Australian insurers for providing crop insurance. The types of insurance covers available (or under consideration) for Macadamia growers are:

Single/'named' peril crop insurance: typically hail, storm, frost or fire cover but very postcode specific with insurers excluding hail and storm affected areas.

Multi-peril crop insurance: typically whole farm yield loss protection (equivalent to 'all risks') where exclusions are specified in the policy such as failure to carry out good farming practice. To the best of our knowledge not being offered to Macadamia growers by Australian insurers at present.

Area yield coverage: for loss of yield by a participating growers in a specified region. Again, to the best of our knowledge, not being offered to growers in Australia.

Weather index-based crop insurance: as outlined below, a simpler way for growers to protect themselves against natural catastrophes and readily available via specialist global insurance markets.

Index insurance and how could it serve the Australian Macadamia industry?

Weather risk management contracts have evolved over the past 25 years to protect weather sensitive industries against precipitation, temperature and other index-based weather perils. These contracts generally reference an independent arbiter of actual weather conditions, such as the Bureau of Meteorology (BOM) in Australia.

Key contract variables such as attachment points, pay-outs and limits are structured to compensate the grower for a pre-defined weather outcome, as opposed to actual loss (or strict indemnity i.e. conventional insurance). For this reason, the analysis and structuring components of the cover are critical in order to eliminate, or at least minimise, basis risk – i.e. the risk that actual losses are not well represented by the index. Correlating weather outcomes to increased costs, or reduced revenue, is an actuarially driven process using either actual or modelled financial and historical weather data.

Rather than competing with any existing insurance arrangements in place through other agricultural insurers, this concept provides Macadamia growers with a totally distinct risk transfer service.

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Prototype index insurance products that tailored to the macadamia industry

Drought index insurance prototype

The drought index insurance prototype below (Figure 5) shows the premiums and payouts for a selected level of cover (in this case against rainfall below 100 mm from April to September). With this insurance option growers would have received payouts of 8,000 and 23,350 during the recent drought years of 2017 and 2018 respectively. The rainfall threshold and payouts levels are adjustable and can be changed to alter the premiums.

