Newsletter

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Rural Funds Management

Managing good assets with good people

About Rural Funds Management

Rural Funds Management Limited (RFM) is one of the oldest and most experienced agricultural fund managers in Australia. Established in 1997, RFM employs over 240 staff in fund and asset management activities and manages approximately $2.5 billion of agricultural assets. The company operates from a head office in Canberra and has additional offices in Sydney and regional Queensland.

RFM has a depth of experience accumulated over 28 years owning, developing and operating Australian farmland, agricultural infrastructure and other assets. Sector experience includes almonds, poultry, macadamias, cattle, cropping, viticulture and water. Assets are located throughout New South Wales, Queensland, South Australia, Western Australia and Victoria.

RFM is the responsible entity for Rural Funds Group (RFF), an ASX-listed real estate investment trust that owns a $2.0 billion portfolio of diversified agricultural assets including almond and macadamia orchards, premium vineyards, water entitlements, cattle and cropping assets.

RFM's company culture is informed by a precision-based approach to asset management and its longstanding motto of "Managing good assets with good people".

Scan the QR code to learn more.

Cover image: Cotton bolls ready to be harvested, Lynora Downs, central Queensland, April 2025.
Image on top: Mustering cattle at Kaiuroo Aggregation, central Queensland, April 2025 (wind turbines in background not an RFF asset).

Contents

Black earth, bright future

David Bryant, Managing Director

> **“From an aesthetic point of view, chernozem is just a beautiful soil, due to its purely black colour in a virgin state, and structural edges on the ploughed furrow crests reminiscent of raven wings. In the spring, the ploughing chernozem is raised in haze, then falls, trembling in the spring, breathes and smells as the living black earth. All these form the aesthetic grandeur of chernozems and their fertility potential.”**
>
> **— Stepan Pozniak[1]**

There are 118 chemical elements that combine with each other to form chemical compounds. Of the millions of compounds known to science, 80%[2] are organic carbon compounds – despite carbon being only the 19th most abundant element in the Earth's crust. For this reason, carbon or organic chemistry constitutes an important field of scientific research. This article is about carbon compounds, soil and saving Earth.

Carbon compounds are the building blocks of all life on Earth, including your body and the eyes you are using to read this article. Incidentally, it is possible to carbon date your eyes based on the concentration of carbon-14 (a particularly scarce radioactive form of carbon) contained in your eye lenses, by comparing it to the atmospheric concentration of carbon-14 at the time of your birth – which is why you should not lie about your age.

There are several reasons why carbon can form so many compounds. Firstly, this element is relatively light and can form carbon-to-carbon bonds that are very strong, which makes long chains, rings and branch structures – an example being the Earth's hardest substance, diamonds. Secondly, strong carbon-carbon bonds joined with other elements, such as hydrogen, are also possible, making products such as hydrocarbons or oil and gas. Carbon's bonding ability allows it to form an enormous variety of structures, from small organic molecules to larger molecules containing hundreds or even thousands of carbon atoms and other elements in complex three-dimensional structures.

Burning hydrocarbons sourced from fossil fuels introduces buried carbon back into the atmosphere through bonding with oxygen to form CO_2. Unfortunately, this practice is releasing around 10 billion tonnes of CO_2 annually into the atmosphere, thereby increasing the concentration of a gas that can last in the atmosphere for a thousand years. This carbon compound, along with others such as methane, is causing global warming, which will be a very big problem for our children – and their children.

An area of science that aims to solve this problem is soil science. The Earth's soil is estimated to store up to two trillion tonnes of carbon, which is more than double the amount of carbon currently in the atmosphere and three times that stored in terrestrial vegetation. Increasing the amount of carbon stored in soil could provide mankind with an avenue for reducing climate change. For this reason, the 2015 Paris Agreement on climate change included the “4 per 1,000 Initiative”, designed to lift soil organic carbon by 0.4% per annum, which would store the equivalent of 3.4 billion tonnes of carbon per annum – equal to the amount of carbon contained in CO_2 that is emitted each year.

Plants deposit carbon into soil by absorbing carbon dioxide during photosynthesis, thereby creating soil organic matter, which is abbreviated to SOM.

