Australian Government
Rural Industries Research and Development Corporation

Domestic and export market expansion of quality buckwheat

A report for the Rural Industries Research and Development Corporation

By Rob Death

February 2004

RIRDC Publication No 04/019
RIRDC Project No DAV-183A

ISBN 0 642 58729 9
ISSN 1440-6845

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Project No. DAV-183A

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Published in February 2004
Printed on environmentally friendly paper by Canprint

Foreword

Expand and develop domestic markets for quality Australian buckwheat through;

- Full analysis of opportunities for the use of Australian grown buckwheat in all human food forms, for example buckwheat sprouts, which would require domestically grown seed supplies to be used rather than imported dehulled product from China. Then a subsequent analysis of the resources the industry would require to develop and then subsequently adopt opportunities that have been identified.
- Comparative analysis of the food value of Australian buckwheat and the published analysis from the Northern Hemisphere.
- Investigation into the potential for buckwheat derivatives such as fagopyritols, flavanoid Rutin and D-chiro-inositol into nutraceuticals or as functional food ingredients.
- Detailed report on future industry links and networks improved by the implementation of a communications strategy (i.e. web site plus Australian buckwheat industry directory made up of:

a) Export operators
b) Domestic manufacturers, processors and re-packers
c) Growers
d) Government agencies
e) Importers).

- Detailed crop modeling plus presentation and analysis of potential land suitable for buckwheat production in Victoria using *Multiple Criteria Evaluation* (MCE) and the *Analytic Hierarchy Process* (AHP). In addition, climate change predictions have been applied to the crop modeling outcomes for the years 2020 and 2050. These outcomes have been utilised when predicting future buckwheat production areas in Australia (using detailed analysis in Victoria as an example).
- Recommendations for the role of Government agencies in the future development of buckwheat in Australia.

This project was funded from RIRDC Core Funds which are provided by the Australian Government.

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Simon Hearn
Managing Director
Rural Industries Research and Development Corporation

Acknowledgments

The Author would like to acknowledge the contribution from the Natural Resources Planning and Food Chemistry Units at the State Chemistry Laboratory in Werribee Victoria.
The author also acknowledges guidance from Chris Bluett, with support and editing help from Stuart Clarke. Both Chris and Stuart are located within the DPI Ballarat office.

Abbreviations

Multiple Criteria Evaluation (MCE)
Analytic Hierarchy Process (AHP)
Fagopyrum esculentum (Buckwheat)
Extreme heat Days (E.H.D's)
Farinetta (Buckwheat Bran)
Unique Selling Proposition (USP)

Contents

Executive Summary

Buckwheat has a long history as a staple food in various Northern Hemisphere countries. Historical production/consumption areas are those with climates dominated by a short summer, latitudes above 35º and with elevation above 1,250 metres and reliable summer rainfall. Countries such as China, Japan, Korea, Russia were and still are the main producers. World production of buckwheat from the 2001 calendar year was 3.261 million tonnes (China represented 52.1% of total production) and world export trade in buckwheat during calendar year 2000 was 158,167 tonnes (China represented 66.7% of total exports) or 4.85% of world production. Australia exported 1,018 tonnes in calendar year 2000. (*Source: FAOSTAT)* Buckwheat is produced in traditional growing areas in the Northern Hemisphere for it's nutritional value (high lysine and arginine contents), starchy endosperm and short season maturity. Gramineae production in these traditional growing areas is often restricted due to climatic conditions and alternative competitive crops to buckwheat are limited.

In this report we are viewing the buckwheat industry from an Australia wide perspective, with certain pieces of analysis (including mapping) conducted on Victoria. The same methodology used in the Victorian studies would be easily applied in other areas of Australia, to determine their suitability for buckwheat cultivation.

The availability of land in Australia that is suitable for summer production of buckwheat (assuming the geographic, cultivar and climatic conditions outlined in this report) is severely restricted by the incidence of E.H.D's (Extreme Heat Days) and lack of reliable summer rainfall. By availing ourselves of the CSIRO Climate Model Output and OzClim data we find that the availability of suitable land for buckwheat production in Victoria is predicted to decline significantly between now and 2050. (*Appendices F, G, H, & I)* However, suitable production conditions for Autumn/Winter production in the northern parts of Australia (such as the Darling Downs area of Queensland) are predicted to become more suitable for buckwheat production as a result of climate change predictions.