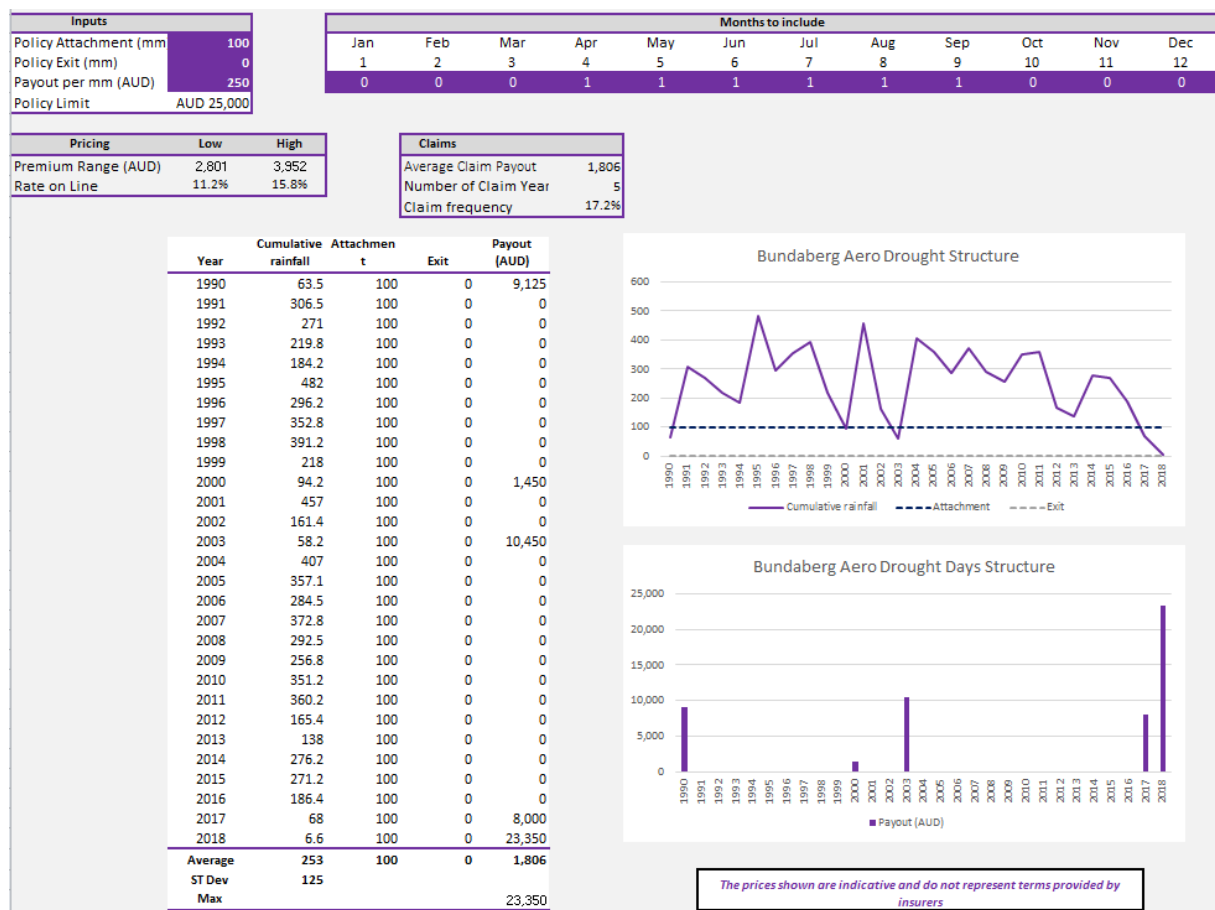


Figure 5 Screenshot of the interactive drought index insurance prototype developed for Bundaberg.

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Excess rainfall index insurance prototype

The excessive index insurance prototype below (Figure 6) shows the premiums and payouts for a selected level of cover (in this case against rainfall over 1000 mm from October to March). With this insurance option growers would have received payouts of 33,100 and 44,050 during the flood years of 2010 and 2017 respectively. The rainfall threshold and payouts levels are adjustable and can be changed to alter the premiums.

