

Expanding the New South Wales rice industry

*Independent review of the viability of developing the
rice industry outside the Murray and Riverina
regions*

A Final Report prepared for Rice Marketing Board (NSW)

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Executive summary

Project overview and scope

This report contains an assessment of the viability of expanding the NSW rice industry into non-traditional growing areas of the state (i.e. outside of the NSW Murray and Riverina regions) and the extent to which expansion opportunities are hindered by current single desk rice marketing arrangements under the Rice Marketing Act 1983.

The review responds to the following terms of reference:

1. The report will identify options for expanding the NSW rice industry to regions outside of the Murray and Riverina, including Northern NSW.
2. The report will examine the current and future productive capacities (over a 5-10 year horizon) of any rice growing regions identified.
3. The report will estimate the cost and benefits of the options identified to the state of NSW as well as identify the share of these costs and benefits that accrue to major stakeholders.
4. The report will recommend options for expanding the NSW rice industry outside the Murray and Riverina region where there are net benefits to NSW.

At the outset of the project the scope was further refined and agreed with the Rice Marketing Board to only consider benefits and costs of expansion within a given region (and not the costs or benefits of expansion in a region to the rest of NSW).

The project team addressed these terms of reference to the extent possible through publicly available information and stakeholder consultations. However, the unavailability of some commercially sensitive information limited the ability to assess future costs and benefits – particularly with respect to accessing and capitalising on market opportunities (including through exports).

Nevertheless, based on the information available and analysis undertaken, the project has resulted in valuable insights and conclusions, which are summarised against the terms of reference below, with further analysis and reporting presented in the body of the report.

Potential areas of expansion

The first of the review's terms of reference - *identify options for expanding the NSW rice industry to regions outside of the Murray and Riverina, including Northern NSW* was addressed through examining potential areas of expansion into the rainfed Northern Rivers and irrigated Northern Basin production regions. This considered the potential impacts of numerous physical, market and regulatory impediments. It also outlines a pathway for establishing a viable industry presence where expansion is a probability.

Northern Rivers

The Northern Rivers region has ample coastal floodplain country suitable for rice cultivation, should farmers in those areas decide to switch from current cattle, sugarcane and/or soybean production. The review team consulted extensively with industry during a trip to the Northern Rivers region, speaking with growers, agronomists, technical consultants, academics and rice marketers revealing

considerable interest in and adoption of rice growing in the area. There are a number of growers consistently and profitably growing rice under contract, and there were indications of wider interest from other farmers in growing rice (e.g. strong attendance and open farm days and regular inquiries regarding growing rice from other farmers).

At current prices offered to rice growers, there are attractive gross margins over other alternative crops (such as soybean production) which might support expansion of production. Based on estimates of long term average yields, input costs, and current prices offered, gross margins for rice outperform soybean production with \$850 per hectare for rice to \$360 per hectare for soybean production. However, a range of other challenges and impediments exist to having successful rice industry expansion in this region.

One challenge is that Australian varieties bred for growing conditions in the Riverina are not well suited to upland rice cultivation in the Northern Rivers. Minimal root depth affects the crop's ability to withstand drought stress during the plant's critical growth phase. Varieties are also not bred for prolonged submergence as may occur in the Northern Rivers. Better varieties and improved grower understanding of planting date risk would assist industry viability.

Another challenge is selecting optimal rates and timing of crop nutrition for growing conditions in this region. This is partly driven by the unpredictability of the weather but is also not well developed given the industry is relatively young (in the region), and it is likely that this will improve over time.

The Northern Rivers industry does not currently have downstream processing capacity sufficient for production in excess of 5,000 tonnes, which limits market opportunities.¹ The small scale of current infrastructure also increases overhead costs for industry participants, and these must be borne along the supply chain. While current delivery and processing options are well regarded by growers, compared with other cropping options, growers were also of the view that investment in infrastructure in the region (milling and storage) would provide them with greater confidence in the industry and lead to increased production:

'Wallet opens more easily when you've got certainty – if we knew that the industry was sustainable for the next 10-20 years it would be invested in. Undoubtedly.' –
Grower quote from consultation.

At the same time, downstream operators are limited to domestic market opportunities and this was cited as a (if not the) major barrier to investing in infrastructure for the Northern Rivers region.

While there are challenges, a number of conditions necessary for industry expansion in the Northern Rivers exist. This includes availability of suitable land, agronomic benefits of rice growing, and attractive gross margins for growers (assuming average yields and prices offered to growers can be maintained). However, for industry expansion to be achieved, a practical pathway is required. This will need to encapsulate three interrelated elements:

1. establishing new market opportunities
2. financing and constructing processing infrastructure
3. improving varietal performance and agronomic knowledge.

¹ Note production capacity is based on reasonable operating hours within the milling season.

Northern Basin

The review found that the irrigated agricultural regions of the Northern Basin do not have the necessary conditions present for a viable industry. This is due to impediments such as variable surface water availability, high water prices, competition from an already profitable cotton industry, and the absence of any downstream infrastructure.

Some rice may continue to be grown opportunistically in the Jemalong District, within the Lachlan Valley, and delivered to SunRice's existing facilities.

Analysis of productive capacity

The review's second term of reference focuses on analysing current and future productive capacities, for the Northern Rivers industry.

There are related interests along the supply chain that need to be aligned to ensure industry viability. This includes farmers apportioning land use to rice cultivation, the effect of supplier price on production quantity, and potential profits available for downstream participants to underpin supplier price.

Farmers' decisions to plant rice are influenced by gross margin opportunities, preference for some farming activities over others, and risk relative to potential return.

The minimum quantity of production at which a Northern Rivers industry will be viable will be determined by what the potential revenue opportunities are for processors and marketers, relative to their costs of production. Downstream participants are currently limited to domestic marketing, and highly exposed to price competition within this single market. These revenue risks cannot currently be offset by exploiting export market opportunities.

There is insufficient data from which to estimate the full supply curve, however, modelling based on substituting alternative crops for rice on suitable country indicates potential industry expansion for supply prices above \$300 per tonne. The review finds that at \$400 per tonne, which is the price currently being offered to growers, there would be a high probability that this would be sufficient to support growth in rice production in the Northern Rivers (beyond the current production target for 2017-18 of approximately 4,000 tonnes).

However, from the evidence made available to this review it is unclear that market opportunities exist for a downstream processor to sustain paying \$400 per tonne. It is also unclear as to whether the production levels likely at supply prices between \$300-400 per tonne, would be sufficient to enable a downstream processor to achieve a viable scale.

The absence of downstream revenue information forthcoming from current Northern Rivers industry participants, or SunRice, limits the ability of this review to draw definitive conclusions about the viability of the current Northern Rivers industry. This information was not provided for consideration as part of this review for commercial-in-confidence reasons.

In future, increased willingness of Northern Rivers growers to supply rice could improve profitably for downstream processors. It would enable investment in more cost-efficient processing facilities, and agronomic research and development to improve yields for growers. At the same time, growers also noted they would be more willing to increase production if there was more investment and certainty for the rice industry in Northern Rivers.

Potential policy options

The third and fourth of the review's terms of reference, are to consider and provide options for expanding the NSW rice industry that could have net benefits to NSW. This has been considered with respect to the Northern Rivers industry, and options for changed export arrangements, and improved research, extension and development.

Export arrangements

The ability to export could increase average rice sale prices in the Northern Rivers. In consultations, the review was informed that approaches had been made to multiple stakeholders by export customers, but evidence of this was not provided, citing commercial sensitivities.

Evidence suggests that the ability to export would improve profitability for the industry and support expansion, including the confidence to invest in infrastructure in the region. However, the magnitude, and whether it would be the deciding factor in whether the industry can expand, is difficult to quantify in the absence of any information being provided in relation to such variables as export volumes, prices, and costs.

The lack of evidence regarding export opportunities is partly a result of private companies not sharing relevant commercially sensitive information with the project team. There is also a more fundamental challenge when quantifying export opportunities in that companies which are prevented from exporting are unlikely to develop firm export opportunities as these opportunities cannot, presently, be realised. Hence, the extent of export opportunities for the Northern Rivers rice industry, and therefore the costs and benefits to the industry, will continue to be challenging to quantify.

In the absence of specific evidence on the benefits and costs of allowing the Northern Rivers rice industry to export rice, the NSW Government could examine the benefits and costs of removing or adjusting similar statutory marketing policies in similar industries and jurisdictions and refer to these results to inform its policy development.

As agreed with the Rice Marketing Board at the commencement of the project, this review did not consider the costs to other growers (in traditional growing areas) of changed export arrangements, nor did it consider the particular means through which exports would be allowed.

Research, development and extension

Current Riverina rice varieties are not well suited to a growing environment where available moisture may not be present near their root system at critical stages of grain development. A lack of timely rainfall can have substantial effects on yield. The industry would be more economically viable with the development of better suited varieties and agronomic research to establish optimal seeding dates to minimise the yield risk of dry and cold events. A number of research, development and extension opportunities that would support the industry were identified by stakeholders (these are further detailed in the body of the report).

The NSW Government should consider whether the Northern Rivers rice industry is receiving appropriate support for research, development and extension. Any investments should be focused on responding to positive externalities and where the benefits are likely to exceed the costs. There may also be scope to fund activities through existing grower levy schemes, or in partnership with industry and research institutions.

Summary and conclusions

The review has considered the viability of expanding the NSW rice industry into non-traditional growing areas of the state. Based on the analysis undertaken two key conclusions may be drawn:

1. *Establishing a viable rice industry in the irrigated Northern Basin is highly unlikely.*

Some rice may continue to be grown opportunistically in the Jemalong District within the Lachlan Valley. However, a viable rice industry in the Northern Basin is unlikely, due to water availability and price, existing farming practices, and the difficulty of developing new processing infrastructure under these circumstances.

2. *There is potential for a viable rice industry in the Northern Rivers, though the review was provided insufficient information on which to make a conclusive assessment of expansion prospects. This includes whether relaxing export restrictions would make a definitive difference to industry viability (noting that it is likely to be beneficial to the industry in the Northern Rivers).*

While there is no shortage of suitable land for rice cultivation in the Northern Rivers region, and growers can be profitable at current supply prices, other challenges to a sustainable industry remain.

Rice growing in the Northern Rivers environment is still not well understood, and reliance on seasonal rainfall increases yield risk. Better agronomic information and upland varieties would assist growers to transition from alternative farming enterprises.

Unfortunately, key information about potential revenue opportunities for the industry under different export scenarios was not available to this review. The absence of this information has made it difficult to draw firm conclusions about the future production potential and financial viability of a Northern Rivers industry.

In our view, relaxing export restrictions for Northern Rivers producers would likely improve the viability of the rice industry there. However, without a sound evidential basis from which to conduct economic analysis, it is not possible to say definitively that either, a) the industry is or is not already viable, or b) that export marketing arrangements are a determining factor in this that would affect the current legislative test for retaining current arrangements.

It is noteworthy that in the process of site visits and grower group consultations, the review process identified considerable interest in rice growing in northern NSW and strong support for expansion. Despite lacking the necessary information on which to make a conclusive assessment, the review provides a strong overview of the Northern Rivers industry, with stakeholder interviews providing information and insight that was previously poorly documented or understood. This includes insights on on-farm practices and processes, information on yields and yearly production targets for the region, gross margins for rice crops over other alternatives and the strong support for future growth and development of the industry amongst growers and supply chain stakeholders.

Finally, stakeholders suggested that more could be done to support development of the industry, and that in this regard, government could play a positive role. This is reflected in the research, development and extension section above, with more discrete guidance and opportunities included in the body of the report.

1. Introduction

This section provides a brief background to the project, the scope of the review, and the approach and methods used to complete the review.

1.1. Background and context

Rice grown in NSW is currently subject to regulations affecting the way it can be marketed, under the *Rice Marketing Act 1983* (NSW) (the Act). For domestic markets, companies wanting to market rice must be 'authorised buyers', as approved by the Rice Marketing Board (RMB) of New South Wales (NSW). This follows de-regulation of the domestic market from a single desk marketing arrangement ten years ago.

The single desk arrangement has been maintained for rice exports from NSW, based on the NSW Government determining that this arrangement meets the test in the Act that vesting export rights in a single marketer (SunRice) serves the best interests of NSW growers.

The current arrangements have implications for growers outside the traditional growing areas of the Riverina, which form the basis of SunRice's receipt, processing and marketing arrangements. While growers beyond the Riverina can market their product domestically as an authorised buyer of rice, exports must be managed through SunRice. Distance from SunRice infrastructure, or disparate marketing characteristics of the rice, may make this arrangement unsuitable for growers outside the Riverina wanting to pursue export opportunities.

From its review of vesting in 2016, the NSW Department of Primary Industries (NSW DPI) estimated that lost export opportunities from non-traditional rice growing areas were small relative to the benefits of vesting. However, the review acknowledged that potential changes to production capabilities or export market opportunities may alter this assessment. Accordingly, the NSW DPI requested that RMB 'investigate and report on measures that deliver net benefit to NSW from developing the rice industry outside the Murray and Riverina.'

The purpose of this review is to examine opportunities for rice industry expansion into non-traditional areas of NSW, the potential economic benefits of feasible expansion options, and any limitations associated with export restrictions. These findings will inform future government reviews of vesting arrangements.

1.2. Scope of the assessment

This review assesses the viability of expanding the NSW rice industry into non-traditional growing areas of the state, and to assess the impacts of current regulatory arrangements for marketing in terms of their effect on expansion feasibility.

The review terms of reference specify the following scope of investigation:

1. The report will identify options for expanding the NSW Rice industry to regions outside of the Murray and Riverina, including Northern NSW.
2. The report will examine the current and future productive capacities (over a 5-10 year horizon) of any rice growing regions identified.

3. The report will estimate the cost and benefits of the options identified to the state of NSW as well as identify the share of these costs and benefits that accrue to major stakeholders.
4. The report will recommend options for expanding the NSW rice industry outside the Murray and Riverina region where there are net benefits to NSW.

Furthermore, the terms of reference specified the following conditions for conducting the study:

1. The investigation and report will be undertaken by an externally appointed consultant.
2. The investigation and report will be funded by the Board.
3. The investigation and report will consider the costs and benefits including employment and the flow-on benefits of supporting and reliant industries.
4. The consultant will consult with, and report on, the full range of stakeholder views.
5. The consultant will provide draft findings and recommendation to the Board and the Director General by end of March 2018.
6. The investigation and report will be completed by end of May 2018 and provided to the Board and Director General.

Based on Aither's proposal, subsequent refinement of the project scope and issues with data availability, the above scope of work has been addressed in part by this report.

The review did not consider the costs and benefits of the rice vesting arrangements as a whole. This means the benefits of rice vesting in general were not considered. The review did consider the potential benefits to the Northern Rivers rice industry from being allowed to export. The broader potential costs from an exemption were agreed to be out of scope. This means that scope point 3 (above) was not directly addressed.

The review also did not consider the employment and flow-on impacts. This allowed additional time to investigate the direct impacts. One of the reasons for this approach is that the small scale of changes identified in this report mean that the employment and flow-on effects are likely to be trivial, where measured appropriately. This perspective is outlined in the New South Wales government economic guidelines (NSW Government 2017; p 12):

As a general practice secondary benefits are not included in a CBA. The major reason is that the expenditure incurred to create this \$10 million of income could have been spent on an alternative project or simply given away as a transfer payment. This counterfactual expenditure could also have created a flow-on impact on income. It would be incorrect to attribute a flow-on (multiplier) income benefit to the project and to ignore the possible flow-on effects of expenditure on an alternative project.

And even where there are employment and flow-on impacts, there are technical reasons to be cautious in how they are treated to avoid substantially biasing the analysis (Boardman *et al* 2010).

In terms of geographic coverage, the review looked at areas outside of the traditional growing areas (defined as the Murrumbidgee and NSW Murray valleys) where rice might be grown. Given this broad geographic coverage, only the prospective areas were subjected to detailed investigation and economic analysis – other areas were ruled out based on rapid investigation of general factors (e.g. if environmental factors were not suitable, water availability was too low, or higher value crops dominated the area).

For prospective areas, the review considered the agronomic, environmental, industry, supply chain, and marketing aspects of potential alternative growing areas, and how access to exports markets (or not) might impact expansion.

This required literature review, consultation and economic analysis as detailed in the approach and method section below.

1.3. Approach and methods

This review has assessed the viability of non-traditional NSW growing regions by:

- Identifying potential areas of NSW for rice industry growth.
- Conducting a desktop analysis of the suitability of rice growing in these areas.
- Consulting with stakeholders in those regions about the viability of rice growing there.
- Conducting economic analysis of rice industry viability in non-traditional areas.
- Exploring policies that could be used to support the growth of the rice industry in non-traditional areas.