Deposits of SOM, which is around 58% organic carbon, enter the soil through decomposition and through the exudation of fluids through roots. Exudates are carbon compounds emitted into the soil to extract nutrients or enable symbiotic relationships with soil microbes. Root exudates can amount to a plant's ‘body weight’ each year. SOM is a vital component of soil fertility that provides increased nutrient storage, improved soil structure and, consequently, better water holding capacity. For this reason, increasing the SOM on our planet's soil could not only lower atmospheric carbon but also increase the productivity of our farms and forests.

Since 2011, Australia has had legislation that has enabled the Australian Carbon Credit Unit (ACCU) Scheme. This program, overseen by the Clean Energy Regulator, provides various methodologies designed to allow the production of ACCUs, which can then be sold to businesses wishing to offset their carbon emissions. One ACCU is equal to one tonne of CO_2 and has a current market value of approximately $35. Since 2019, the soil carbon methodology has seen over 650 projects registered, where farmers alter management practices on their land with the aim of sequestering carbon in their soil. The Rural Funds Group (ASX: RFF) is currently engaged in the process of applying to register a soil carbon project on a portion of grazing land on ‘Kaiuroo’, in central Queensland.

Staff from RFM and an external consultant, assessing the proposed soil carbon project at the Kaiuroo Aggregation, central Queensland, May 2025.

As the issuance of ACCUs from grazing-based soil carbon projects has been accelerating, members of the scientific community have been questioning the probability of how much carbon is being permanently sequestered. Scientists believe that many of the ACCUs generated over the past several years are more likely due to above-average rainfall rather than changed farm management. They also believe that much of the carbon will not be stored durably once rainfall returns to average.[3] The primary reason why carbon can be re-emitted to the atmosphere is that once soils become dry, plants cease to grow and absorb CO_2, while soil microbes continue to decompose organic matter and release CO_2.

In theory, soil carbon projects are an excellent opportunity for farmers to generate significant additional income while permanently improving their soils by increasing SOM, which will make their farms more productive. In practice, however, it remains to be seen if the increased SOM will be durable. This characteristic of carbon that is sequestered in the soil for long periods is known as recalcitrance.

There are, however, large areas in the world where ancient people may have demonstrated that massive increases in SOM are possible with very high recalcitrance. The Spring 2006 edition of this newsletter included an article discussing terra preta (Portuguese for “black earth”), which is a soil “made” by pre-Columbian Amazonian people. These soils exist in patches averaging 20 ha but up to 350 ha, cover more than 50,000 hectares

Figure 1: Typical soil profiles for chernozem soils

of central Amazonia and have sequestered carbon for several thousand years.[4]

In the past 30 years, terra preta soils have been the subject of extensive research by soil scientists. Much of this terra preta has a SOM as high as 14%, which is seven times the surrounding natural soil[5] and ten times that of Australian farmed soils. These soils are understood to have been made by incorporating charcoal combined with manures and household waste to create a more fertile soil that enabled more permanent inhabitation.

Other man-made soils with high SOM exist elsewhere on the planet. In Germany, Plaggenesche soils were made by cutting sods of fertile turf then combining this with livestock manures to fertilise cultivated fields. This practice, carried out 1,000 years ago, produced soils that still hold SOM of up to 14% today. In Australia, mounds of soil similar to terra preta have been identified and, using carbon dating, determined to be as old as 1,600 years.[6] The largest extent of what are probably human-influenced soils is chernozem soils, which extend across the cool temperate regions of the northern hemisphere. Starting in Germany and extending across Ukraine and the steppe regions of Eurasia, then into China and North America, these soils occupy 314 million hectares or 2.4% of the world's land area.[7] Chernozem is a Ukrainian and Russian word, and it too translates to "black earth".

Just how chernozem soils were created is still the subject of scientific research, but it is clear that the presence of charcoal and an associated accumulation of stable SOM is common across these vast former grasslands. Black carbon, which is the carbon fraction found within charcoal, has been carbon dated and found to have been deposited in these soils at the time of the Neolithic transition, beginning about 8,000 years before present (BP) – the transition was the Agricultural Revolution, the change from hunter-gatherer to larger, settled agricultural communities.

Analysis of the origin of black carbon in chernozems has found that the feedstock that created the charcoal was the in-situ vegetation, indicating the charcoal was created from the local vegetation. Furthermore, the additional organic carbon, which has been stored in the soil but derived directly from plant matter, was also derived from the decomposition of the plants that grew on site.