Production of buckwheat in Australia (especially Victoria and New South Wales) from the 2002/2003 season was severely restricted due to drought conditions in most producing areas. Total production of buckwheat in Australia during the 2002/2003 season was less than 1,000 tonnes. (Source: compilation from Industry intelligence)

Australian consumption of buckwheat is increasing slowly in the human health food sector (the health food sector incorporates special dietary needs such as celiac and vegetarian/vegan which rely on the Gluten free and high lysine/arginine levels in buckwheat). However the adoption of buckwheat as a regular ingredient in the "main stream" processed food sector in Australia is not showing appreciable growth. The main target areas for consumption of significant volumes of buckwheat are the starch-based industries of breakfast cereals, bakery, pasta and smallgoods plus sweet and savoury snack foods. Each sector has some unique needs and all these needs are identified in detail in Chapter One.

Restrictions and limitations to the adoption of buckwheat in these "main stream" processed food industries are:

(i) high cost of buckwheat versus gramineae produced starch,

(ii) adverse flavour implications in some products,

(iii) allergic reactions in some members of the population (*Appendix B*) and

(iv) lack of a USP (Unique Selling Proposition) that would justify buckwheat inclusion in the products.

Significant market research in the food processing industry over many years has indicated that health based claims alone are not enough to convince consumers to consistently purchase a product unless it also tastes good, is competitively priced and meets their perceived needs and wants.

Australian grown buckwheat is not statistically different to buckwheat produced in the Northern Hemisphere, in regard to chemical components and/or nutritional value (*Table 1:001a*). By carrying out limited food analytical test in Australia (by the *State Chemistry Laboratory Werribee, Victoria*) we have been able to demonstrate that storage of whole grain for up to 2 years does not significantly effect the chemically analysed nutritional aspects of buckwheat. We are then able to extrapolate these results to indicate that in all probability imported buckwheat that is a minimum of 2 years old may retain the chemical and nutritional value exhibited at harvest.

However time and conditions of storage may well effect certain organoleptic characteristics and hence some customer preferences. For example the reduction in green colour of the buckwheat groat (a groat is the buckwheat seed with the outer hull mechanically removed) is a major concern for buyers in Japan. The seed sprouting industry (*see Chapter One for details)* is the only food industry that we could identify that is likely to benefit from Australian grown buckwheat. This benefit results from an increased seed germination percentage in fresh versus aged seed.

Research into buckwheat components such as fagopyritols, rutin and D-Chiro-Inositol is well advanced in the USA and has been investigated for many years in China, Russia and Eastern Europe. To date the author has been unable to find any commercially significant nutraceutical or pharmaceutical products using these components extracted from buckwheat, anywhere in the western world. Even in China, the home of modern buckwheat production, rutin derivatives are primarily manufactured from plant sources other than buckwheat. (*Appendix J*)

Communication between all participants in the Australian buckwheat industry is possible via an industry association. However the industry participants at this stage are not willing to form an association and as such the Victorian DPI external web site may be the only potential source of up to date information.

Our research has utilised detailed crop modeling to determine the most appropriate sites in Victoria for buckwheat production. The Victorian areas that are most suitable on a crop physiology basis (taking into account all the factors present in *Appendix D*) are also the areas that are generally least suited to broad acre grain production. The primary influences are slopes that create difficulties with mechanisation and the areas are also suited to competitive high value horticultural/agricultural and tourist/commercial pursuits.

In addition to the crop modeling, we have also employed CSIRO climate predictions for 2020 and 2050 (*Appendices F, G, H, & I*) in order to ascertain the trends in regard to future availability of appropriate sites for buckwheat growing in Victoria. The climate prediction models use 2 scenarios - moderate and extreme emissions – when predicting 2020 and 2050 outcomes.

With this report we have completed 9 years of buckwheat project funding (joint funding provided by RIRDC and DPI Victoria) and so it is appropriate to suggest ways of retaining a "watching brief" on the industry to ensure it remains contemporary. The most important aspects that we must maintain are:

(i) the retention of current information in regard to Australian and Overseas market developments for buckwheat grain

(ii) developments in nutraceutical and functional food derivatives

(iii) overseas developed cultivars that may be more suitable than the current cultivars for production under Australian climatic conditions.

The last 9 years has seen The Department of Primary Industries in Ballarat (as the lead agency) heading up a consortium that consisted of the Department of Agriculture NSW and the Agronomy and Soil Science unit of the University of New England (Armidale NSW). The UNE carried out agronomic trials on the Northern Tablelands of New South Wales and also supervised buckwheat research by students. One such report completed in 2002 is titled: *Report on The Buckwheat Variety Trials in Armidale, New South Wales by Kerrin Price Henderson, 2002.*

Introduction

Buckwheat was one of the earliest crops domesticated in Asia, occurring around 2,000 years ago in the western part of China. (*Source: Wei 1995*) Current world production is estimated to be in excess of 2.6 million hectares (*Source: FAOSTAT Database*) with approximately 30% of this area in China.