Stakeholder consultation was undertaken in person and over the phone and a list of consultees has been provided at Appendix A.

Economic analysis has been conducted on the basis of verifiable data where it is available. However, in some instances the review has relied on direct evidence from stakeholders that was unable to be fully tested. These instances are identified within the report.

2. Current industry structure and settings

This section provides general information on the rice vesting arrangements and the current industry settings in the Riverina as well as in the Northern Rivers.

2.1. Regulatory arrangements for rice marketing in NSW

2.1.1. Single desk marketing

Under the *Rice Marketing Act 1983* (NSW) (henceforth the Act), the marketing of rice grown in NSW is regulated by a statutory authority. This is the last statutory marketing arrangement of its kind in Australia.

The Act establishes the authority of the Rice Marketing Board for the state of New South Wales (RMB) to regulate NSW rice marketing. The Act provides that all rice produced in NSW be vested in the RMB.

Under Section 51 of the Act, RMB appoints Ricegrowers' Ltd (trading as SunRice) as the holder of the *Sole and Exclusive Export Licence* (SEEL) to export rice grown in NSW. Under the SEEL arrangement, other companies are unable export rice grown in NSW.

The objective of this vesting authority is to maximise returns to NSW growers from the marketing of their rice production.

The composition of the RMB is four nominated members appointed by the NSW Minister for Primary Industries, and three grower-elected members (who also sit on the SunRice board). The Chair is a nominated member.

The RMB has three objectives:

- (a) to encourage the development of a competitive domestic market for rice;
- (b) to ensure the best possible returns from rice sold outside Australia based on the quality differentials or attributes of Australian rice; and
- (c) to liaise with and represent the interests of all NSW rice growers in relation to the Board's functions and objects.

Responsibilities of the RMB include:

- overseeing the performance of the SEEL in delivering the objectives of the Act
- approving licenced buyers for the purchase of NSW grown rice, for domestic marketing.

One of the conditions of SunRice holding the SEEL is that it acts as buyer of last resort for rice grown in NSW. This requires SunRice to purchase all rice of merchantable quality offered to it by growers in NSW.

2.1.2. Periodic review

In accordance with National Competition Policy, the arrangement is subject to periodic review to ensure that legislation restricting competition is only retained on the basis that:

- the benefits of the restriction to the community as a whole outweigh the costs
- the objectives of the legislation can only be achieved by restricting competition.

To date, the NSW Government has determined that this arrangement meets the test in the Act that vesting export rights in a single marketer (SunRice) serves the best interests of NSW rice growers and communities.

The most recent review of current vesting arrangements occurred in 2017. The review concluded that the benefits of vesting are likely to outweigh the costs, and that it should be continued.

However, the review also found that current vesting arrangements are ‘discouraging the future growth and development of the rice industry in Northern NSW, which may have substantial future costs from lost export earnings’ (NSW DPI 2016, p. i). It also noted that ‘it appears that vesting arrangements are one of a number of constraints on Northern NSW rice producers preventing it from expanding’ (NSW DPI 2016, p. 17).

The review recommended that:

The Rice Marketing Board investigates and implements ways to develop the rice industry outside the Murray and Riverina, to avoid costs from restricting the growth of the industry in Northern NSW. (NSW DPI 2016, p. i)

RMB has noted that in submissions to the 2012 review, Northern Rivers growers ‘argued that their remoteness from the main SunRice operations in the Riverina and their inability to develop new niche export markets limits the expansion of rice growing in that region’ (NSW DPI 2016, p. 9).

The RMB view expressed in their recent submission to the NSW Government’s review of vesting was:

The Board is cognisant of these issues but remains strongly of the view that vesting delivers benefits to NSW rice growers at no cost to taxpayers and consumers that far outweigh the small gains that may be made for individual growers and companies if vesting was to be discontinued (NSW DPI 2016, p. 10).

2.1.3. Assessment of benefits

Previous reviews have led to changes in the transparent reporting of benefits from vesting. Following the NSW Government’s review of vesting in 2012, the RMB instituted an annual, independent verification of the claimed premium to growers.

This verification process is conducted on behalf of SunRice by Grant Thornton Australia Ltd. According to RMB:

The export price premium is calculated for each of the five major export regions in which SunRice operates. These markets comprise the Pacific Majors (Papua New Guinea (PNG) and Solomon Islands), the Middle East, World Trade Organisation (WTO) Markets (Japan, Taiwan and South Korea), New Zealand, and the Pacific Islands.

The premium is calculated as the difference between the average local SunRice sale price, less the average weighted local competitor sale price, multiplied by the volume sold (NSW DPI 2016, p. 3).

A monetary value from achieving freight scale advantage is also calculated:

Freight scale advantages arise due to the benefit of delivering larger volumes into export markets thereby lowering delivery costs for NSW rice into export markets. These benefits provide a further advantage against international competitors and would not be available in the absence of the scale delivered under the SEEL agreement (RMB 2017, p. 4)

The RMB also receives monthly commercial-in-confidence financial reports to assist monitoring the performance of SunRice (RMB 2016, p. 4).

2.1.4. Domestic marketing

For domestic market destinations, companies wanting to market NSW-grown rice must be 'authorised buyers', as approved by the Rice Marketing Board of NSW. This follows de-regulation of the domestic market from a single desk marketing arrangement ten years ago. At the time of writing, the RMB had licensed eleven authorised buyers. These are:

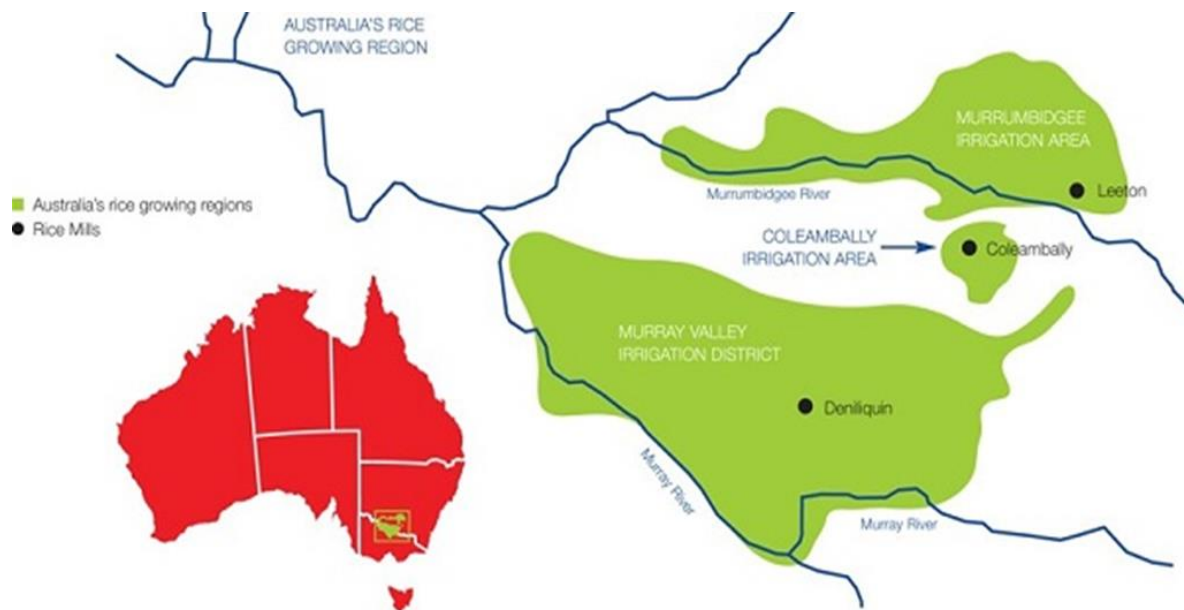
- Australian Food and Agriculture Company Limited
- Carmac Trading Pty Ltd Trading as OzRice
- Graincorp Limited
- Natural Rice Co Pty Ltd
- Organic Grains Pty Ltd
- Ricegrowers Limited Trading as SunRice
- Slater Farms
- Frank Boyle
- RG and WL Heffer
- PS & JM Randall
- GJ & BJ Woolley.

The RMB sub-committee responsible for approving authorised buyers consists of the four non-grower board members (RMB 2016, p. 8).

2.2. Riverina industry overview

2.2.1. Summary

Nearly all rice growing in NSW occurs in three Riverina irrigation districts sourcing water from storages at the headwaters of the Murray and Murrumbidgee rivers. When general security allocation water is well allocated, approximately 1100 farmers in the NSW Riverina can grow rice (Rice Marketing Board 2016, p. 9). These areas are shown in Figure 1.



Source: Riceworkers' Association of Australia

Figure 1 Map of Australia's main rice growing regions

Rice has also been produced, occasionally, and in small quantities, from irrigation supplied from the Lachlan River, in the Jemalong Irrigation District near Forbes. This rice paddy has been delivered into SunRice's Riverina facilities.

Potential rice growing areas in the Riverina are limited by environmental conditions attached to rice growing. Farms must have paddocks of soils with heavy clay to be approved for rice cultivation, to prevent excessive changes to groundwater across the landscape. In some cases landholders have accepted government funding to take their land out of rice production for a specified period. Contemporary market dynamics also limit the likelihood of farmers with permeable soils growing rice, as it is uneconomic to use excessive water for production.

Annual production volumes are shown in the Table below.

Table 1 Recent rice production by region (tonnes)

	2017	2016	2015	2014	2013	2012	2011	2010
Murrumbidgee Irrigation Area	308,511	152,951	254,031	233,760	377,850	315,868	300,167	109,262
Coleambally Irrigation Area	109,316	39,849	97,638	115,466	190,540	154,431	146,218	45,652
Murray Valley	381,016	51,834	333,540	476,647	589,668	486,201	350,214	49,171
Northern NSW	833	603	419	193	282	471	497	1,593
TOTAL	799,676	244,787	685,628	826,066	1,158,340	956,971	797,096	205,678

Source: Rice Marketing Board, Statistical Summary, <http://www.rmbnsw.org.au/statistical-summary>

2.2.2. Water sources

Water availability and price are the primary determinants of NSW rice industry production volumes in any given year.

The Hume and Dartmouth dams are the primary storages for the NSW Murray Valley. The water in these storages is distributed between NSW, Victoria and South Australia under terms established in the Murray Darling Basin Agreement. In the Murrumbidgee valley, the storages supplying water to irrigators are Burrinjuck and Blowering dams.

The river systems these storages deliver into are physically connected, enabling trade between them, subject to prescribed limits. The total storage volumes for each are shown in Table 2.

Table 2 Murray and Murrumbidgee storage volumes

Storage	Full supply volume (GL)
Dartmouth	3,856
Hume	3,055
Blowering	1,631
Burrinjuck	1,026

Source: Ricegrowers' Association of Australia 2016, p. 10

These storages underpin bulk water licence entitlements to three irrigation companies in the NSW Riverina: Murray Irrigation Ltd (Murray Valley), Murrumbidgee Irrigation (Murrumbidgee Valley), and Coleambally Irrigation Co-operative Ltd (Murrumbidgee Valley). These irrigation schemes service most rice growers, though some divert their irrigation water directly from watercourses.

Upper Murray storages are also required to meet Victorian and South Australian requirements, in accordance with the Murray Darling Basin Agreement. The share of water available to upstream irrigators is also influenced by the ability of downstream storages to meet end-of-system requirements.

The water available to general security irrigators in the NSW Murray and Murrumbidgee valleys is included in Table 3.² This includes water owned by the Commonwealth Environmental Water Holder and used for environmental purposes, which represents around one quarter of overall entitlement.

Table 3 Water entitlement on issue (ML)

	NSW Murray	Murrumbidgee
General Security	1,673,764	1,891,994
High Security	190,561	359,412
Local water utility	36,692	43,585
Domestic and stock	17,083	34,444
Conveyance	330,000	373,000
Supplementary water	252,579	198,778

Source: Ricegrowers' Association of Australia 2016, p. 24 and 26.

The Jemalong Irrigation District near Forbes, NSW, has also produced rice. This irrigation scheme derives its water from the Lachlan River, via a 100 000ML extraction licence held by Jemalong Irrigation Ltd.

As an annual crop, rice is typically grown using lower reliability (general security) water entitlements, against which the responsible NSW government authority determines annual allocations. These allocations are determined by the volume of water available in the storages, after higher priority commitments have been met (Table 4).

The variability of rice production between seasons is primarily a function of the variability of allocations to general security licences and the related effect this has on annual water market trade prices. The amount of water carried from allocations in the previous season can also affect availability for production (and price).

Table 4 NSW General Security allocations 2010-2017

	2017	2016	2015	2014	2013	2012	2011	2010
Murrumbidgee	100%	37%	53%	63%	100%	100%	100%	31%
NSW Murray	100%	23%	61%	100%	100%	100%	100%	34%

Source: Ricegrowers' Association of Australia 2016, Appendix 4

2.2.3. Varieties

Growers supplying SunRice are not permitted to generate their own seed supply, as this could potentially compromise varietal purity, and affect logistics and marketing. Varietal management and seed supply is undertaken by the SunRice subsidiary, Rice Research Australia P/L.

² Via water markets, irrigators in these valleys can also access water allocated to Northern Victorian and South Australian irrigators, subject to these connected trading zones being open for trade.

There are currently ten varieties grown commercially for SunRice. They are a combination of older public varieties, and more recent varieties subject to plant breeders' rights, held by SunRice, NSW DPI, and AgriFutures Australia under a tripartite agreement. Recent varieties Opus, Reiziq, Sherpa, and Topaz fall into the latter category, and SunRice can exert its intellectual property rights over these varieties.

The varieties most susceptible to cold-induced sterility during microspore are generally allocated to growers delivering in the Murrumbidgee Valley, as temperatures are on average higher there than the Murray Valley.

All varieties except the Japanese variety Koshihikari (or 'Koshi') have been bred specifically for growing conditions in the temperate climate of the NSW Riverina. Medium and short grain japonica varieties are typically unsuited to tropical and sub-tropical environments. Long grain indica varieties, which are suited to tropical growing environments, have been developed by Australian plant breeders for cultivation in a temperate climate.

Funding from the Commonwealth Government's Rural R&D for Profit program has recently been made available for the industry to undertake research and development on rice growing systems in Northern Australia. Part of this work will be to develop varieties better suited to tropical environments, which may have some application to rice growing in the Northern Rivers region.

The ten varieties currently in use are as follows:

Doongara

Long grain variety marketed for its low glycemic index (GI) quality grown in the Murrumbidgee Valley. This characteristic may be subject to temperate growing conditions. It is resistant to lodging but susceptible to cold-induced sterility and straighthead.

Illabong

Arborio style medium grain variety grown in the Murray Valley. It has high yield potential, moderate establishment vigour, moderate cold stress tolerance and moderately susceptible to lodging.

Koshihikari

Short grain premium Japanese variety grown in the Murray Valley. It is highly susceptible to lodging and is lower yielding than Australian-bred varieties.

Langi

Long grain soft cooking variety grown in the Murrumbidgee Valley. It has moderate cold stress tolerance and resistance to lodging, however will shed grain if allowed to stand too long in the field.

Opus

Short grain sushi variety grown in the Murray Valley. It is high yielding albeit sometimes unpredictable, and has moderate cold stress tolerance and resistance to lodging.

Reiziq

Core medium grain variety comprising the majority of Australian production, with good market potential because of its large grain size. It is high yielding and resistant to lodging, but moderately susceptible to cold induced sterility.

Sherpa

Medium grain variety with good growing characteristics but limitations in the market. It is high yielding, has high cold stress tolerance, and is resistant to lodging.

Viand

Short season medium grain variety. This new variety can be sown later but has similar yield potential to Reiziq. This enables a more flexible cropping system. It is moderately resistant to cold induced sterility and moderately susceptible to lodging.

YRK 5

Short season, short grain sushi variety grown in the Murray Valley. It is susceptible to lodging with early nutrition application and/or when sown aerially. It is moderately cold resistant (NSW DPI 2017, pp. 2-3).

Medium grain varieties Reiziq and Sherpa comprise the bulk of Australian rice production. However, SunRice did not share detailed data on production by variety. The only information available to this review indicated that Koshi constitutes 10 000 tonnes of production to meet market demand, with 65 000 tonnes of Opus, and 4000 tonnes of low GI Doongara (SunRice 2017f, p. 11). Some of the balance comes from long grain varieties Langi and Topaz, though the overwhelming majority is Reiziq and Sherpa.

2.2.4. Agronomic practice

In the NSW Riverina, crops are planted in October and November, with harvest occurring in April and May. Rice seed is either drill sown and flush irrigated before the application of permanent water, or aerially sown into permanent water (or dry broadcast with permanent water applied immediately after). Growers also apply plant nutrients and pesticides (for weed and pest control) during the growing season to maximise yield.