Figure 1 presents photos of typical soil profiles for chernozem soils. What is apparent is the significant depth of the dark earth soil profile, which is typically 60 cm but can reach 2 metres deep, with charcoal particles found throughout. There are a number of factors that have caused charcoal initially deposited at the soil surface to

be buried so deeply. Perhaps the most interesting of these factors has been the work of anecic earthworms – the longish, fat brown ones you find in a good vegie garden.

At Maidanets'ke in central Ukraine, 190 km south of Kyiv, there is an archaeological site called the giant Chalcolithic Trypillia, where, 5,000 BP, a settlement of probably 10,000 people lived in 1,500 houses.

Figure 2: Anecic worm cast material

A paper on the chernozems at this site notes that agricultural practices that fostered grasslands in combination with livestock favoured anecic worms, compared to other species.[8] This type of worm forms vertical burrows up to 1.8 m deep, which they excavate and clean by moving material to the soil surface as worm casts (see **Figure 2**). This process, first postulated by Charles Darwin, enables the transport of soil particles and deep organic matter to the surface, which is then mixed with surface vegetation during decomposition. This enables the dark earth horizon to thicken, rather than descend, since the process of transporting material from below, combined with the addition of new surface organic matter, enables the soil surface to build, as the subsoil is mined and subsides.

It is important to examine the role that charcoal plays in creating durable SOM, since its presence is a common feature in the super fertile soils discussed above. Charcoal is able to secure organic matter and organic compounds almost

Figure 3: The Australian Synchrotron which houses an electron accelerator

permanently in soil, with the result that the amount of carbon sequestered can be ten times the amount of carbon contained in the initial charcoal application. This multiple could be an important aspect in creating economics favourable to the widespread use of charcoal for sequestering carbon. This is because this additional amount of organic carbon is essentially deposited for free, using the power of solar energy and the chemistry of photosynthesis.

A 2021 study conducted by a group of scientists in Australia created the first visual evidence of how charcoal protects SOM from decomposition and thereby enables more rapid and permanent accumulation of soil carbon.[9] The study produced images using the Australian Synchrotron, a $220m electron accelerator located in south-east Melbourne (**Figure 3**). Charcoal is a bit like a honeycomb labyrinth that includes microscopic pores to create a surface area of around 500 square metres per gram of charcoal.

The study found that charcoal particles can adsorb (adhere) root exudates and protect them from consumption by microbes. These compounds are then able to build on the charcoal nucleus and adsorb microbe necromass (dead microbes) to form tiny, but expanding, aggregates of SOM.

While we now have an explanation of how charcoal works, we are not yet confident in how much it will work. At around $450 per tonne, charcoal is relatively expensive, particularly if it needs to be applied at high rates, such as 50 tonnes per hectare. There are several ways of overcoming this challenge, including using the charcoal production process to produce heat or electricity and thereby generate another revenue stream. Ultimately, producing higher crop yields as a consequence of higher SOM, making more fertile soils, is the key objective for a farming business.

Conclusion

Since the Newsletter article in 2006, Rural Funds Management (RFM) has continued to investigate the possibilities and economics of using charcoal to increase SOM in farms owned by RFF. This includes one of the worlds oldest field trials of charcoal conducted 18 years ago on a farm previously owned by RFF.

RFM will soon commence new trials on RFF farms, including a trial using lower rates of charcoal charged with nitrogen, with the aim of using the porosity of charcoal to better preserve nitrogen in the soil until it is required by crops. Using repeated applications of charcoal to better apply nutrients for crop production was possibly the methodology used by the people who, thousands of years ago, created some of the world's most fertile and productive soil.