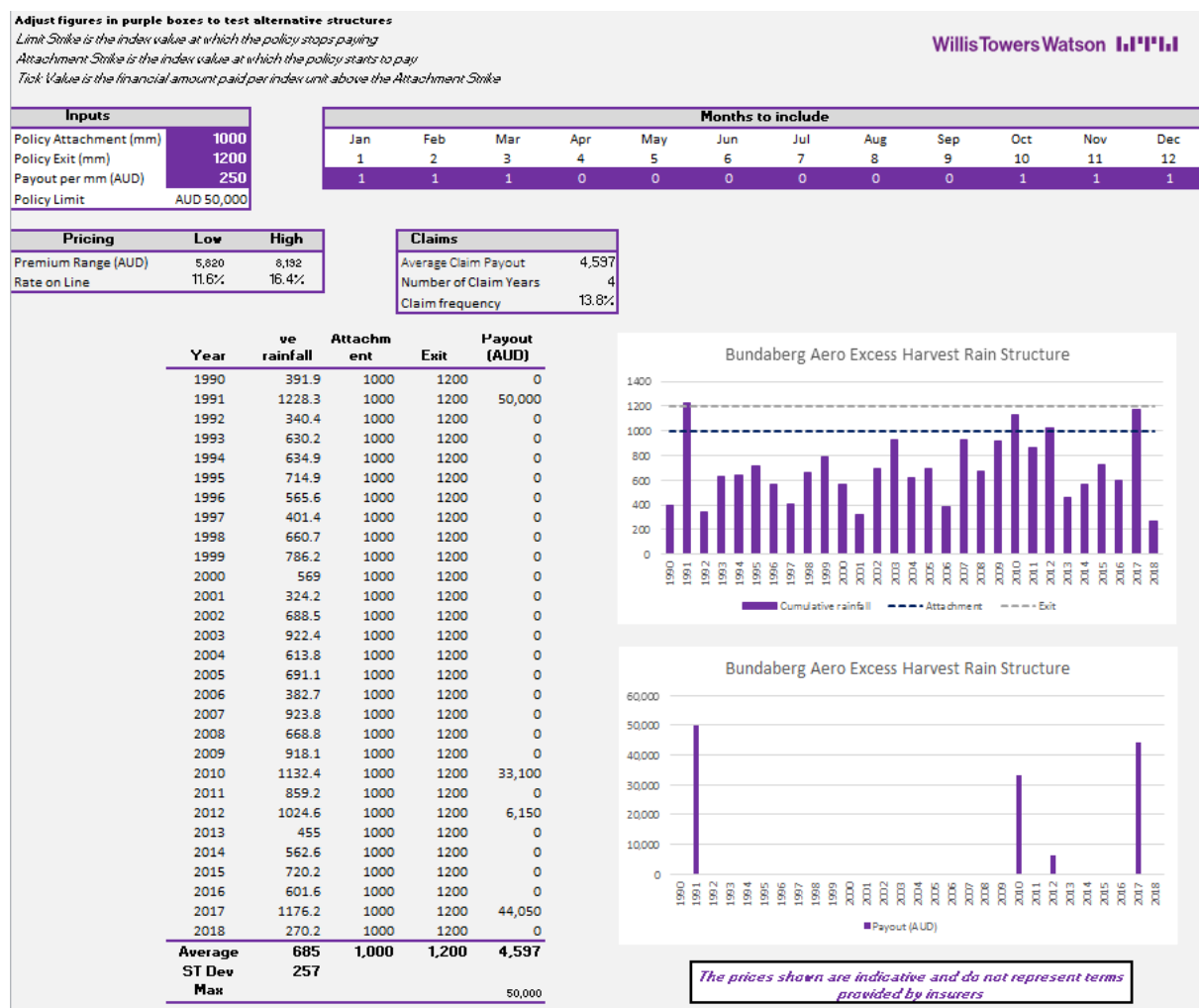


Figure 6 Screenshot of the interactive excess rainfall index insurance prototype developed for Bundaberg

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Heat day index insurance prototype

The head day index insurance prototype below (Figure 7) shows the premiums and payouts for a selected level of cover (in this case more than 2 days with extreme temperatures $>36^{\circ}\text{C}$ in a year). With this insurance option growers would have received payouts of 30,000 during 2002. The temperature threshold and payouts levels are adjustable and can be changed to alter the premiums.