Due to the hot and dry growing conditions in the Riverina, and the significant distance from other growing regions, there are few pest and disease pressures. Bloodworm, armyworm, ducks, purple swamphen and mice are the major pest challenges for Riverina rice growers.

Typical yields per hectare are around 10-11 tonnes of paddy rice per hectare, and average water use is around 12 ML per hectare. Table 5 outlines yield results for each variety.

A small amount of organic rice is grown in the Riverina, where synthetic fertilisers and pesticides are not used.

Table 5 Summary of rice yields by variety

Variety	5-year industry average yield (tonnes/ha)
Doongara	9.3
Illabong	10.5
Koshihikari	7.6
Langi	9.4
Opus	9.7
Reiziq	11.0
Sherpa	10.6
Topaz	9.0
YRK 5	7.4
YRM 70	10.6
All varieties	10.4

Source: NSW DPI 2017

2.2.5. Post farm gate handling

SunRice subsidiary Australian Grain Storage (AGS) owns and operates rice storage infrastructure with capacity for 1 million tonnes of rice, across 17 sites in the Riverina. Riverina growers deliver to these storages at harvest, where grain is dried to moisture levels where it is ready for milling.

SunRice transports dried grain to facilities at Leeton and Deniliquin for milling and packaging. There is also a mill at Coleambally, which provides surge capacity when a large Riverina crop is grown.

Rice is milled to either white or brown rice and packaged or processed into a range of value added products such as microwave rice and rice cakes.

2.3. Northern Rivers industry overview

2.3.1. Summary

A small quantity of rice is currently grown in the Northern Rivers region, using seasonal rainfall. Local sources indicate there are approximately 15 to 25 Northern Rivers growers producing rice on the coastal river floodplains in the Richmond Valley, near Lismore (Figure 2). According to RMB, only four growers produced rice there from the 2014-2016 crops.

RMB production figures suggest annual production of between approximately 200 and 1500 tonnes since 2010.

There are no rules limiting rice production in this region. However, most land on which rice can be grown in this region is currently used for cattle, sugarcane and soybean production. While water availability is not a limiting factor, its timing and quantity applied to the crop provides a production risk.

More detail about potential rice production in the Northern Rivers is included later in this report.



Source: Environment NSW

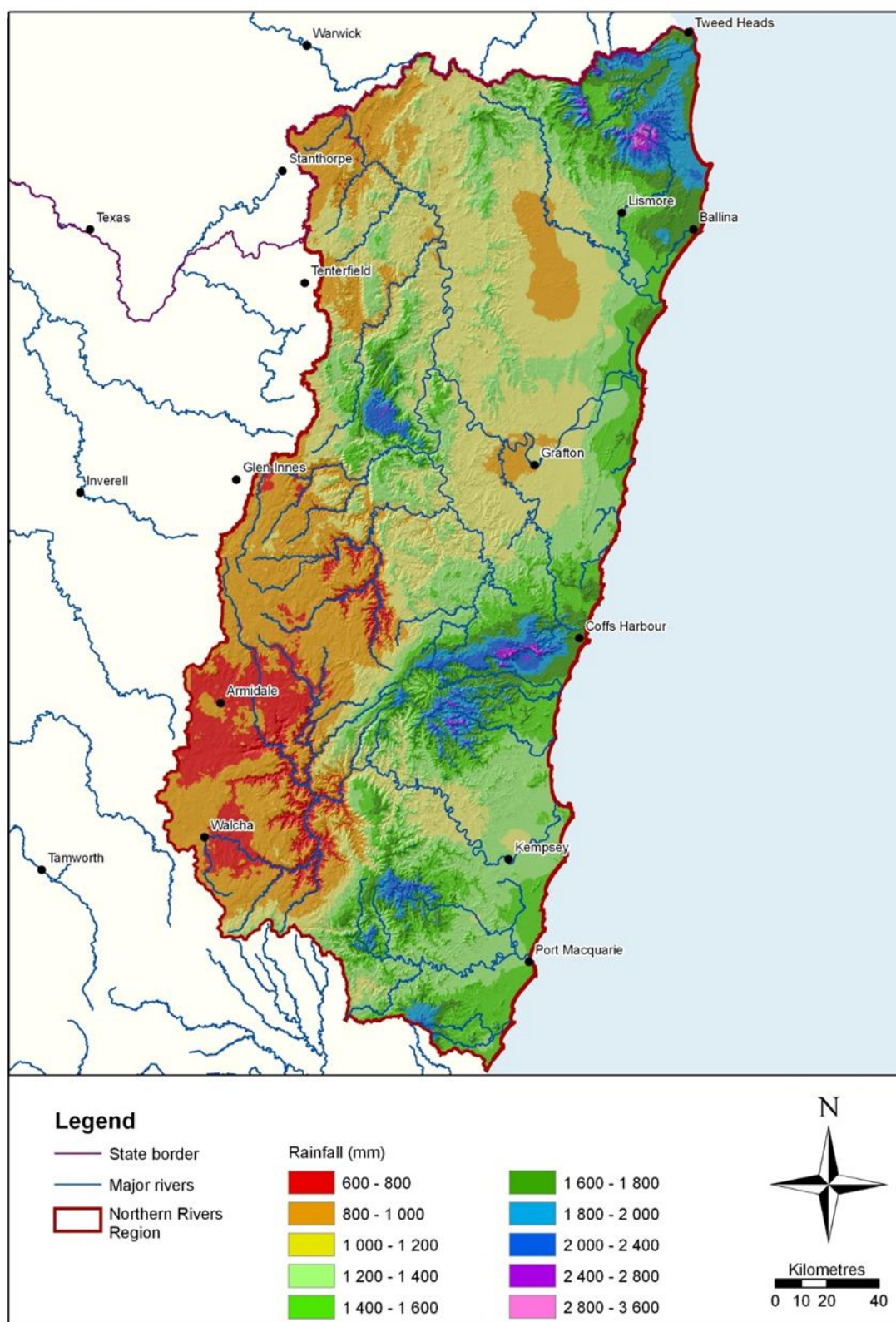
Figure 2 Map of Richmond River Catchment

2.3.2. Water sources

Rice grown in the Northern Rivers region depends on in-season summer rainfall, rather than stored water.

Annual rainfall in currently utilised growing areas typically ranges from 800 to 1200mm (Figure 3). Summer storms are the principal source of water required for plant growth. As a general rule, the further inland (westward) the lower the average rainfall becomes, with areas west of Casino typically experiencing rainfall at the lower end of the range given above.

For crops further inland, where summer rainfall reliability diminishes, there is some opportunity to supplement seasonal rainfall with irrigation. This was the subject of discussion during industry consultations, particularly after two recent difficult seasons. However, irrigated rice remains uncommon in the Northern Rivers and requires investment in infrastructure.



Source: Environment NSW

Figure 3 Annual rainfall in the Northern Rivers Region

2.3.3. Varieties

Northern Rivers growers have in recent years grown medium grain Sherpa, and long grain Langi and Doongara, which are supplied by SunRice on commercial terms. These are not considered well suited for the rain-fed growing environment of the Northern Rivers, as they have not been developed to endure water deficient conditions.

Consultation with Northern Rivers stakeholders suggested some dissatisfaction regarding the level of co-operation from SunRice in supplying seed to growers supplying alternative marketing companies.

Northern Rivers growers also grow medium grain upland rice variety Tachiminori, which is not a SunRice managed variety. This is considered the most suitable variety for the climate and production system of the Northern Rivers, as it can sustain acceptable yields better than other varieties in variable seasonal conditions.

Increased industry investment in improved tropical northern Australian varieties is currently proposed, supported by the Commonwealth Government's Rural R&D for Profit program. This initiative has been developed to support broad varietal and agronomic research needed by the fledgling North Queensland rice industry. However, breeding requirements for Queensland growers differ from Northern Rivers as their production systems are mostly different (irrigated vs. upland rice production).

Northern Rivers growers contribute very small amounts of levy funding for industry R&D, and have little opportunity to influence breeding objectives (and therefore receive less useful R&D outputs).

2.3.4. Agronomic practice

In the Northern Rivers region, cultivation practices vary from those common to the Riverina.

Rice is drill sown any time from October to mid-January, depending on rainfall and demands from other cropping operations, such as cane sowing.

Rice crops are well suited to Northern Rivers floodplains that receive high rainfall and are prone to inundation, which is often detrimental to other cropping options. Crops grown on these floodplains are, however, dependent on timely summer rainfall during key growth stages. Where this rain fails to eventuate in the quantity needed, yield is lower.

Consultation with stakeholders revealed small scale attempts at irrigated rice production in the 2017-18 season, using both flood and overhead irrigation techniques. This is mainly in the more western growing areas (e.g. west of Casino) where summer rainfall is less reliable.

The yield data from production in this region is less reliable owing to the relatively young age of the industry and 'abnormal' weather in recent years. However, crops of 8-10 tonne per hectare yield have reportedly been grown under summer rainfall in the Northern Rivers (growing Tachiminori). Consultations with growers indicated that 4-6 tonnes per hectare has been considered average yield in recent (difficult) seasons.

Conservative yield estimates have been used to quantify industry potential in following sections. Potential yields from developing varieties better suited to the Northern Rivers climate and production system are also discussed.

Rice can be incorporated within different farming system options, in rotation with other crops such as sugar cane or maize. However, growing rice is incompatible with cattle production, which is currently a major use of arable land in the Northern Rivers floodplains.

Most rice is grown conventionally, using synthetic fertiliser and pesticides, though there is one organic grower in the region. Nutrition rates and timing are still subject to experimental practice and further research is required to understand best practice management. Only one grower is currently using an organic production system, partly because farmers are growing rice with other crops such as cane and soybeans in a conventional farming system.

There is little reported disease pressure for rice in the Northern Rivers, though the potential for a rice blast outbreak is a concern.

2.3.5. Post farm gate handling

There are limited storage, drying and milling facilities available to Northern Rivers growers. Currently, growers deliver paddy for storage and drying to Mara Global at Sharnbrook.

Dried paddy is processed by Brett Slater, who also grows and markets organic rice under his Rainfed Rice Australia brand.

Northern Rivers rice is largely milled at this facility to brown rice for packaging and sale. Their milling capacity does not currently extend to polishing rice to produce white rice.

2.4. Production trends

This section provides a brief overview of production trends for both the Northern Rivers and Riverina growing areas.

2.4.1. Introduction

Table 6 encompasses long term production data from the Riverina and charts the recent establishment of a Northern Rivers industry.

This data shows a decline in overall rice production in NSW since the peak of the late 1990s and early 2000s.

Table 6 Historic NSW rice production

	MIA	CIA	Murray Valley	Northern Rivers NSW	TOTAL
2017	308,511	109,316	381,016	833	799,676
2016	152,951	39,849	51,834	603	244,787
2015	254,031	97,638	333,540	419	685,628
2014	233,760	115,466	476,647	193	826,066
2013	377,850	190,540	589,668	282	1,158,340
2012	315,868	154,431	486,201	471	956,971
2011	300,167	146,218	350,214	497	797,096
2010	109,262	45,652	49,171	1,593	205,678
2009	34,690	17,680	12,459	403	65,232

2008	6,970	5,448	6,879	-	19,297
2007	60,099	83,399	23,210	-	166,707
2006	386,238	180,811	470,508	-	1,037,557
2005	102,174	60,043	142,649	-	304,866
2004	210,376	101,489	217,119	-	528,984
2003	236,006	114,590	39,483	-	390,079
2002	478,171	211,620	551,919	-	1,241,710
2001	629,964	289,766	824,336	-	1,744,066
2000	453,883	227,819	407,063	-	1,088,765
1999	517,813	252,428	611,582	-	1,381,823
1998	504,034	262,902	554,963	-	1,321,899
1997	396,635	232,297	751,862	-	1,380,794

Source: RMB statistical summary

2.4.2. Riverina

Since the turn of the century, NSW Riverina rice production on average declined and became more variable.

Through water reform over the past 20 years, land and water titles in the Murray Darling Basin have been uncoupled, meaning water entitlements are no longer attached to a specific parcel of land. A consequence is that water is more easily tradeable to alternative uses within the connected waterways of the Southern Basin. High value horticulture crops, cotton and winter cereals now use proportionally more of the available water in the southern connected system. The mobility of water entitlement and seasonal allocation has enabled traditional rice growers to divest their assets or sell on the annual allocation market where other irrigators have a higher per ML threshold for cropping profitability.

Compounding this change has been the overall reduction in entitlement available for irrigation due to Murray Darling Basin Plan water reform. Aither analysis indicates that the effect of this water entitlement shift has increased annual allocation prices by 12-14 per cent (Aither 2016, p. 22). As a higher water use crop, rice growers are sensitive to reductions in allocation against entitlement and increases in annual water market prices.

The years since 2002 have also been characterised by more natural climatic variability, including drought, which has reduced water available for NSW Government to allocate to the state's irrigators.

2.4.3. Northern Rivers

According to RMB statistics, small quantities of rice have been grown in the Northern Rivers since 2009. Although production has been on an increasing trend recently, reported production has been below 1000 tonnes per year, which represents less than 0.2 per cent of the total average Australian rice crop.

During the review consultation process, industry sources reported 900 hectares contracted for rice in the Northern Rivers for the 2017-18 season. Assuming modest four tonne per hectare yields during a difficult growing season, expectations are that 3600 tonnes will be produced in the region this year.

The possibility exists that some historic rice production in the Northern Rivers has not been reported to RMB. However, any potential underreporting does not alter the area's production being low relative to the overall industry. Even under a potential scenario of 5000 tonne annual production, this would still represent less than one per cent of total industry production.

Following sections of this report will analyse the potential factors driving this low production volume, and opportunities for greater scale in the Northern Rivers.

2.4.4. North-west NSW

Apart from occasional production in the Lachlan Valley, no rice is currently grown in the irrigation areas of the northern Murray-Darling Basin (Northern Basin).

Irrigators in the Jemalong Irrigation District near Forbes, NSW, have at times of high water availability produced rice in small quantities, delivered to SunRice's Riverina storages. Expansion prospects for this area are touched on briefly in the following section.

Historically, rice has not been grown in Northern Basin catchments.

2.4.5. Queensland

Although not in NSW, the re-emergence of a North Queensland rice industry since 2008 is relevant to overall industry production trends.

Queensland growers are not subject to export restrictions, but the industry has struggled to gain a major foothold there.

In 2014, SunRice purchased the assets of Queensland rice processor and marketer Blue Ribbon Seeds and has been developing market opportunities for varieties suited to the tropical North Queensland environment. Prior to SunRice's acquisition of Blue Ribbon, rice from their production areas was sold domestically as well as for export.

No official data for SunRice's Queensland production and processing was made available to this review. However, annual production is estimated at below 20 000 tonnes. The majority of growers are in the Burdekin region, though there are also growers around Mackay and Tully. Impediments to growth include competition with sugarcane, Riverina varieties being unsuited to the tropical north, poor understanding of best practice rice agronomy there (especially in the wet season), and the additional management effort required to grow rice.

Long grain variety Doongara has performed best in commercial production in the Burdekin region.

2.5. Trade environment

2.5.1. Global production and trade

Annual global paddy rice production is around 750 million metric tonnes (FAO 2017).

However, despite enormous global production, rice is a thinly traded commodity internationally. As a staple food in many countries, rice is a politically sensitive crop and most global production is retained internally to maintain domestic food supply certainty. The USDA estimates that only around 45 million tonnes of rice are traded internationally each year. Largest exporters are India (11.6 million tonnes) Thailand (10.2 million tonnes) and Vietnam (6.5 million tonnes) (US Department of Agriculture 2017).

The principles of free trade and fair market competition do not apply in global rice markets. Much of the trade that does occur is between single government buyers and sellers. Export and import bans exist in many countries, as do subsidies and production schemes. With relatively few net exporting countries, changes to government policy in response to domestic supply and price concerns can disrupt global trade significantly.

Low volumes of global trade and the absence of a material futures market hinders price transparency, with limited public information about price and market transparency relative to other soft commodities.

In the medium grain market, in which the Australian rice industry exports most of production, few other countries are active exporters. Australia's major competitor is rice grown in California, which produces on average 2 million tonnes of paddy rice, of which approximately half is exported.

2.5.2. Current destination markets

SunRice

For commercial-in-confidence reasons, SunRice was unwilling to provide detailed production and market information to this review.

However, SunRice has indicated to growers and shareholders that it has market demand for more than one million tonnes of paddy rice marketed under the SunRice brand (SunRice 2017f). This includes destination export markets across 50 countries in Asia, Middle East and the Pacific region.