Notes:
1. Pozniak, S. (2019), '*Chernozems of Ukraine: past, present and future perspectives*', Social Science Annual, 70(3), 193–197. See: C:\CanoScan\DANE\BASIA\gleba\ro.
2. Sato, K., '*Chemistry Chat: Focusing on the Elements: Chemistry between Carbon and Other Elements*' TCIMail No 155. https://www.tcichemicals.com/assets/cms-pdfs/155E_ChemistryChat-1SK.pdf.
3. Mitchell, E., Takeda, N., Grace, L., Grace, P., Day, K., Ahmadi, S., ... Rowlings, D. (2024). '*Making soil carbon credits work for climate change mitigation*.' Carbon Management, 15(1). https://doi.org/10.1080/17583004.2024.2430780.
4. Glasser B., et al. (2001). '*The 'Terra Preta' phenomenon: a model for sustainable agriculture in the humid tropics*', The Science of Nature 88(1), 37–41.
5. Cornell University Department of Crop and Soil Sciences (n.d.) Terra Preta de Indio.
6. Downie, A. E., Van Zwieten, L., Smernik, R. J., Morris, S. & Munroe, P. R. (2011), '*Terra Preta Australis: Reassessing the carbon storage capacity of temperate soils*' - ScienceDirect, Agriculture, Ecosystems & Environment, 140(1–2), 137–147.
7. Pozniak, S. (2019), '*Chernozems of Ukraine: past, present and future perspectives*', Social Science Annual, 70(3), 193–197. See: C:\CanoScan\DANE\BASIA\gleba\ro.
8. Geoderma 409 (2022), '*Earthworms, Darwin and prehistoric agriculture-Chernozem genesis reconsidered*'. www.elsevier.com/locate/geoderma.
9. Weng Z. et al, '*Microspectroscopic visualization of how biochar lifts the soil organic carbon ceiling*', Nature Communications, 2 September 2022.

Cattle grazing at the Kaiuroo Aggregation, central Queensland, May 2025.

Tree nuts are *growing*

Almond harvest at Kerarbury, Riverina NSW, February 2025.

Almonds and macadamias, the two types of tree nut properties owned by the Rural Funds Group (ASX: RFF), generate approximately half of its revenue. Over the past year, both nut types have experienced significant increases in their price. This article looks at the drivers for this sector and the benefits to RFF.

Growing sectors within the RFF portfolio

Tree nuts have been a growing component of the RFF portfolio. Four years ago, RFF owned $431m of tree nut orchards. RFF now owns $856m: almonds represent $453m of these assets, and macadamias represent $403m.

The growth in these sectors has mainly come from additional investment in macadamia assets in both mature orchards and greenfield developments.

One reason for RFF's ongoing investment in tree nuts is that the higher value of these commodities supports higher lease income. They comprise 44% of RFF's total property portfolio value, yet they are forecast to generate 49% of revenue.

Another benefit of tree nuts is that they are a permanent crop, so they suit long-term leases. RFF almond orchard leases, which commenced about a decade ago, have on average over 10 years remaining, while the macadamia orchard leases have a substantial 37 years remaining! These types of leases are valuable to RFF unitholders as they are designed to generate long-term and predictable income.

Growing industries and communities

Tree nut industries are also growing in Australia. In less than 10 years, the macadamia sector has grown over 76%, from approximately 25,000 ha in 2018 to over 44,000 ha in 2024. Production has increased from 43,600 t nut-in-shell (NIS) to approximately 57,850 t NIS over the past decade (2014–2024). The industry is expected to produce approximately 92,000 t NIS (or 27,600 t kernel – see explainer on page 11) by 2030, as recently planted trees mature and reach bearing age.

RFF has driven part of this industry growth. Later this year, 3,000 ha of developments in Maryborough, Bundaberg and Rockhampton in central Queensland are expected to be completed.

Expansion of high value crops can also benefit local communities. Economic analysis of the RFF macadamia orchard developments near Rockhampton highlights the regional benefits.[1] Specifically, the report identified significant job creation, multiplier effects to the local economy through the demand for goods and services to supply business operations, and consumption from the large and permanent new workforce.

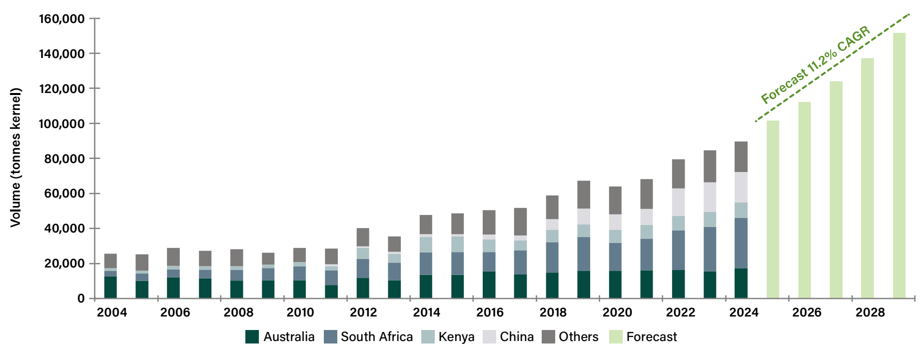
Historically, the beef industry has been the dominant agricultural commodity in the Rockhampton region, generating over 80% of agricultural production. However, it is estimated that from 2035 onwards, the macadamia orchards will provide comparable agricultural output. Converting lower-value grazing land into higher-value irrigated land is expected to increase productivity from $130 per hectare to approximately $34,500 per hectare annually. Additionally, it is expected that the macadamia orchards will produce three times the agricultural value per megalitre of water used ($3,450/ML), reflecting macadamias' higher value relative to other irrigated commodities currently produced in the region.