The majority of the buckwheat grown in Asia and the sub-continent is at higher altitudes (above 700 metres). Buckwheat is one of very few crops suitable for a very short Summer growing season with the added benefit that the crop also tolerates low nutrient soils in rugged country. However it is intolerant to temperature extremes (> 28º Centigrade or frost).

Due to the long history of the crop and the isolated growing regions and conditions, there are 10 wild and 2 cultivated species of Fagopyrum. Within the F. esculentum species there are between 3,000 and 4,000 accessions, lines and landraces (*Source: Ohnishi O 1998*). As buckwheat is an outcrossing, self-incompatible plant the variability is seen to be very high. (*Source: Ohnishi & Asano 1999, Kump & Javornick 1996*)

It is a reasonable assumption that focus on breeding in the Northern Hemisphere will eventually lead to improvements in consistency of yield and the in-field performance of buckwheat. It is also reasonable to assume that due to the current small world market for buckwheat (total world trade in buckwheat in the calendar year 2000 was 158,167 tonnes – *Source FAOSTAT*), it is most unlikely that Australia will justify any stand-alone plant breeding activities. As a result all our future efforts need to be directed toward increasing utilisation of Australian grown buckwheat in Australian food products and monitoring plant breeding developments overseas (*especially Kade Research Ltd., Manitoba, Canada and around 20 research institutes within China*).

Chapter One
Human Food Potential in Australia

Full analysis of opportunities for the use of Australian grown buckwheat in all human food forms, for example buckwheat sprouts, which would require the use of domestically grown seed supplies, rather than imported dehulled product from China.

a) Fresh Sprouts
The Australian fresh sprout industry is now an established industry.

The estimated volume of seed used for sprouting per annum in Australia (Source: cross referenced industry sourced estimates) is:
Lucerne: 315 tonne per annum
Mung Beans: 445 tonne per annum
Snow Peas: 445 tonne per annum
Mixed Sprouts: 240 tonne per annum
Estimated new specialty entry like buckwheat: 37.5 tonne per annum

Nutritionally, buckwheat sprouts have many positive attributes in addition to wholemeal buckwheat flour that include elevating the rutin content by 27 times and increasing the lysine by 51% on a dry weight basis. (Source: Sun Lim et. al. August 2, 2001)

In order to achieve penetration of Australian grown buckwheat into this market sector, it is estimated that a contribution of A$2,000 to Just Sprouts would enable factory trials to be completed. A further A$2,500 for market research using trial sprouts would determine if this market sector were viable. The questionnaire and responses from 2 email market surveys carried out by the Author during December 2002, can be seen in Appendix C.

b) Smallgoods Industry
The smallgoods industry uses binders and fillers in order to provide functionality (holding the products together) and also make their products more competitively priced.

If Soy Bean flours are used for their functional and bulk filler attributes, there is a perceived negative flavour profile, lysine levels are lowered and there is an increase in flatulence if used at levels in excess of 10% in the total formula.

Buckwheat flour is a potential partial replacement as a bulk filler and lysine additive. Buckwheat has the advantage of being a low flatulence product, however it is not a functional protein ingredient due to the absence of gluten and as a result cannot be used as a 100% replacement for Soy Bean flours.

In order for the industry to accept buckwheat as an alternative source filler, there will need to be trials completed by a major industry operative. As the smallgoods industry is still recovering from the E. coli and Salmonella trauma's of the early 1990's, it is reticent to try new raw materials without extensive testing and aged storage. For the companies to begin testing buckwheat as an alternative, an attractive financial costing needs to be completed, product processing trials completed, followed by storage trials and then finally consumer preference testing.

At this stage we do not have any firm indications if the industry is willing to try buckwheat. However if trials were initiated after full costing, then a 40% replacement of Australia wide soy ingredients in smallgoods could translate to around 200 tonne per annum of milled buckwheat.

c)Bakery and Pasta Industry

The Australian bakery industry had a turnover of A$3.41 billion in 1998-99 with annual consumption per capita of 53.4 kg of bread, 7.9 kg of breakfast cereals and approximately 30 kg of cereal flour in addition to bread making flour. (*Source*:*Australian Food Statistics 2002*)

Within this industry, buckwheat is currently used as an ingredient in food service pancake mixes, on and in crispbreads, bread making flour, snackfoods, pasta and cakes. The majority of product is not being used in the "main stream"** food manufacturing industry. Health food and special dietary (e.g. Celiac) needs are mostly contained in the health food sector.