Despite strengthening demand for Australian rice, limited available water supply and increased water market competition prevent Riverina growers from producing the million tonnes buyers are seeking. Consequently, SunRice has embarked on a strategy of sourcing paddy from overseas to supply lower paying international markets and provide flex for dips in Australian production. Of the 500 000 tonnes sourced from overseas in 2016-17, 320 000 tonnes were from Vietnam and 115 000 tonnes from their Californian based subsidiary, SunFoods (SunRice 2017c)

To maintain local production for key premium markets, and to ensure local storage and processing infrastructure is used efficiently, the Riverina paddy price needs to keep increasing to compete with higher value horticulture and cotton options.

To raise prices to suppliers, SunRice has indicated an intention to focus Riverina production on higher value niche and premium varieties. This includes:

- medium grain to discerning markets
- sushi rice into the expanding Asian food service sector
- low GI rice into health-conscious markets (SunRice 2017d).

There is substantial variation between SunRice's most lucrative markets and its low returning markets. The figure below demonstrates the significant price premium for Koshi and low GI varieties.



Source: SunRice 2017b, p.17

Figure 4 Market premium and discount index

SunRice has expressed optimism about the price outlook for medium grain rice and considers the Riverina industry well placed climatically to meet increasing demand for short grain rice. However, these opportunities to expand market opportunities for higher value niche varieties remain to be more fully exploited and matched by grower willingness to shift their varietal selection.

A useful case study of niche market opportunities is Randall Organic Rice, which grows, mills and packages organic rice products from the Randall family farm at Murrumbidgee in the NSW Riverina. Their products include organic brown or white long and short grain rice, brown rice cakes, and brown or white rice flour. Products are sold online and through limited other retail channels, with the price of 1kg bags of rice available for between \$9-12, depending on the variety.

This rice marketing business also does not have access to export markets, relying on domestic marketing for rice under its own brand. In this regard, and assuming commercial viability for Randall Organic Rice, the business serves as an example of potential success without export market access. However, it should be acknowledged that their proximity to SunRice receival and processing infrastructure does enable access to export markets in their niche category, albeit via another company brand.

Northern Rivers production

Under current single desk arrangements, Northern Rivers growers cannot access export markets.

The Natural Rice Co Pty Ltd buys most rice produced in the area and markets it through domestic retail channels.

2.6. Grower remuneration

2.6.1. Riverina

SunRice uses a pool system to manage and market crop receivables and distribute payments to growers for their paddy. The final price paid for paddy rice delivered to the pool is calculated when the season's crop has been fully processed, packaged, and marketed. As the pool is run on a revenue neutral basis for the benefit of growers, the paddy price represents the revenue left after the cost of storage, processing and marketing have been accounted for.

As a grower owned company, this ensures that those who supply rice to the pool capture the benefits of marketing the crop. It also provides a mechanism to equitably satisfy the buyer of last resort obligation applied to SunRice as the SEEL holder.

Indications about crop pricing generally commence after planting, with growers receiving updated indicative prices (provided as a price range) as the crop size and market conditions become clearer.

For example, on 27 October 2017, SunRice advised growers that the likely price range for the crop harvested in autumn 2017 would be \$335-\$365 per tonne (Reiziq medium grain). The range was further revised to \$350-365 on 27 February 2018. This was an increase on the first indicative range of \$300-\$320 provided in June 2017 (SunRice 2017e, p. 1).

The final price will be announced in June 2018 and paid to growers in July 2018.

Table 7 illustrates the estimated payment schedule for SunRice suppliers, provided in October 2017 for the crop harvested in autumn 2017. These are estimates and will alter between their release in October 2017 and the final payment in July 2018.

Table 7 Crop 2017 pool payment schedule (\$/tonne)

	Reiziq/ YRM 70	Sherpa	Langi	Opus/ YRK 5	Illabong	Topaz	Koshi	Organ ic premi um	Bio- dynamic premium
1st payment	180	168	213	192	180	252	258	100	100
2nd (24/10/17)	56	53	61	58	56	70	70	50	50
Supplem entary payment	15	15	15	15	15	15	15		
3rd (27/2/18)	37	35	41	38	37	45	46	50	50
4th (24/4/18)	24	23	29	26	24	34	34	35	35
5th (22/5/18)	15	14	18	16	15	21	21	40	40
6th (24/7/18)	23	22	28	25	23	33	33	-	-
TOTAL	350	330	405	370	350	470	480	275	275

Source: SunRice 2017b

SunRice has newly introduced payment terms for the 2018 crop. Twelve instalments to suppliers will be made across the life of the pool, with the first payment paid 61 days from the end of the month of harvest delivery. For those who opt in, growers can also choose flexible payment terms under a new payment facility called 'PayRice' (SunRice 2017e).

Historic prices the pool has paid to growers are included in Table 8.

Table 8 Historic paddy prices paid to SunRice suppliers

Crop year	2017	2016	2015	2014	2013	2012	2011
Medium grain (Reiziq) pool price (\$/tonne)	\$350- \$365	\$415	\$404	\$395	\$294	\$317	\$255

Source: SunRice 2017d

While limited in their capacity to provide specific price indications, prior to crop planting SunRice is increasingly providing growers with guidance about price dynamics. In August 2017, SunRice announced fixed price contracts of \$360 per tonne for an undisclosed quantity of medium grain Reiziq (SunRice 2017b)

In recent years, SunRice has instigated alternative, contract-based, supply agreements with growers to stabilise supply during reduced water availability.

In response to impending low water allocations for the 2016 crop, in October 2015 SunRice offered all growers fixed price contracts of \$415 per tonne of production (medium grain Reiziq). This was intended to give growers confidence to enter water markets and secure their needs prior to planting and water authority allocation announcements. The shareholder-owned profit side of the SunRice business provided the pool with \$32.5 million to cover the shortfall associated with this price commitment (SunRice 2017f).

A fixed price offering was also made available in May 2016 for the 2017 crop, with growers offered the opportunity to contract an undisclosed quantity of their production at \$400 per tonne (SunRice 2017d). As outlined above, indicative pool prices for the 2017 crop are currently \$350-\$365 per tonne (medium grain Reiziq).

In an update to growers on 9 October 2017, the company stated:

In response to the new strategic move to expand production of niche and premium varieties and ... increasing risk management options to growers, a new range of fixed price options and pool varietal premiums ... opened to growers on 6 September (SunRice 2017d).

The focus of fixed price contracts is on securing supply for niche premium varieties, as outlined in Table 9.

Table 9 Fixed price contracts for 2018 crop (\$/tonne)

Crop	Fixed price contracts (\$/tonne)
Koshihikari	520
Doongara	450
Opus	380
YRK5	450
Reiziq	360
Organic/biodynamic	750

Source: SunRice Grower Services

These arrangements apply only to growers in the NSW Riverina and those from Northern Victoria who choose to supply SunRice. They are available for undisclosed quantities.

As described above, SunRice and the Riverina rice industry broadly claim that the single desk marketing arrangement provides a paddy price premium to grower suppliers. Analysis by Grant Thornton Australia Ltd on behalf of RMB has estimated significant benefits to growers over the past four years (Table 10). This review makes no assessment as to the accuracy of these estimates.

Table 10 Price premium and freight scale advantage from vesting

Year	Price premium (per tonne)	Price premium (total)	Freight scale advantage (per tonne)	Freight scale advantage (total)
2016-17	\$108	\$26.4m	\$10.05	\$2.45m
2015-16	\$102	\$70.66m	\$13.33	\$9.24m
2014-15	\$99	\$82.41m	N/A	\$14.32m
2013-14	\$82	\$95.2m	N/A	\$18.49m

Source: Rice Marketing Board, 4th and 6th Annual Report to NSW Rice Growers

2.6.2. Northern Rivers

Northern Rivers growers have opted not to deliver into the SunRice pool, as it is uneconomic to do so. Freight from the Northern Rivers to the Riverina costs approximately \$200 per tonne, and delivery needs to occur within fifteen hours from harvest to prevent grain spoilage. Cost aside, this is itself logistically difficult given the distance from Lismore to Griffith and SunRice (AGS) receival facilities not being open 24 hours a day.

All arrangements with grower suppliers in the Northern Rivers are fixed price contracts. The Natural Rice Co Pty Ltd contracts growers for \$400 per tonne for a set production area. This year, 900 hectares were contracted with an aim of 4000 tonnes, which is unlikely to be met due to difficult seasonal conditions.

3. Preliminary analysis of potential areas of expansion

The first of the review's terms of reference is to *identify options for expanding the NSW rice industry to regions outside of the Murray and Riverina, including Northern NSW*. This is addressed in the following sections.

Based on a desktop review into where growing rice is technically feasible, the following possible expansion areas for rice cultivation in NSW were identified:

1. rice grown under seasonal rainfall on coastal river floodplains in the Northern Rivers region of NSW, and
2. rice grown under irrigation on irrigated farms in the northern region of the Murray-Darling Basin (Northern Basin).

Aither consulted with stakeholders from both regions to undertake a preliminary assessment of the nature and extent of expansion opportunities for the rice industry, considering a wide range of possible impediments.

3.1. Northern Rivers

In February 2018, Aither consulted with the following Northern Rivers rice industry stakeholders:

- Terry Rose (SCU researcher)
- Steve Rogers (technical expert and grower)
- Nelson Green (owner of Natural Rice Co Pty Ltd - purchaser and marketer)
- Brett Slater (organic grower and miller)
- Northern Rivers growers (at a workshop held with six local growers).

Discussion with stakeholders covered challenges and opportunities relating to: suitable arable land; suitable rice varieties; crop agronomy; seasonal risk management; research, development and extension; processing infrastructure; and product marketing.

3.1.1. Suitable land for rice production

The availability of land suitable for rice cultivation is not an impediment to a rice industry in the Northern Rivers region. Tens of thousands of hectares of coastal river floodplain in the Richmond, Clarence and Tweed valleys – currently used for sugarcane, beef and soybean production – could be used for rice production. This was supported by multiple sources.

3.1.2. Varietal suitability

One of the main challenges for Northern Rivers growers is insufficient rainfall in January and February to provide moisture for the crop at key growth stages.

The short-rooted varieties developed for Riverina conditions provide little drought resistance in the Northern Rivers environment, as they cannot penetrate deep enough to reach subsoil moisture prevalent in river floodplain country. Japanese variety Tachiminori has deeper roots and provides better insurance against 'drought' conditions through the growing season.

A successful Northern Rivers variety also needs to be resilient to the opposite problem: the possibility of prolonged inundation from the major flooding that can occur in these valleys. Major autumn rainfall in the reproductive growth phase can affect yield and grain quality significantly if the crop remains submerged for a lengthy period. Autumn rain can also impair harvest until floods recede and the land is trafficable.

The other varietal challenge is limiting risk of cold events during microspore, which causes sterility and affects yield. There are trade-offs in timing to avoid various weather risk events that need to be understood for different varieties.

Currently, Riverina varieties are unsuited to these upland growing conditions. Better understanding of the timing of crop planting, to mitigate weather risk by variety, would generate yield benefits and attract additional growers.

Southern Cross University research agronomist Terry Rose is conducting agronomic research into rice cultivation in the Northern Rivers, including experimenting with some new breeding lines better suited to the extremes of water availability in the Northern Rivers' upland growing environment. He works with limited funding support.

Terry indicated that potential yield under average conditions could increase by 1 to 1.5 tonnes per hectare with better suited varieties and could improve resilience in suboptimal years.

3.1.3. Crop nutrition

Another challenge is understanding the optimal rate and timing for crop nutrition. While Riverina irrigators will favour mostly up-front fertiliser application (for most varieties), this may cause problems with yield and crop lodging in these growing conditions.

Growers are currently making decisions without sufficient information about effective crop nutrition management practices.

3.1.4. Rice cultivation knowledge

Steve Rogers formerly worked with Blue Ribbon and SunRice in the Burdekin region in North Queensland. He is growing rice under contract and assisting other growers with technical agronomic and crop management information.

Southern Cross University research agronomist Terry Rose is also conducting agronomic research into rice cultivation in the area, in conjunction with Steve Rogers and other local growers. He undertakes trial work within commercial crops and engages with growers in a quasi-extension role as part of his research work.

In consultations growers indicated that rice presents an easier management task than crops such as soybeans and corn.

3.1.5. Infrastructure

There is little storage, drying, milling and processing infrastructure in the region and what exists is geographically disparate and not co-ordinated at an industry level. This creates the dilemma common to fledgling food industries: how to satisfy market opportunities without needing to invest in infrastructure prior to these opportunities being available?

Currently, there is capacity to comfortably handle production of 5000 tonnes of paddy rice per annum, with the potential to increase up to 8,000-10,000 (e.g. if the mill were to operate non-stop). This will hamper market opportunities until there is further investment in downstream processing infrastructure.

However, although extensive infrastructure to handle rice post farm gate does not exist, the options available are appealing to growers when compared with other cropping alternatives. For example, summer corn requires on farm storage facilities that many farmers do not have and are not prepared to invest in. Rice provides a cropping option where production can be delivered to an external site and handled by a third party. Growers have been enabled to include a cereal in their rotation with minimal barriers to entry.

3.1.6. Market opportunities

Northern Rivers growers have to date focussed on producing brown rice, while emphasising the environmental sustainability of growing their product without irrigation. The review has not assumed that export opportunities would be limited to marketing brown rice, as the current industry strategy reflects.

Domestic sales include supply to Australian retail grocery outlets. These arrangements were not outlined in detail for commercial-in-confidence reasons.

Consultations with industry stakeholders did not yield strong evidence regarding the presence or absence of long term export prospects. Evidence was not forthcoming as it was considered commercial-in-confidence, however industry stakeholders suggested that there were contacts and markets for export that they would access if the regulatory restrictions were not in place. They suggested that export opportunities would be more niche and small scale than those currently serviced by large suppliers like SunRice. It is not possible to speculate on or validate the veracity of these claims.

There are a range of challenges associated with agricultural exporting that a viable Northern Rivers industry would need to address.

In particular, production quantity and quality need to as closely as possible match export consumer market demand. This can be challenging in the context of variable planting area and yield between seasons, or where grain quality within a season is poor and millout yield fails to meet planned sales. The scale of market demand can also prove a challenge, where the retail supply chain is dependent on volumes greater than can be supplied by a particular grower body and their processor and marketer.

However, these challenges would not be unique to any potential Northern Rivers industry permitted to market rice under their own brand. Selling branded rice into retail markets requires processors and marketers to either stabilise production across seasons, supplement low production seasons with supply from other production sources, or secure a conservative market presence and find other opportunistic markets when favourable seasonal conditions permit.

SunRice currently manages significant production variability and attendant marketing risk through several strategies. Where practical, production from strong seasons will be held over to subsequent

seasons to smooth out variability and maintain reliable supply to key premium markets. Where production in any given season is poor, supply is sourced from overseas producers to supplement Australian production, in markets where price sensitivity to this approach is low.

For the purposes of this review, we recognise that production variability is a significant challenge when seeking to establish a long-term presence in branded markets. However, it would not be appropriate to assume that a Northern Rivers industry would not also be capable of successfully applying similar risk management strategies.

3.1.7. Regulatory barriers

There does not appear to be any current environmental regulations or other local planning impediments to the expansion of rice production in the Northern Rivers. In an environment characterised by high rainfall and potentially uncontrolled runoff, growers will need to adopt best practice fertiliser and chemical application techniques to minimise runoff into downstream waterways and estuaries. However, environmental risks associated with rice cultivation do not present a greater risk than other cropping options such as cane or soybean production.

There is also no evidence that an application to develop larger processing facilities in the region would face significant planning hurdles, subject to usual, development application, environmental impact statement, and other processes being fulfilled.

3.1.8. Preliminary assessment of opportunities for expansion

Aither's preliminary assessment based on consultations indicated that while there are challenges, several of the conditions required for the Northern Rivers rice industry to expand are present. In particular, there is sufficient land available suitable for rice growing, rice has management benefits over alternative cropping options, growers are receiving professional advice, and growers have harvested high yielding crops with no water costs when seasonal conditions have been favourable.

However, a practical pathway to industry expansion is required, which will need to encapsulate three interrelated elements:

1. establishing new market opportunities
2. financing and constructing processing infrastructure
3. improving varietal performance and agronomic knowledge.

Before the investment necessary for building processing infrastructure and undertaking plant science research and development, a business case based on consumer demand for Northern Rivers rice needs to be established. This includes expanding the industry's footprint in the domestic market, as well as establishing firm export opportunities that could generate sales revenue if regulatory constraints were lifted.

Although export markets are not practically accessible under current regulatory arrangements, it will be difficult to either make the case for regulatory change, or attract investment for expansion, without a comprehensive understanding of export market opportunities. The extent to which accessing export markets is the determining factor of viable industry expansion is discussed in the following section.

Subject to a business case being established, the industry will need to attract finance for the construction of new storage, milling and packaging facilities to handle production at larger scales. This

finance may come from a range of sources, including private investors, retained profits from an existing processor, bank debt, and/or grower capital.