It is not surprising then that, macadamias are also expanding in other parts of the world. **Figure 1** shows increasing production from South Africa, China and Australia who produce the majority of the world's macadamias (68% in 2023 by kernel). Total production is forecast to grow by 11.2% (CAGR 2024–2029) to 152,000 t.

However, it is important to put this growth into context, as macadamias are in fact a very small crop compared to overall nut production. The world macadamia crop of 89,420 t (kernel) represents less than 2% of the world's tree nut production (see **Figure 2**). In 2029, the forecast 152,000 t production would still represent less than 3% of today's world tree nut supply.

Almonds, conversely, are a much larger crop globally, representing 32% of global tree nut production or approximately 1,691,000 t of kernel (see Figure 2).

Figure 1: World macadamia historical and forecast production[2]



Understanding tree nut volume measures: Kernel vs NIS

There are two distinct ways of measuring the volume of tree nuts: kernel and nut-in-shell (NIS).

Kernel refers to the weight of the edible nut. NIS, as the name suggests, refers to the weight of both the kernel and the shell within which the kernel grows.

Production and consumption volumes of tree nuts, such as almonds and walnuts, are typically referred to in terms of the weight of the kernel product. However, because macadamias and pistachios have historically also been sold to consumers as a NIS product, these nut types are typically measured in terms of NIS product.

As the macadamia kernel only represents approximately one-third of the total NIS weight, converting to a kernel equivalent price is important for comparison purposes.

Both kernel and NIS measures are used throughout this article, depending on the source of the data. The measure used will be specified on each occasion.

Figure 2: World tree nut (kernel) production[3]

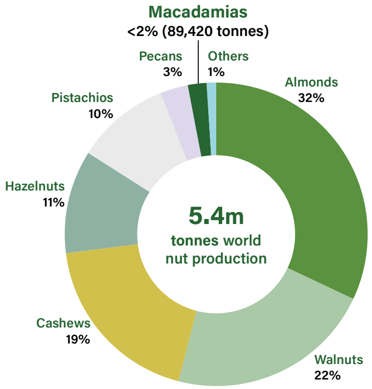
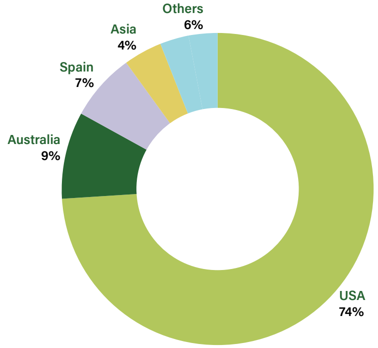


Figure 3: Global almond (kernel) production[4]



Over the past 10 years, Australia has increased the area planted to almonds by approximately 125% to over 64,000 ha, with total production at approximately 153,600 t (see **Figure 3**) and a value now estimated at over $1b annually. This makes Australia the second largest almond producing country in the world.

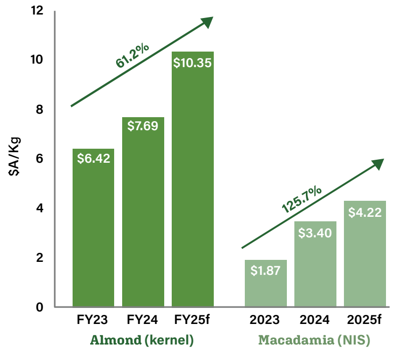
Part of the reason for the expansion here is that Australia is well suited to almond production, as it has regions with specific climatic characteristics suited to growing the nut: a Mediterranean-type climate with cold winters and warm, dry summers. These regions include the Riverina (NSW), Sunraysia (NSW/Victoria), Riverland and Northern Adelaide Plains (SA) and the Swan region (WA).