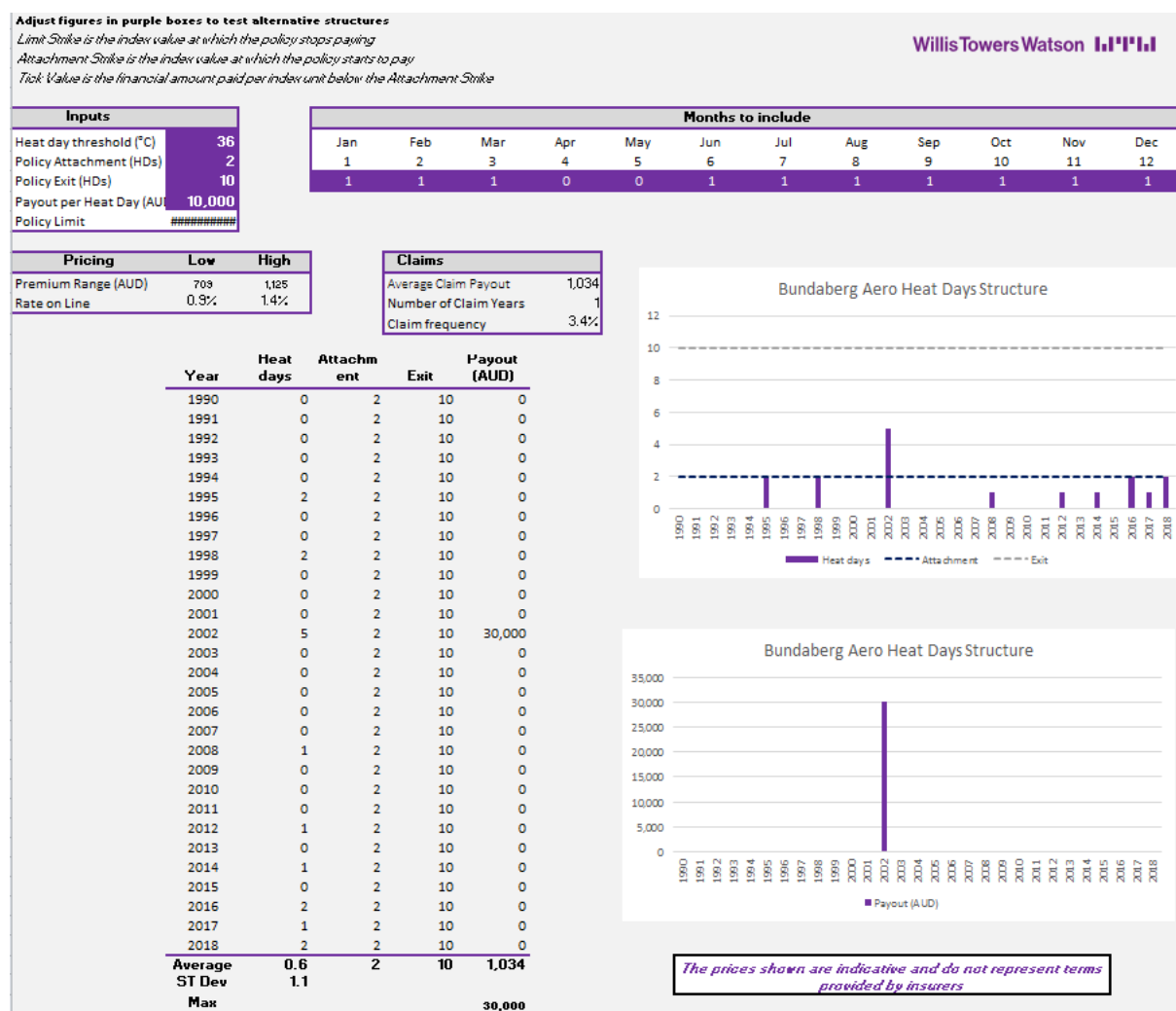


Figure 7 Screenshot of the interactive heat day index insurance prototype developed for Bundaberg

Options for making index insurance widely available

Group Buying Power

Macadamia growers are in a position to use the size and scale of their grower base as a way of providing more cost-effective cover. Mechanisms, such as a captive insurer or discretionary mutual fund (DMF), can be used to pool risk common to growers. Such arrangements can facilitate efficient risk sharing among growers by aggregating low value, high frequency losses and funding these from a dedicated pool of shared capital, meaning that external insurer capital would only be used – and paid for – to protect against an accumulation of smaller losses or one-off large losses in excess of the industry's group risk appetite.

Discretionary Mutual Fund

This commercially proven mechanism not only provides group buying power but also gives members the opportunity to control their own destiny by retaining surpluses/profits in the good claims' years through the setting up of an independently managed fund protected by re/insurance. Whilst similar to a captive insurer, a DMF can be established in a shorter timeframe and at a lower cost than a captive.

Possible Policy Directions

Agricultural production in Australia, particularly in Queensland, is subject to volatile weather and climatic conditions such as drought, floods, storms, frost and cyclones. These risks will pose increasing challenges for farmers, as it is predicted that climate change will increase the frequency and impact of such events. Further, the Australian farm sector experiences a higher degree of production risk than other sectors of the economy.

There is currently very little availability of affordable insurance products to address the key risks of macadamia growers. The current adaptation options available to macadamia producers may not be robust enough to address critical risks to the production and/or profitability of these systems and that macadamia producers would prefer to have alternative risk management options (especially through index-based insurance) when deciding on managing risks that meet their business needs.

Government policy and investment can have large impacts on agricultural insurance. The South Australian, Victorian and New South Wales state governments have recently removed stamp duty from agricultural insurance, a positive and proactive step to drive agricultural insurance uptake. The Western Australian Government and New South Wales Government are also investing in weather station infrastructure to assist the agricultural insurance market.

The level of premium is still a major concern for farmers. Effective policy decisions, coupled with self-supporting low cost products may be able to deliver attractive and affordable insurance products for farmers.

The project has recommended index-based insurance products as it recognises the necessity for self-supporting low cost products. The project has shown the potential for more affordable insurance products. However, in order to ensure product affordability, innovative mechanisms need to be identified to roll out index-based insurance products. This may involve investigating options of new funds 'such as discretionary mutual funds' to roll out optimal insurance options.

It may also be possible that farmers with the appropriate Best Management Practice (BMP) accreditation benefit through a premium rate discount. The effects that viable agricultural insurance would have on risk profiling of rural lending is another area that needs to be researched with government support.

Large parts of the agricultural sector are unaware of the potential benefits of agricultural insurance and its use as a risk management tool. Therefore, there is a need to educate

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farmers about the value of insurance, through shed meetings, workshops and one on one facilitated meetings.

References

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