The industry will need to determine the most appropriate location for these facilities to maximise logistical efficiency and build to a scale to account for future industry growth, but not overcapitalise relative to need, thereby generating excessive business overheads per tonne of production. This assessment will be informed by market demand and grower willingness to produce at different prices along the supply curve.

Lastly, investment will be required to provide improved agronomic and varietal support to growers, in order to underpin sustainable production levels. Current needs include access to new varieties better able to withstand seasonal rainfall variability, and agronomic knowledge to support more effective risk management and consistent yields in the upland growing environment.

The economic analysis of these issues and a viable scale for the industry is considered in more detail and rigour in Chapter 4.

3.2. Northern Basin

In February 2018, Aither undertook brief telephone consultations with the following Northern Basin stakeholders in these regions:

- David Trodahl, NSW DPI Rice Agronomist, Yanco
- Grant Tranter, Executive Officer, Macquarie Rivers Food and Fibre,
- Neil Toole, Manager, Jemalong Irrigation Limited
- Louise Gall, Project Office, Gwydir Valley Irrigators Association
- Namoi Valley Water – did not return Aither’s call.

In the Northern Basin, summer rainfall contributes to water supply for summer cropping, which is predominantly cotton. In most parts of the Northern Basin, annual rainfall is between 400 and 600mm, slightly higher than the rice growing areas of the Riverina, and more likely to occur in the summer. This is not sufficient for rice production, however. There are several catchment areas within the Northern Basin that have access to water for irrigated summer cropping, including the Lachlan, Macquarie, Namoi and Gwydir (Figure 5).

Occasional rice growers in the Jemalong Irrigation District have demonstrated the potential for rice crops under irrigation north of the Riverina. However, other irrigated areas of the northern region of the Murray-Darling Basin (Northern Basin) have not produced commercial rice crops.

Stakeholders said that the chance of rice industry expansion was very low. This sentiment was exemplified by one stakeholder who stated that:

Not even with a belly full of schooners have I heard a farmer talk about growing rice up here.

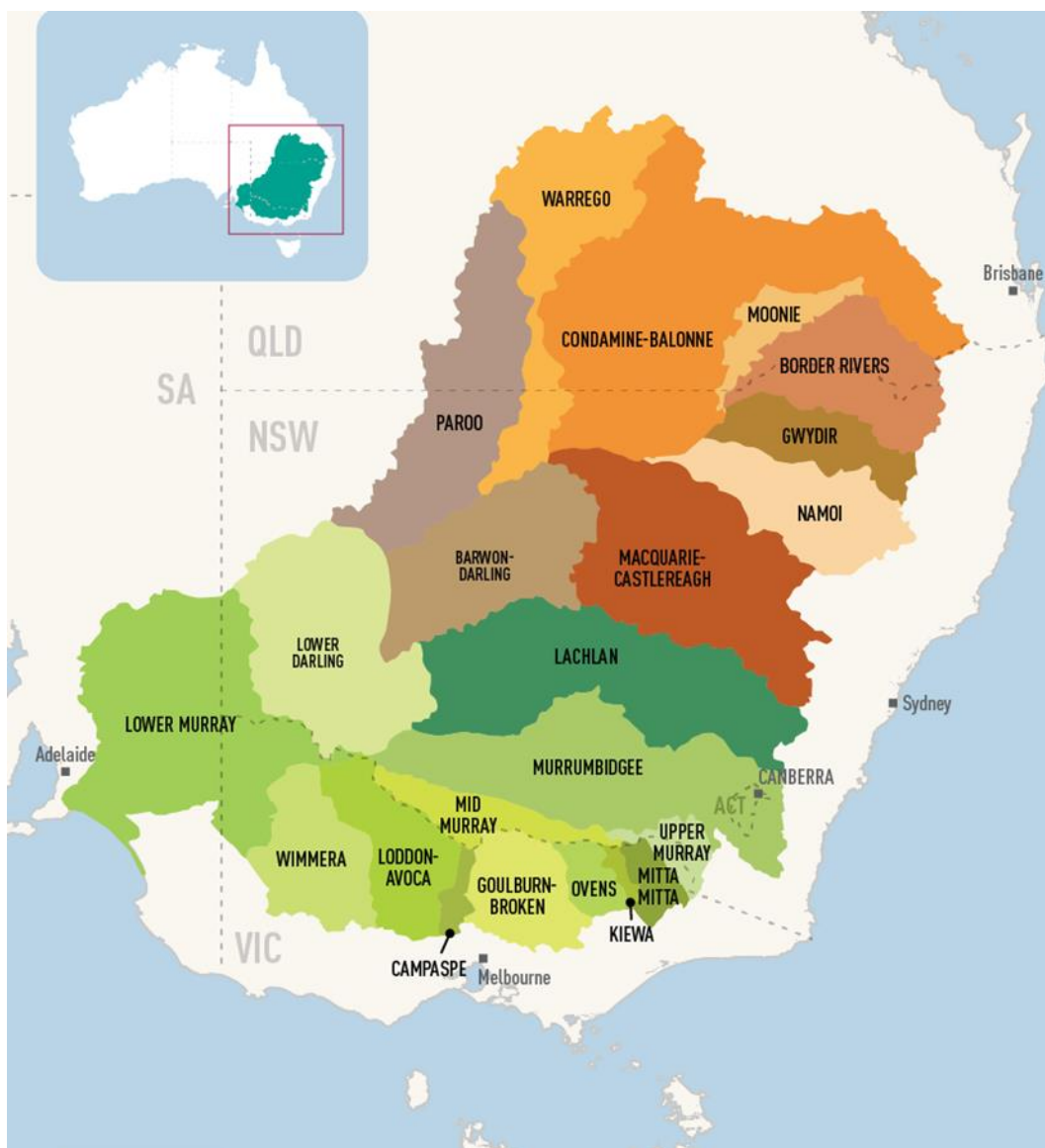
The reasons identified for rice being unlikely to be grown include:

- little historical presence or understanding of rice cultivation
- cotton growing in these areas being profitable
- variability of surface water availability

- reliance on unsuitable groundwater in many areas
- absence of rice storage and processing infrastructure
- inappropriate soils for rice
- high temporary water prices.

In terms of high temporary water prices, annual water market prices have predominantly been in the \$200 to \$300 per ML range in recent years in these valleys. Setting aside agronomic and infrastructure impediments, this cost input remaining at these levels would render rice growing uneconomic in the Northern Basin.

Appendix B explores these water constraints further considering surface water entitlement, their annual reliability, and annual water market prices. Groundwater entitlements are not included in this analysis. Using groundwater for rice is problematic, unless it is of very high quality, as rice varieties grown in Australia are susceptible to salt.



Source: Murray Darling Basin Authority

Figure 5 Map of the Murray-Darling Basin

3.2.1. Preliminary assessment of opportunities for expansion

Aither's preliminary assessment based on the consultations indicated that the conditions required for expansion of the rice industry in the Northern Basin are not present. Therefore, no further analysis has been undertaken.

4. Agronomic and economic analysis

The following section contains more detailed agronomic and economic analysis of the Northern Rivers expansion prospects and addresses the review's second term of reference which focuses on analysing current and future productive capacities of the Northern Rivers industry.

The **optimistic future** is that rice is profitable throughout the supply chain. The industry grows over time in response to these profit opportunities. As the size of the industry increases, the average costs of processing and marketing decrease. It also becomes viable to invest in the development of new varieties that improve average yields. This spurs further growth, and a large and viable industry develops.

The **pessimistic future** is that rice is unprofitable across parts of the supply chain. The Natural Rice Co Pty Ltd leaves the Northern Rivers, and the industry returns to its previous size, with a handful of growers. In addition, there are many possible futures between the optimistic and pessimistic extremes.

While it is impossible to predict the future of the Northern Rivers rice industry with certainty, it is possible to assess the likelihood of different futures by drawing on the best theory and evidence.

4.1. Conceptual model

The fundamental principle underpinning the conceptual model is that nobody is compelled to contribute towards the development of the Northern Rivers rice industry. For the industry to grow, it will need to be in the mutual interests of those involved. Farmers will have to want to grow rice, and downstream participants will have to want to perform the tasks required to take that rice to market (including storage, milling, marketing, and transport).

The conceptual model describes these related interests and their implications for the Northern Rivers rice industry. It is structured as follows:

- The first part considers how farmers in the Northern Rivers decide what area of land to allocate to growing rice.
- The second part shows the relationship between the price offered to growers and the aggregate quantity of rice supplied in the Northern Rivers.
- The third part explores how downstream participants in the Northern Rivers decide what quantity of rice sell, and hence what price they need to offer growers. The Northern Rivers rice industry will only be viable if downstream participants can make a profit.

4.1.1. How much land to dedicate to growing rice

Farmers in the Northern Rivers have a number of agricultural activities available to them. At the same time, farmers have a limited amount of land available. A challenge is to work out how much land to commit to different activities, including rice.

Gross margin budgets

The simplest approach is to use gross margin budgets. This involves calculating the income per hectare by multiplying yield with price. Total variable costs per hectare are then calculated by summing the variable costs per hectare associated with sowing, fertiliser and application, herbicide and application, insecticide and application, harvesting, levies and insurance. The gross margin per hectare is the difference between income per hectare and total variable costs per hectare. Under this approach, land might be allocated to the activity with the highest gross margin per hectare.

Gross margin per hectare can vary markedly from paddock to paddock based on factors such as available plant moisture, management expertise and cold induced sterility at microspore.

Other benefits and costs

There are a number of benefits and costs that are not captured in gross margin budgets but nevertheless influence decision making. For example, farmers often have a preference for some activities over others. Hence, some farmers may choose enjoyable activities that have low gross margins over unpleasant activities that have high gross margins. Gross margin budgets also do not account for the costs of transitioning between activities. In some cases, farmers may choose to continue activities with low gross margins rather than make significant investments in transitioning towards activities with high gross margins.

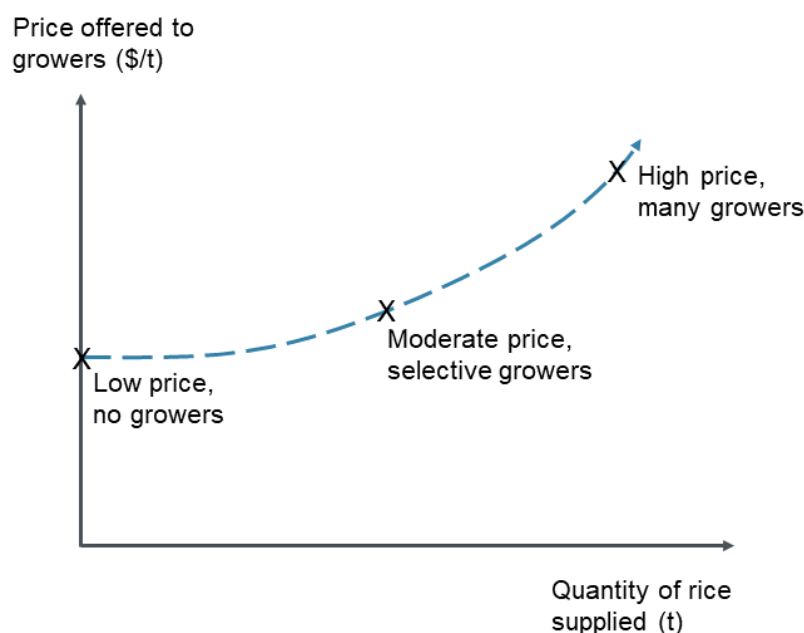
Risk

Gross margin budgets do not explicitly consider risk either. The risk associated with yield is an extremely important in the Northern Rivers. Most farmers in the Northern Rivers do not irrigate, and so the absence of rainfall at important times can negatively affect yields, especially in higher paddocks. At the other extreme, flooding associated with excessive rainfall can also negatively affect yields, particularly in lower paddocks. Farmers tend to choose the activities that offer the most attractive combination of risk and return. Hence, some farmers may choose low risk activities with low gross margins over high risk activities with high gross margins.

4.1.2. Aggregate quantity of rice supplied in the Northern Rivers

The discussion above provides a conceptual framework for understanding farm level decisions regarding the allocation of land to different activities. These individual decisions have important implications for the industry in aggregate. All else equal, the more land individual farmers allocate to growing rice, the greater the aggregate quantity of rice supplied in the Northern Rivers.

The price offered to growers for rice is an important determinant of the quantity of rice supplied in the Northern Rivers. Figure 6 shows a hypothetical relationship between price and aggregate quantity.



Source: Aither.

Figure 6 Hypothetical supply curve for the Northern Rivers rice industry

Low price, no growers – Below a threshold price, the perceived net benefits from rice will be less than other activities for all farmers, and no rice will be grown.

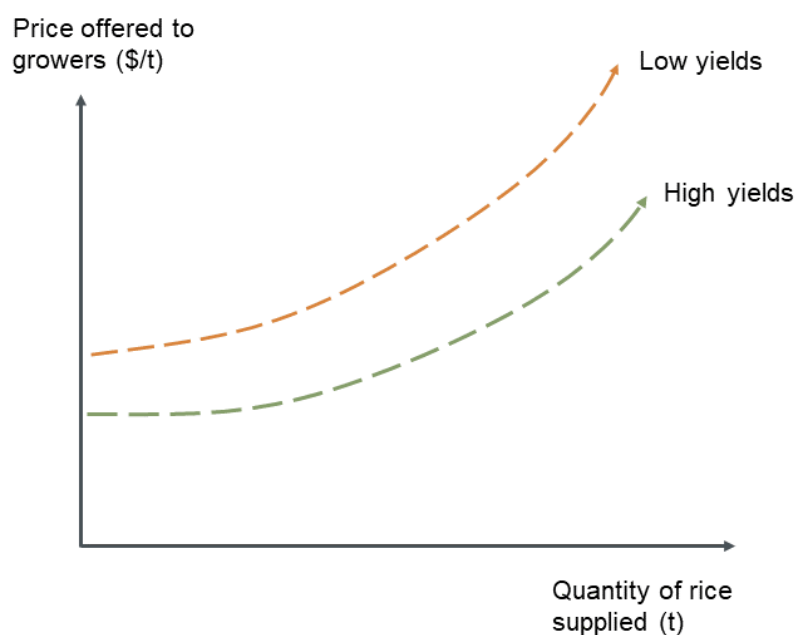
Moderate price, limited growers – As the price increases, the calculations change. Initially, some farmers would start to grow rice in a few paddocks. Based on the conceptual framework outlined above, this limited group of growers are likely to share the following characteristics:

- have paddocks with favourable climates and soils that flood frequently (such that rice is preferred to soybeans in rotations) but not too frequently (such that rice is preferred to beef cattle),
- have a preference for cropping over livestock, and be able to use their existing machinery to grow rice, and
- (potentially) be exposed to significant financial risks from floods, and willing to accept lower returns to reduce these risks by growing rice.

High price, many growers – As the price increases further, the calculations change again. Existing growers will find it profitable to increase the area of rice planted. For example, expanding into paddocks that were previously more profitable in beef cattle. The number of growers would also increase, as would their diversity of characteristics. For example, because of the high relative profitability of rice, even farmers with a preference for livestock might start growing rice (or sell or lease their land to people who would).

Other factors

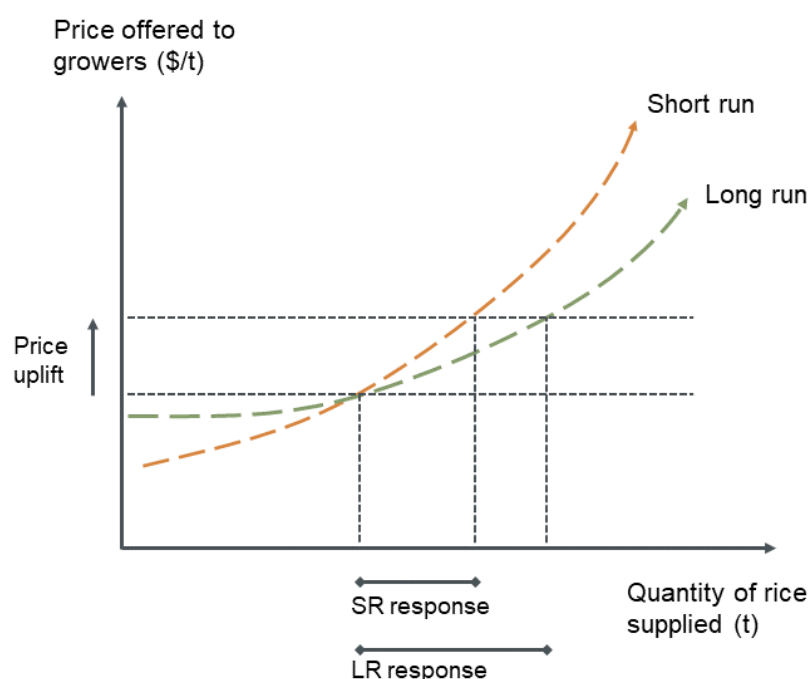
A number of other factors are also relevant determinants of the quantity of rice supplied in the Northern Rivers. For example, an improvement in rice yields increases the net benefits from rice, resulting in more land being allocated to rice. It also means that more rice is produced per hectare of rice grown. As a consequence, the quantity of rice supplied is higher at any price (Figure 7). Supply is also affected by the costs of growing rice and the gross margins of alternative activities.