Conversely, the largest producer, the US, specifically California, has experienced three consecutive years of decreases to total almond orchard areas. This has been driven by a combination of reduced new plantings and orchard removals. This decline could lead to a positive outcome for the Australian industry against a backdrop of continued global demand.

Growing prices

Also due to global demand, prices for both almonds and macadamias have increased

Figure 4: Almond and macadamia price[5]



significantly over the past few years. Domestically, almond prices are expected to reach $10.35/kg (kernel) and macadamias $4.22/kg (NIS) by the end of the year — up 61% and 126% respectively from 2023 levels of $6.42/kg and $1.87/kg (see **Figure 4**).[5]

Growing commodity prices are beneficial for RFF, for several reasons. Firstly, they benefit the lessees of these assets, which in turn creates stronger counterparts for lease payments. Secondly, some leases have mechanisms that provide exposure to commodity prices – which means rents may increase over time. Finally, some of the macadamia orchards are operated rather than leased. These assets are most leveraged to benefit from higher prices.

Conclusion

Almonds and macadamias are growing sectors within the RFF portfolio – almost doubling over the past four years. This has increased revenue generation within RFF and provided long-term lease arrangements.

At a national level these industries are also expanding, with substantial increases in plantings of macadamias and almonds over the past decade.

The production of these higher value commodities benefits the economies where they are produced. In the case of RFF's plantings near Rockhampton, they are expected to lead to job creation and additional consumption of goods and services.

The prices of these commodities are also growing. From 2023 to 2025, almond and macadamia prices are forecast to increase by 61% and 126% respectively, benefitting both RFF and its lessees.

Notes:
1. Independent Assessment of Public Benefit commissioned by RFM, conducted in May 2022.
2. Production data combination of INC (2004–2023) and World Macadamia Organisation (WMO) (2024, no country allocation available). Forecast 2025–2029 is based on CAGR to reach INC forecast of 152,000t in 2029.
3. Data is kernel produced. International Nut & Dried Fruit Council (INC), Statistics database, https://inc.nutfruit.org/. Data labels not shown for pecans (3%), others (brazil nuts and pine nuts) (1%). Figures subject to rounding.
4. Data is kernel produced. INC, Statistics database, https://inc.nutfruit.org/. Others include Africa, Latin America (Chile) and Europe (excluding Spain). Figures subject to rounding.
5. Source: FarmOnline, Australian Financial Review and Marquis Macadamias, https://marquis.com/.

Charleville orchard, Maryborough, central Queensland, February 2025.

Rural Funds Management

Rural Funds Group | ASX: RFF

Recent views from across the sectors


Vineyards


Cattle


Cropping


Macadamias


Almonds

You are invited!

Investor Roadshow

October 2025

- Sydney
- Melbourne
- Brisbane
- Canberra

Rural Funds Management will be travelling to various capital cities to present an update on the Rural Funds Group (ASX: RFF) and meet with current and prospective Unitholders.

Scan to RSVP

This event is not just for our current Unitholders, we encourage you to bring a friend, family member or colleague. To RSVP and receive more details as the event approaches, scan the QR code.

Images on left:

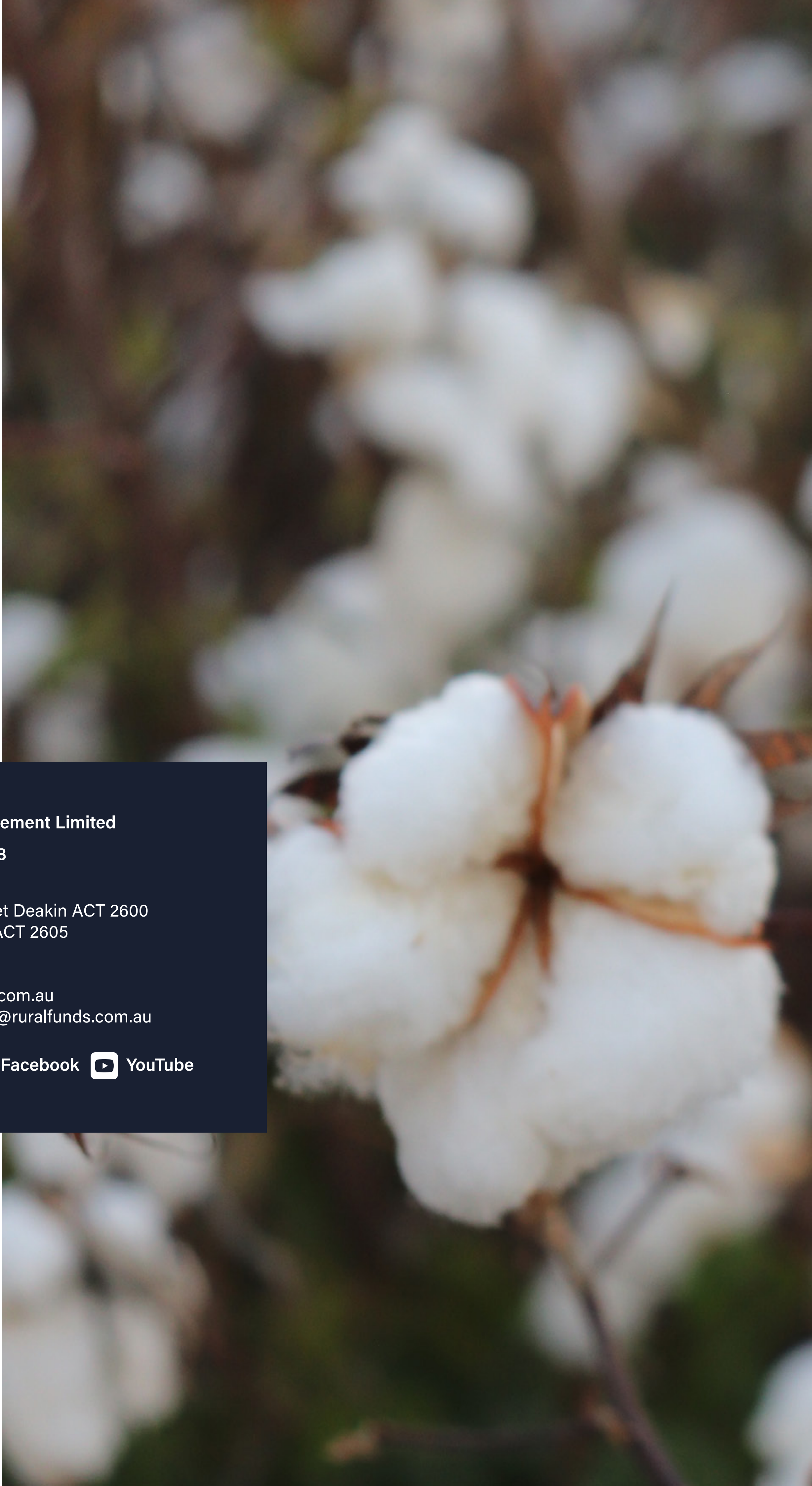
Vineyards Shiraz grapes at Geier vineyard, Barossa Valley, South Australia, February 2025. Geier is one of six RFF vineyards leased to Treasury Wine Estates (ASX: TWE), a global leader in luxury wine production with market capitalisation of over $6.5b.

Cattle Mustering cattle at Kaiuroo, central Queensland, April 2025. Kaiuroo Aggregation, used for both cattle and cropping, is being operated by RFF while productivity developments are undertaken. Developments primarily include water and irrigation infrastructure in areas used for cropping.

Cropping Cotton crop at Lynora Downs, central Queensland, May 2025. RFM operates Lynora Downs and two nearby cropping properties, Mayneland and Baamba Plains. Mayneland and Baamba Plains are operated on behalf of a joint venture lessee between TRG (The Rohatyn Group) and a global institutional investor.

Macadamias Established Glendorf macadamia orchard, Maryborough, central Queensland, February 2025. Glendorf, planted in 2021, is part of 3,000 ha of macadamia orchards being developed by RFM and leased to a joint venture lessee between TRG (The Rohatyn Group) and a global institutional investor, to 2062.

Almonds Harvested almond rows at Kerarbury orchard, Riverina, NSW, February 2025. Kerarbury was developed from 2016 to 2018 and is now reaching mature production. It is leased by Olam Orchards Australia, a subsidiary of Olam Orchards International (SGX: 032), until 2038.



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