Source: Aither.

Figure 7 Effect of rice yield on hypothetical supply curve for the Northern Rivers rice industry

The time frame is also important. For example, the short run response to an increase in the price offered to growers could be more limited than the long run response (Figure 8). This is partly because some farmers accumulate physical capital (such as machines) and human capital (such as skills) in other activities that are not directly transferable to growing rice. This increases the profitability of other activities relative to growing rice. Over time, these sources of capital depreciate, and it may become worth transitioning to rice.



Source: Aither.

Figure 8 Effect of time frame on hypothetical supply curve for the Northern Rivers rice industry

4.1.3. What quantity of rice to sell

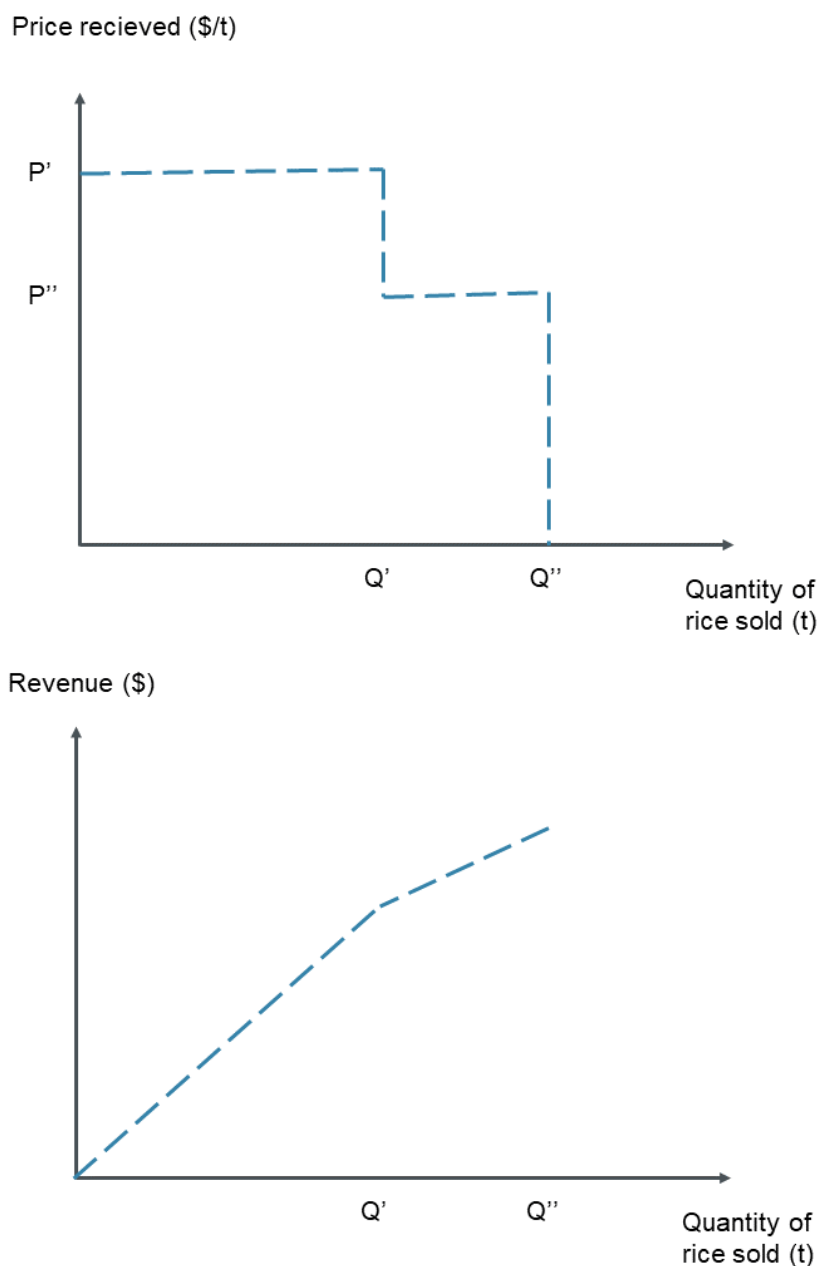
The previous discussion relates to farm level decisions and their implications for the aggregate quantity of rice supplied in the Northern Rivers at different prices. This constrains downstream participants – to incentivise growers to supply rice, downstream participants must offer a sufficient price. Hence, as discussed below, the supply curve for the Northern Rivers rice industry has important implications for the costs and behaviour of downstream participants.

In this analysis, we assume for simplicity that there is a single major downstream business who undertakes or contracts for all downstream activities, including storage, milling, marketing and transportation. We assume that the downstream business is seeking to maximise their profits, although like farmers they may have other objectives.

A challenge is to work out what quantity of rice to sell. This depends on how different quantities affect the components of profit – revenues and costs – for the downstream business.

Revenue

The demand curve shows the relationship between quantity and price received (Figure 9). In the hypothetical example, some opportunities are more lucrative than others and there are practical limits on quantity that can be sold, although these characteristics are not universal. The downstream business is able to sell Q' tonnes of rice for P' dollars per tonne. They are also able to sell $Q'' - Q'$ tonnes of rice for P'' dollars per tonne. They are unable to sell additional rice beyond that. The demand curve can also be used as a basis for deriving the relationship between quantity and total revenue.



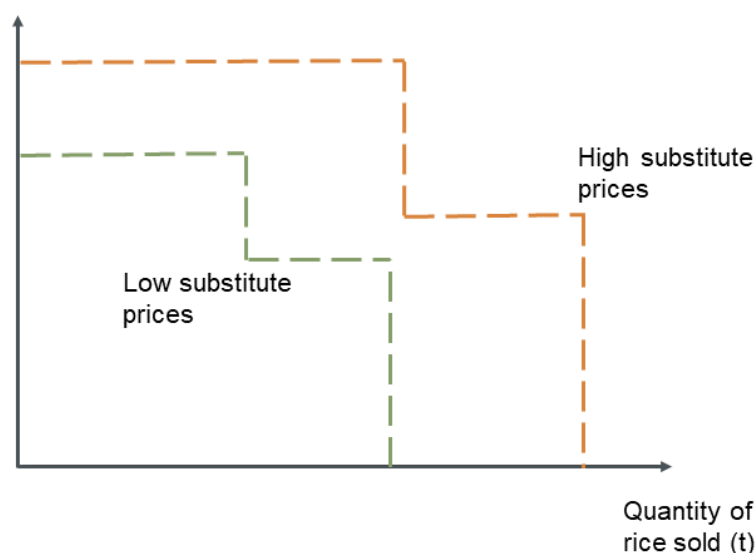
Source: Aither.

Figure 9 Hypothetical demand for rice sold by the downstream business and associated total revenue curve

The demand for the downstream business' rice depends on the prices of substitutes and the degree of product differentiation. There are a number of competitors in the domestic market, including SunRice. In the event that these competitors were to reduce their prices, the demand for the downstream business' rice could fall (Figure 10). The impact depends on the degree of product differentiation. Rice produced in the Northern Rivers is typically marketed as being 'Australian' and 'rain fed'. This creates a degree of product differentiation and reduces the demand impact of a

decrease in competitor prices. It also allows the possibility of selling some rice at a premium relative to brands that are unable to make these claims.

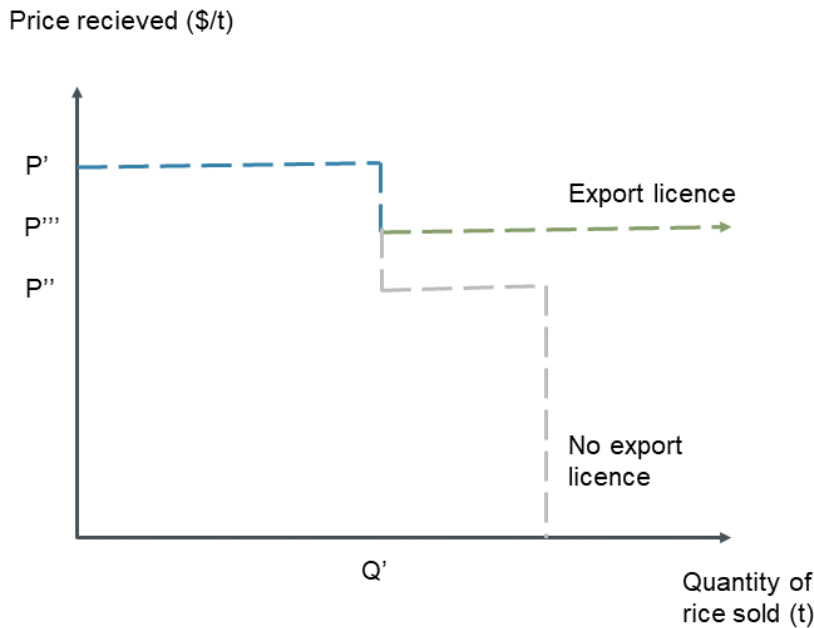
Price recieved (\$/t)



Source: Aither.

Figure 10 Effect of prices of substitutes on hypothetical demand for rice sold by the downstream business

As discussed in Section 2, the Northern Rivers rice industry is not legally able to export rice. To the extent there are export opportunities available, being able to export has the potential to increase both the price received and the quantity of rice that can be sold (Figure 11). In the following hypothetical example, the downstream business is able to export a large quantity of rice at P'''. This is the next best option available to the downstream business after the most lucrative domestic market is exhausted.



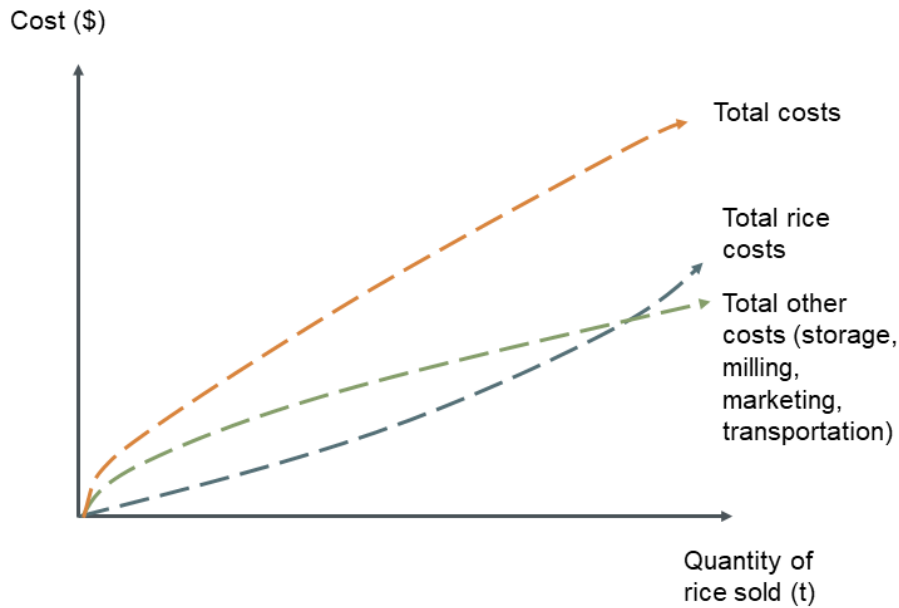
Source: Aither.

Figure 11 Effect of export licence on hypothetical demand for rice sold by the downstream business

Costs

Buying rice represents an important cost to the downstream business. The supply curve for the Northern Rivers rice industry (Figure 6) shows the average cost associated with acquiring different quantities of rice from local growers, if all growers are paid the same price. (The possibility of sourcing rice from outside the region is not considered.)

While the average cost of rice is likely to increase with quantity, this may not be the case for other important costs. There may be economies of size in storage, milling, marketing and transportation. This means that the average costs associated with these activities could fall as the industry grows, especially initially. This is evident in the total cost curves (Figure 12), which increase at an increasing rate for rice costs (blue curve) and increase at a decreasing rate for other costs (green curve). The orange curve shows the overall costs.



Source: Aither.

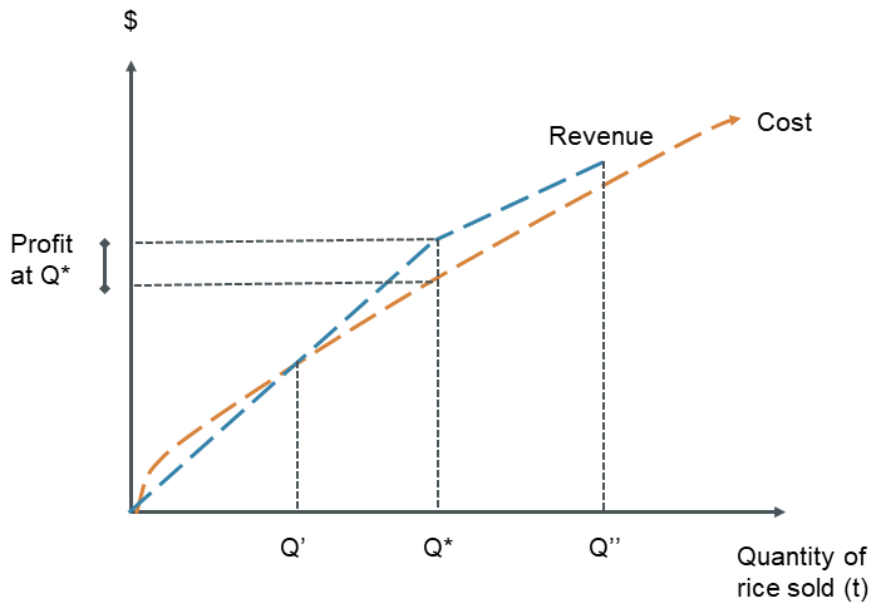
Figure 12 Hypothetical total cost curve, disaggregated into rice and other costs

Profits

The revenue and cost curves can now be used together to assess whether the Northern Rivers rice industry is viable, and if so, the scale at which it would operate.

The industry will be viable if revenue exceeds cost at any quantity. In the hypothetical example shown in Figure 13, revenue exceeds costs at all points between Q' (which is the minimum viable scale) and Q'' . Hence, The Northern Rivers rice industry would be viable under these revenue and cost conditions. The downstream business would be profitable. It would be profitable for farmers in the Northern Rivers to supply rice (since the downstream business has to pay growers enough to make it profitable to supply the desired quantity of rice, and this is reflected in the cost curve).

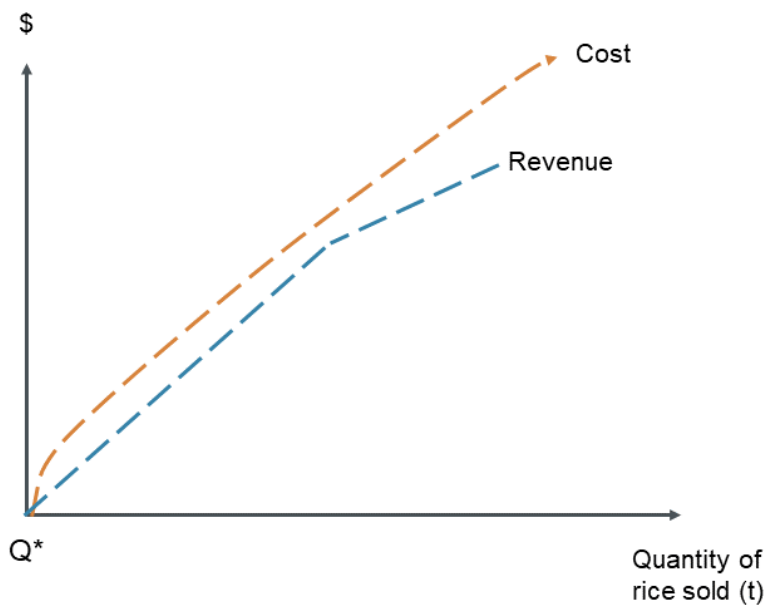
In terms of scale, the quantity that maximises profit is where revenue minus cost is greatest. This occurs at Q^* .



Source: Aither.

Figure 13 Profit maximising quantity (viable industry)

On the other hand, there may be no quantity at which the industry will be viable (that is, there is no viable scale). In Figure 14, cost exceeds revenue at every positive quantity. In this case the downstream business would leave the industry (unless there was sufficient prospect of the situation improving).



Source: Aither.

Figure 14 Profit maximising quantity (unviable industry)

This subsection has explored the key conceptual issues around whether the Northern Rivers rice industry will be viable in the future, and if so, the scale at which it would operate. The following subsection provides empirical evidence on key aspects of the conceptual model.

4.2. Empirical evidence and analysis

This subsection draws on empirical evidence from multiple sources to assess the likelihood of different futures for the Northern Rivers rice industry. There are information gaps throughout that limit our ability to draw strong conclusions. These are noted as areas for further research.

4.2.1. Farm level evidence and analysis

The aggregate quantity of rice supplied in the Northern Rivers at different prices can be estimated in a number of ways.

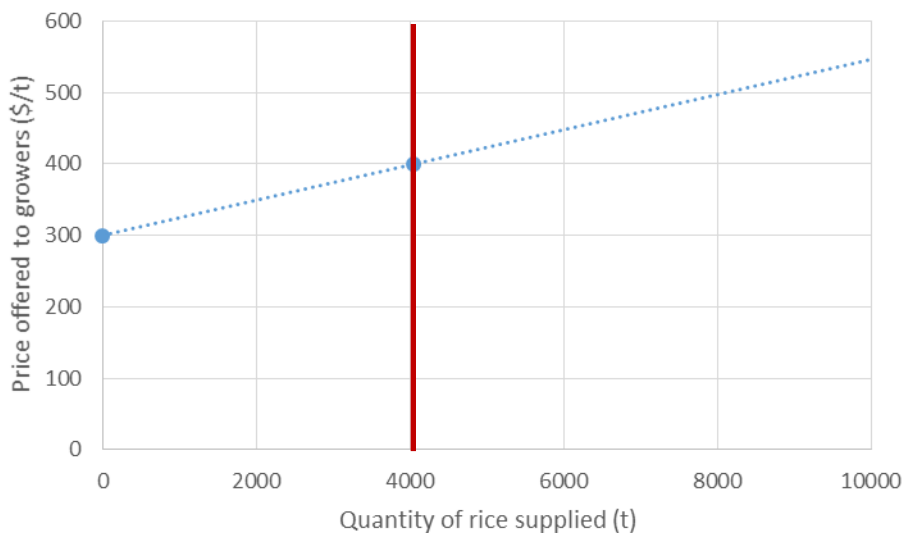
Supply curve estimation

The most direct option is to estimate the supply curve based on observed combinations of aggregate quantity and prices. This approach is valuable, however the estimates can be biased and given that the industry has only been recently established there are insufficient observations to estimate the full supply curve.

In 2017-18, about 900 hectares were contracted for rice in response to growers being offered \$400 per tonne. The expected yield at the start of the season would have been about 4.5 tonnes per hectare, although this is unlikely to be realised by all growers. Hence, about 4 050 tonnes were expected to be forthcoming at that price. This provides one point on the supply curve (Figure 15). During consultations, existing rice growers nominated \$300 per tonne as the threshold price at which they would no longer grow rice. This provides another point on the supply curve.

There are no observations to allow us to estimate the aggregate quantity of rice supplied in the Northern Rivers at other prices, or even the general shape of the supply curve. A linear trendline has been fitted for illustrative purposes, although there is no reason to suppose that this is accurate, especially at prices in excess of \$400 per tonne where the supply response has not yet been tested.

The supply curve shown below is a short run supply curve. As discussed in the previous subsection, in the long run, the aggregate quantity is likely to be greater at many prices. The supply curve will also shift over time for a number of reasons. For example, the introduction of varieties that increase yields could have a dramatic impact on the supply curve.



Source: Aither.

Note: The red line indicates 2017-18 production. See caveats in text.

Figure 15 Short run supply curve for the Northern Rivers rice industry (direct estimation)

Agronomic-economic modelling

Another option is to estimate the supply curve based on agronomic-economic modelling. In the Northern Rivers, soybeans are commonly grown in rotation with sugar cane or in rotation with maize. During consultations industry stakeholders suggested that a substantial proportion of any future growth would come from rice replacing soybeans in some of these rotations. Hence, the model used in this report focuses on the decision between soybeans and rice. The model does not consider the potential for growth to come from other activities such as beef cattle, and will therefore have a tendency to underestimate the potential aggregate quantity of rice supplied in the Northern Rivers.

The key features of the model are set out below. The full code for the model is available from Aither on request.

Objectives

Farmers are assumed to choose the land allocation that maximises their profitability.

Land use constraint

It is estimated that approximately 10 000 hectares are currently being used for soybeans in the Northern Rivers. This is a small proportion of the area identified by industry stakeholders as being suitable for growing rice, which ranges from about 25 000 to 70 000 hectares. In addition, there are 900 hectares currently being used for rice.

Gross margins

The estimated gross margins are \$850 per hectare for rice and \$360 per hectare for soybeans (Table 11). These are intended to be typical for farmers in the Northern Rivers. The estimates for soybeans were checked against the New South Wales Department of Primary Industries gross margins for soybeans to ensure plausibility. For the most recent year available, 2012-13, the Department of Primary Industries gross margins for soybeans were \$320 per hectare. After adjusting for inflation, this is very similar to the estimate used in the model.

As discussed in the previous subsection, the gross margin for an activity depends on the price received and variable costs. It also depends on the yield, which vary substantially across seasons. The yields for soybeans are estimated to range from 0.0 tonnes per hectare in bad seasons to 3.5 tonnes per hectare in good seasons (Table 12). The yields for rice are estimated to range from 2.0 tonnes per hectare in bad seasons to 7.0 tonnes per hectare in good seasons. The seasons do not necessarily align for soybeans and rice – a good season for soybeans may be a bad season for rice, and vice versa. The yield used in the model is based on the long term average. The long term average yield for rice is 4.5 tonnes per hectare, which is low compared with irrigated rice.

This is broadly consistent with the analysis in DPI (2016):

Historical yields in Northern NSW are reported by the Board to have reached 5 tonnes per hectare in 2011/12 but have averaged closer to 3.5 tonnes per hectare. DPI agronomists believe achieving average yields of 5 tonnes per hectare in Northern NSW is highly probable and have observed some commercial plantings in the region that achieved 7 tonnes per hectare in 2010.

The long term average yield can vary substantially from paddock to paddock, although there is no clear empirical evidence on the magnitude of differences. The technical assumptions made to model this process are outlined in Box 1.

Box 1: Technical assumptions in modelling paddock variability

The model was run assuming that 95 per cent of paddocks have a long term average yield within 30 per cent of the typical paddock. Sensitivity analysis showed that the estimated supply curve was not significantly affected by this assumption. The long term average yield for soybeans and rice were assumed to be independent, meaning that paddocks with high soybean yields are no more likely to have high rice yields than paddocks with low soybean yields. As a result of this modelling approach, each paddock has a unique combination of long term average yields for soybean and rice, which can differ from the typical paddock. This is important in generating a realistic supply response.

Table 11 Typical gross margins for soybeans and rice in the Northern Rivers

	Soybeans	Rice
Long term average yield (tonnes/hectare)	1.85	4.50
Price received (\$/tonne)	600	400
Variable costs (\$/hectare)	750	950
Gross margin (\$/hectare)	360	850

Source: Terry Rose, Southern Cross University; Farmer consultations.

Table 12 Typical yields for soybeans and rice in the Northern Rivers by season

Season	Frequency	Soybeans	Rice
Good	3 in 10	3.5	7.0
Moderate	4 in 10	2.0	4.5
Bad	3 in 10	0.0	2.0
Long term average		1.85	4.50

Source: Terry Rose, Southern Cross University; Farmer consultations.

Transition costs

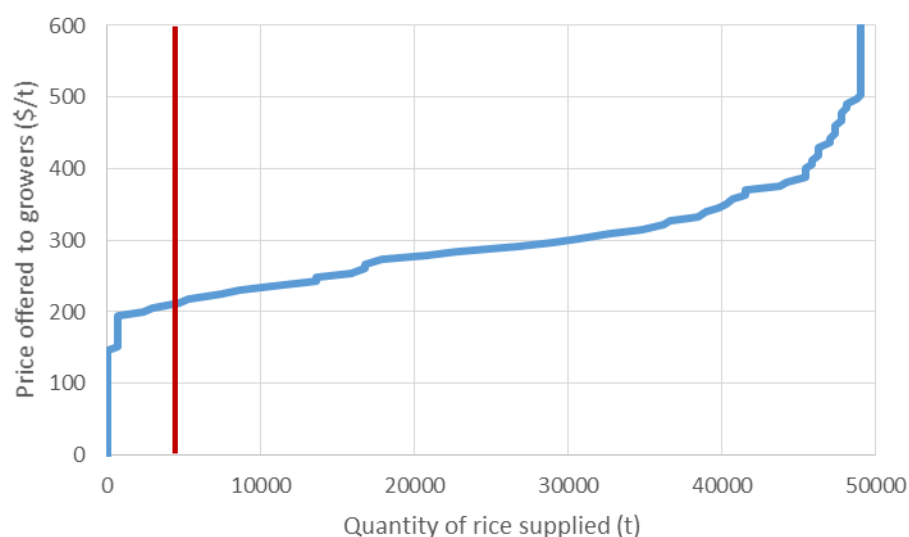
Industry stakeholders said that the costs of transitioning between soybeans and rice are not material. Much of the equipment and skills required are similar, and where there are significant differences, growers have been able to hire contractors and obtain external advice. We have assumed that there are no transition costs.

Risk

Farmers are assumed to be risk neutral. To the extent that farmers in the Northern Rivers are risk averse, the model may have a tendency to underestimate the potential aggregate quantity of rice supplied in the Northern Rivers at low prices and overestimate at high prices.

Supply curve

The model was used to estimate the supply curve for the Northern Rivers rice industry (Figure 16). This shows substantial long term potential for growth in the quantity of rice supplied, even without considering the potential to displace activities other than soybeans, or for new varieties with higher yields to be adopted.

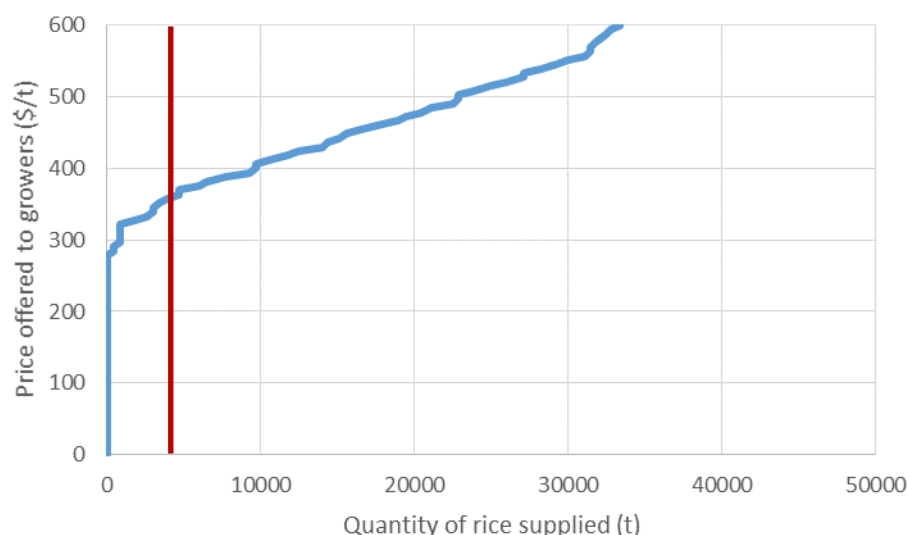


Source: Aither.

Note: The red line indicates 2017-18 production. See caveats in text.

Figure 16 Best guess long run supply curve for the Northern Rivers rice industry (agronomic-economic modelling)

There is substantial uncertainty around the estimated supply curves, both in terms of the extent to which it adequately reflects the current situation and how important factors will change over time, which is inherently difficult to predict. To illustrate, a pessimistic scenario was estimated, assuming that long term average yields are 25 per cent lower for rice and the price of soybeans is 25 per cent higher. Under these conditions, the long term potential for growth in the quantity of rice supplied would be much more limited.



Source: Aither.

Note: The red line indicates 2017-18 production. See caveats in text.

Figure 17 Pessimistic long run supply curve for the Northern Rivers rice industry (agronomic-economic modelling)

Grower perspectives

In consultations, a number of existing rice growers in the Northern Rivers indicated that they expect to expand rice production in the future and that there is interest from other farmers. The growers said that other farmers were waiting to see what yields were possible before deciding to grow rice. Lower than average yields due to recent unusually dry weather may therefore affect the growth of the industry, especially in the short term.

They also indicated that a lack of certainty in the future of the industry in the Northern Rivers was constraining growth, especially for rice growers further inland who are considering investing in their capacity to irrigate. These investments would be expensive, and are of limited value in activities other than rice.

In addition to other factors discussed above, the future for rice growers in the Northern Rivers depends on the prices offered by the downstream business.

4.2.2. Downstream industry evidence and analysis

The Natural Rice Co Pty Ltd is currently offering growers about \$400 per tonne. Based on the supply curves estimated above, there is a high probability that this would be sufficient to support growth in rice production in the Northern Rivers.

However, it is unclear whether the Natural Rice Co Pty Ltd (or equivalent firm) will continue to offer \$400 per tonne. It may be that it is profitable for the Natural Rice Co Pty Ltd to offer more or less than \$400 per tonne. It is also possible that there is no price that will allow the Natural Rice Co Pty Ltd to operate profitably (equivalent to Figure 14).

Without seeing the financial details of the Natural Rice Co Pty Ltd, it is not possible to draw strong conclusions about the overall viability of the Northern Rivers rice industry (this includes minimum viable scale). The Natural Rice Co Pty Ltd has shared some confidential cost information with Aither. However, they were unable to share revenue information with Aither for commercial reasons. This has made it difficult to ascertain whether the Natural Rice Co Pty Ltd is currently profitable in the Northern Rivers.

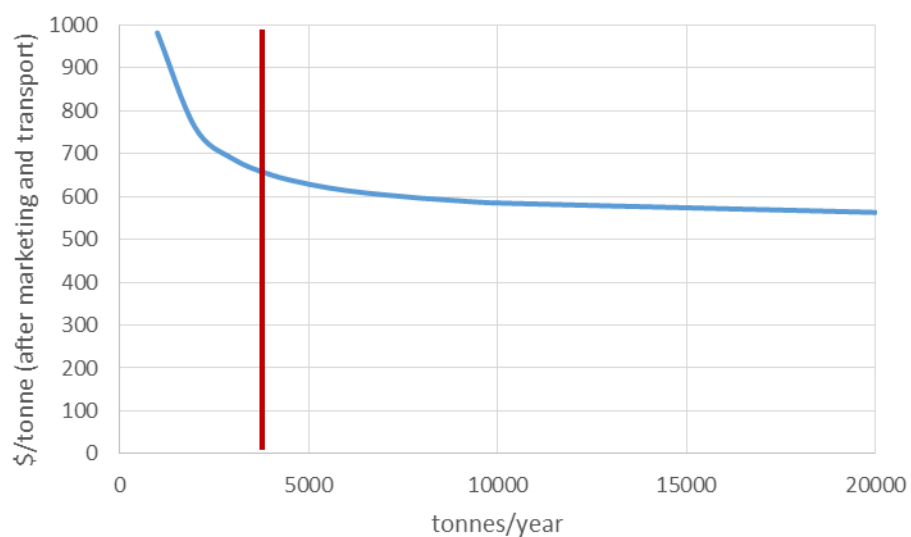
Aither sought similar information from SunRice, as an indirect way of evaluating whether the Natural Rice Co Pty Ltd is likely to be currently profitable in the Northern Rivers, albeit for a different company operating at a significantly larger scale. SunRice was also unable to share this information. However, the 2017 pool prices can provide some evidence. Growers received between \$330 and \$480 per tonne depending on the variety (the main variety grown in the Northern Rivers is not part of the SunRice pool). The pool price is calculated such that the rice milling and marketing pool is generally cost neutral. This suggests that if the Natural Rice Co Pty Ltd had access to the equivalent markets to SunRice and the same average costs, they would be making either small loss or small profit in the Northern Rivers.

As premium export markets are not available to the Natural Rice Co Pty Ltd, it is possible that their average price received is currently lower than SunRice. They also operate at a much smaller scale, and so their average costs are likely to be higher. This reduces the likelihood that the Natural Rice Co Pty Ltd is currently making a profit in the Northern Rivers at \$400 per tonne.

Future developments

This may change in the future. As discussed above, the downstream business may be able to source substantially more rice at \$400 per tonne than is currently the case. This could improve profitability in a number of ways. The increase in size would enable a downstream business to invest in major storage and milling facilities, which could substantially reduce their average costs. It would also allow for greater investment in varieties, which could improve yields, further enhancing ability of the downstream business to source rice in the Northern Rivers.

During consultations, a possible investment in additional storage and milling facilities was proposed. Based on indicative cost data provided, Aither has undertaken analysis to show the breakeven price needed (after subtracting marketing and transport costs) to make the investment commercially viable at different levels of throughput. We assume a discount rate of 7 per cent after inflation. This analysis is shown in Figure 18.



Source: Aither.

Note: The red line indicates 2017-18 production. See caveats in text.

Figure 18 Threshold price (after marketing and transport costs) required for investment in new capacity to be viable

5. Potential policy responses

The previous sections examined the potential for the rice industry to expand beyond traditional growing regions, considering a wide range of commercial impediments. The analysis showed that the potential for the rice industry to expand into the Northern Basin is very limited at this stage, but that many of the conditions required for the rice industry to expand into the Northern Rivers are satisfied. This section addresses the third and fourth terms of reference which are to consider and provide options for expanding the NSW rice industry. Is there a role for the NSW Government in facilitating the development of the Northern Rivers rice industry, and if so, what policy responses might be appropriate?

In exploring potential policy responses, Aither has identified two potential distortions that may be amenable to government intervention – restrictions that prevent the Northern Rivers rice industry from exporting and externalities around research, development and extension.

5.1. Export arrangements

Northern Rivers stakeholders identified their inability to export rice as significant regulatory impediment to industry growth.

If the Northern Rivers rice industry was able to successfully export rice in the future, this could increase their average price received (relative to not being able to export). However, there is uncertainty around the extent to which these opportunities exist.

The Natural Rice Co Pty Ltd said that it had been approached to export rice from the Northern Rivers, but was unable to provide evidence to Aither, citing commercial sensitivities. Given that the Natural Rice Co Pty Ltd is not able to export rice under current legislation, a lack of developed export opportunities would be expected. This does not necessarily indicate that export opportunities would not be available in the future.

The Natural Rice Co Pty Ltd stated that being able to export would be valuable in the event that the actions of competitors in the domestic market caused a substantial reduction in domestic prices. They also argued that the ability to export would assist as the company grows, as the limited size of their domestic markets constrains the quantity that can be sold without exports.

The available evidence suggests that the ability to export would have the potential to improve the profitability of the Natural Rice Co Pty Ltd, and other current and future downstream businesses, although the magnitude is difficult to quantify.

At the same time, there are concerns that allowing the Northern Rivers rice industry to export would impose costs on growers in traditional growing areas. This might include costs from damage to the reputation of NSW rice (in international markets) if, for example, lower quality rice was to be exported; or costs to the Riverina industry if other elements of rice vesting (e.g. Buyer of Last Resort functions) were also repealed in conjunction with allowing the Northern Rivers industry to export (outside of the SEEL).

Assessing the magnitude of these costs is outside the agreed scope of this report.

And, as part of the agreed scope, Aither has focused solely on whether the Northern Rivers industry can or cannot export and has not considered the specific means by which this would be achieved and any associated impacts. There may be a few ways that this could be achieved for example, it could be

through removal of the Rice Vesting Proclamation altogether, or there may be options to exempt the Northern Rivers region, or to issue an additional licence to export – each would have different implications for growers in traditional growing areas.

5.1.1. Findings and possible options

There are likely to be benefits to the industry in the Northern Rivers through allowing them to export. However, the information required to calculate the benefits and costs is privately held and cannot be obtained for reasons discussed above. It is therefore uncertain whether the ability to export would be the main determining factor in industry expansion.

In the absence of specific evidence on the benefits and costs of allowing the Northern Rivers rice industry to export rice, the NSW Government should examine the benefits and costs of removing or adjusting similar statutory marketing policies in similar industries and jurisdictions and use this to inform its policy development.

5.2. Research, development and extension

Northern Rivers stakeholders identified a number of ways in which research, development and extension (RD&E) could assist the development of the Northern Rivers rice industry and support expansion. Where market failures exist, there may be case for government support of research, development and extension. An example of this could be where there is low incentive for an individual or group to invest in research if the benefits accrue to all stakeholders – this is a positive externality that might warrant government support (i.e. to help fund the research), assuming that the benefits outweigh the costs of providing the support. By considering externalities it is possible to reduce the probability of funding inefficient investments or funding investments that would occur even without support.

Some of the potential research, development and extension needs are further described below and could be supported through both industry, government or combined funding (depending on the context).

Investment in breeding cultivars of rice adapted to the rainfed subtropics would likely be the most cost-effective way to improve sustainability of the industry since yield and grain quality will determine continuity of supply (yield stability across seasons) and potential high value markets (grain quality).

Traits for yield stability are deeper roots for drought tolerance in a rainfed environment and submergence tolerance given the likelihood of flooding in the region during autumn/summer. Key genes for these traits are available in international Indica germplasm but would require a breeding program to introgress these traits into Japonica material with higher grain quality. Any introgression of flood/drought tolerance genes is predicted to increase average yields by over 2t/ha in the long term.

Key traits for high quality grain would include fragrance, colour (red/black/purple) and low GI traits in addition to standard eating quality traits that exist in current Australian rice cultivars from the Southern NSW breeding program. Again, germplasm exists internationally but a 5+ year breeding program would be required to deliver suitable cultivars to northern NSW.

Agronomic research on weed control and fertiliser management would also enhance potential industry sustainability by maximising yields while minimising input costs. Weed control and nitrogen fertiliser management differ from management used in the Southern NSW flooded rice industry, and optimisation of herbicide and fertiliser management would be critical in Northern NSW to maintain a social licence to farm in this environmentally-sensitive region.

Possible funding mechanisms include rice grower levies matched by the federal government through AgriFutures Australia, but this may not be popular given that most of the levies are received from rice growers in Southern NSW at present. Government investment (100% federal funded) through AgriFutures may be an option but given that \$5 million was just allocated to 'Northern Rice' (although none of it was invested in development of the Northern NSW industry) this may not be popular. The current main buyer of rice in the region may be open to co-investment in rice breeding and agronomy research with either the state or federal government, but this would remain to be negotiated.

5.2.1. Findings and possible options

There are likely to be a number of improvements through RD&E that would help support industry expansion. The NSW Government should explore whether the Northern Rivers rice industry is receiving appropriate support for research, development and extension. Any investments should of course be focused on areas where there are likely to be substantial externalities and where the benefits are likely to exceed the costs.

6. Conclusions

This report has assessed the potential for the rice industry to expand into the Northern Murray-Darling Basin and Northern Rivers, considering a range of possible impediments. The report also canvassed potential policy responses to facilitate the development of the Northern Rivers rice industry.

6.1. Northern Basin

Irrigated summer cropping in Northern Basin catchments is predominantly cotton, which is currently a more profitable enterprise than rice in those conditions.

Establishing a rice industry in the Northern Basin is unlikely. Variable water availability and high temporary market prices preclude irrigators from investing in land use change to rice.

There may continue to be opportunistic rice crops in Jemalong District, which will vary according to water availability and commodity prices.

Conclusion: Establishing a rice industry in the Northern Basin is unlikely.

6.2. Northern Rivers

Rice is currently being profitably grown in the Northern Rivers region on waterlogged land that is not well suited to other farming enterprises.

The optimistic future where the industry grows substantially, perhaps to 50 000 tonnes, is possible but not guaranteed.

Although industry assessments about suitable land vary, it is not an inhibiting factor in the growth of a Northern Rivers rice industry. There are substantial areas of waterlogged river floodplain country where rice provides a cropping option. Currently, these areas are mostly being farmed for cattle, soybean and sugarcane production, and rice provides a competitive alternative to these enterprises.

As generational change in the district passes, more land will become available for well managed cropping enterprises that can generate better returns than low management options such as cattle or sugarcane.

Whether moving to rice is profitable depends to a large extent on what yields are realised. If the Northern Rivers rice industry can generate long term average yields of 4.5 tonnes per hectare (or greater), there could be significant supply at prices similar to those offered by SunRice to growers in southern New South Wales and prices currently offered by the Natural Rice Co Pty Ltd. Whether such yields are possible will be tested further over the next few seasons if climatic conditions return to normal. However, changing climatic conditions during traditional summer rainfall months remain a risk.

Current Riverina varieties are not well suited to a growing environment where available moisture may not be present near their root system at critical stages of grain development. A lack of timely rainfall can have substantial effects on grain yield. The industry would be more economically viable with the

development of better suited varieties and agronomic research to establish optimal seeding dates to minimise the yield risk of dry and cold events.

Beyond the farmgate, success depends on whether the Northern Rivers rice industry can reduce its average costs significantly. This will be easier if the scale of the industry increases, but will require major investments and handling and processing facilities.

Success also rests on whether the industry can sell the rice it produces at favourable prices. The distance between the Northern Rivers rice industry and SunRice receival facilities makes access to export markets through SunRice unviable, and local companies are prevented from exporting. The ability to export would open up new sources of demand and improve the prospects for the Northern Rivers rice industry. However, the magnitude of these opportunities and their implications are not possible to quantify at the moment due to a lack of evidence.

The lack of evidence regarding export opportunities is partly a result of private companies not sharing relevant commercially sensitive information with the project team. There is also a more fundamental problem – companies that are prevented from exporting are unlikely to develop firm export opportunities, even if export opportunities were available. Hence, the extent of export opportunities for the Northern Rivers rice industry will continue to be challenging to quantify.

Given the above:

Conclusion: There is potential for a viable rice industry in the Northern Rivers, though the review was provided insufficient information on which to make a conclusive assessment of expansion prospects. This includes whether relaxing export restrictions would make a definitive difference to industry viability (noting that it is likely to be beneficial to the industry in the Northern Rivers).

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SunRice 2017f, *2017 AGM CEO's report*.

Appendix A – Consultees

Northern Rivers consultation:

Grower group (for Natural Rice Co Pty Ltd):

- Paul Fleming
- Domonic Hogg
- Zac Geldof
- Rick Gollan
- Jeff Gollan

Natural Rice Co Pty Ltd:

- Mitchel Green

- Nelson Green
- Matthew [surname not known]
- Steve Rogers

Milling (and independent grower):

- Brett Slater

Independent grower:

- Anthony Carusi

In additional, Dr Terry Rose was consulted and contributed to the project (as a subconsultant).

Northern Basin:

- David Trodahl, NSW DPI Rice Agronomist, Yanco.
- Grant Tranter, Executive Officer, Macquarie Rivers Food and Fibre,
- Neil Toole, Manager, Jemalong Irrigation Limited
- Louise Gall, Project Office, Gwydir Valley Irrigators Association
- Namoi Valley Water – did not return Aither's call.

Appendix B – Water constraints on rice production in the Northern Basin

Lachlan Valley

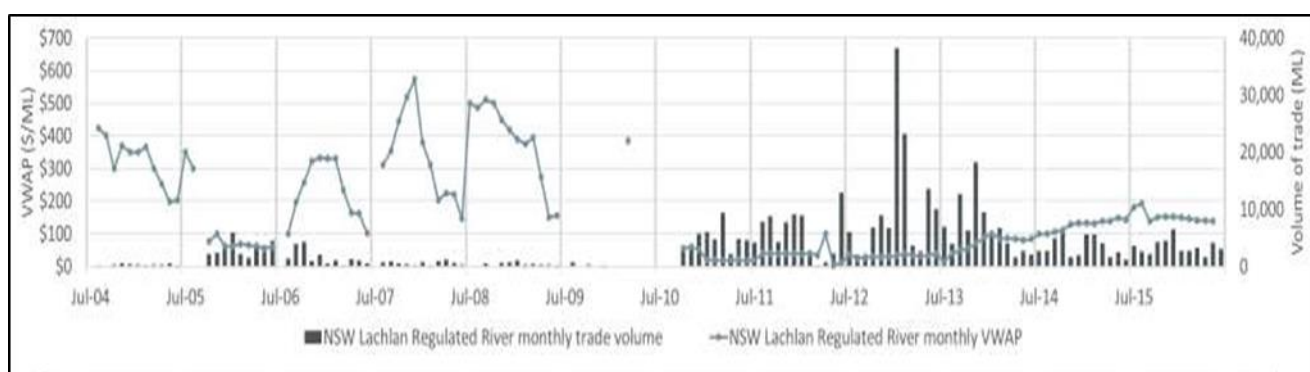
The following tables and figures outline the water entitlements, allocation and prices in the Lachlan Valley. Rice has been grown opportunistically, however stakeholder consultations suggested this was unlikely to transition to a significant industry given lower reliability of water and other higher value cropping options.

Table 13 Lachlan valley water entitlements

Entitlement Type	Entitlements on Issue (ML)
General Security	592,801
High Security	27,680

Table 14 Lachlan valley historical allocation

Year	GS allocation (total %)	HS allocation (total %)
2015/2016	25	100
2014/2015	0	100
2013/2014	0	100
2012/2013	0	100
2011/2012	0	100
2010/2011	117	100



Source: Aither, Water Markets in NSW, p. 167

Figure 19 Lachlan valley Volume-Weighted Average Prices

Macquarie valley

The table below shows allocation to entitlements in the Macquarie valley. Temporary water market prices in recent years have been around \$200-300 per ML (Aither, Water Markets in NSW, p. 186). Consultation with Macquarie stakeholders indicated that rice was not and would not be grown in the region given the higher value of cotton and the availability and price of water.

Table 15 Macquarie valley water entitlements

Year	GS allocation (total %)	HS allocation (total %)
2016/2017	100	100
2015/2016	7	100
2014/2015	2	100
2013/2014	6	100
2012/2013	64	100
2011/2012	49	100
2010/2011	100	100
2009/2010	0	100
2008/2009	10	100
2007/2008	5	100
2006/2007	0	100
2005/2006	44	100
2004/2005	9	100

Aither, Water Markets in NSW, p. 186

Namoi valley

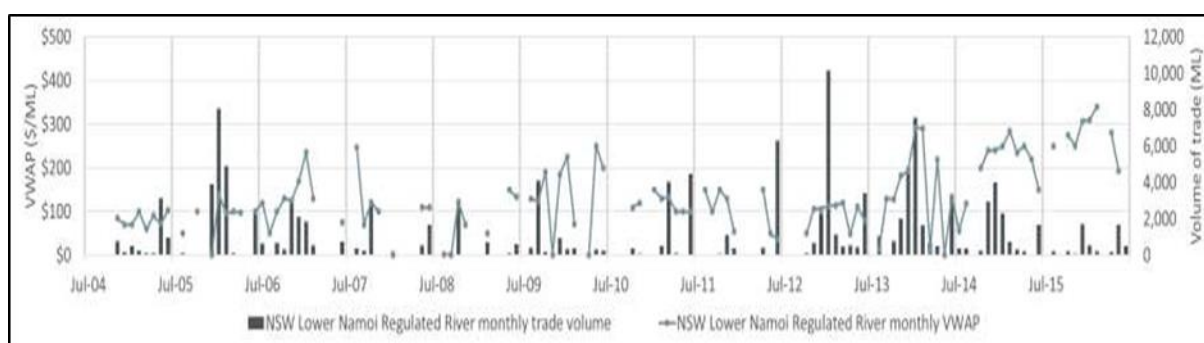
The tables below show water entitlements and allocation in the Namoi valley, as well as allocation prices.

Table 16 Namoi valley water entitlements

Entitlement Type	Entitlements on Issue (ML)
General Security	256,212
High Security	3,984
Supplementary	115,479

Table 17 Namoi valley historical allocation

Year	GS allocation (total %)	HS allocation (total %)
2016/2017	124.67	100
2015/2016	0	100
2014/2015	0	100
2013/2014	6.36	100
2012/2013	48.8	100
2011/2012	116.11	100
2010/2011	109.73	100
2009/2010	0.58	100
2008/2009	23.4	100
2007/2008	13.65	100
2006/2007	0	100
2005/2006	31.15	100
2004/2005	14.21	100



Source: Aither, Water Markets in NSW, p. 209

Figure 20 Lower Namoi Regulated River trades

Gwydir valley

The tables below show the entitlements and allocation for the Gwydir valley. Consultation with Gwydir stakeholders indicated that rice was not and would not be grown in the region given the higher value of cotton and the availability and price of water.

Table 18 Gwydir valley water entitlements

Entitlement Type	Entitlements on Issue (ML)
General Security	509,665
High Security	20,260
Supplementary	181,982

Table 19 Gwydir valley historical allocation

Year	GS allocation (total %)	HS allocation (total %)
2016/2017	78.63	100
2015/2016	5.28	100
2014/2015	0	100
2013/2014	0	100
2012/2013	150	100
2011/2012	150	100
2010/2011	82.84	100
2009/2010	0	100
2008/2009	0	100
2007/2008	24.7	100
2006/2007	0	100

Temporary water market prices in recent years have been around \$200-300 per ML (Aither, Water Markets in NSW, p. 238).

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