Buckwheat has not entered the "main stream" bakery industry to any extent due primarily to:
i - cost being approximately 3 times that of wheat and other main stream cereals such as barley and oats,
ii – perceived issues with "allergic reactions, including asthma and anaphylactic shocks" (*Source*: *Allergy to Buckwheat Gunilla Wieslander. Department of Occupational and Environmental Medicine, University Hospital, S-753 31 Uppsala, Sweden)*
iii – Flavour differences from main stream cereal flours and
iv – The costs of launching new products with unknown ingredients into the retail food industry.
To overcome points **i** to **iv** above (assuming any flavour and/or product acceptance issues are overcome) in the Australian food-manufacturing sector, then major buckwheat marketing and educational campaigns would be required. At this time, we have not been able to secure a major partner from the main stream food processing industry that is willing to undertake this significant investment.

As the Australian Food Industry generally becomes more concentrated (2 companies share 80% of the Australian bread market) it becomes more challenging to start new niche product concepts with main stream food companies. Of the 2 million tonnes of cereal flour produced per annum in Australia, 1.3 million tonnes goes into human food manufacturing. Of this 1.3 million tonnes 45% is consumed as bread, with general food manufacturing taking 7%, biscuits 5% and pasta 5%. (*Source: 2001 statistics from the Flour Millers Council of Australia)*

There is one significant Australian manufacturer of soba noodles, based in Victoria, with their entire production being exported to Japan. Buckwheat for this production is either sourced from imports or Australian grown organically certified buckwheat, with purchases of Australian grown product being dependent on availability and price.

**Refers to the processed food industry that sells mostly through the major retail stores.

d)Health Food Industry

(i) Non-Retail

There are several manufacturers in Australia in the Health Food Sector that are manufacturing products that have buckwheat as an ingredient such as breakfast foods, pasta, bread flour, pancake mixes, savoury and sweet snack foods plus pre-packaged whole groats for in-home use.

The total consumption of Australian grown buckwheat for the health food industry is around 120 tonne per annum. (*Source: broad industry discussions*) This sector of the industry is growing and will continue to do so based mainly on increases in food allergies and/or intolerance's. The continuing trend toward individual healthy eating habits and commercial "intake control/portion control" eating programmes will ensure continued growth in buckwheat consumption (*e.g. Jenny Craig P/L*).

In order to increase the volume of Australian buckwheat that is consumed in this sector of the market, we would be required to demonstrate that Australian buckwheat is more nutritious or safer than the cheaper imported alternatives. Both these aspects are difficult to prove chemically (*as can be seen in*

Chapter 2 of this report) and as such if we increase consumption of buckwheat in the health food sector, the increases may well be shared with cheaper imported buckwheat.

The suggested way to increase consumption in this sector of the food industry is consumer education regarding the benefits of consuming quality assured Australian buckwheat and promotion of buckwheat in-store and in the print/radio media. It is estimated that to produce and complete an educational and promotional programme (including market research) for a range of buckwheat products, the estimated cost is in the order of A$65,000 for a 1 month intensive programme followed by low level reminders on a bi-monthly basis, for 12 months. At this time there are no individual operators in the health food sector that are willing to make this investment in buckwheat.

(ii) Retail

The retail sector no longer demands new line listing fees for major supermarket chains. In lieu of this historical charge, the supplier must convince the retailer that the new product has received sufficient market research and is supported by a national advertising programme. In addition, the trading terms would reflect the category (minimum of 13.5% for dry grocery and increasing for cool chain products) and an agreed promotional programme. If agreed target sales numbers are not reached within the specified time frame then the product would be deleted from the shelves.

The estimated cost to nationally launch a new product into retail is between A$250,000 and A$500,000 dependent on the market research and the advertising/promotion strategy. The more logical way to approach a new product is to include buckwheat as an ingredient to allow a new variant to be included in an existing product range. However to date the “main stream” breakfast cereal, bread, biscuit and pasta markets have chosen not to adopt ideas presented to them by the buckwheat industry

Chapter Two

Food Value Analysis – Australia Compared to North America

Comparative analysis between the food value of Australian buckwheat with published analysis from the Northern Hemisphere.

A significant issue of concern in promoting the use of Australian grown buckwheat to the Australian food industry is that success may simply lead to increases in the level of imported buckwheat. This potential increase in imports would be driven by a significant price advantage of imports over Australian produced products (current prices for buckwheat from China are more than 35% cheaper than Australian grown product on a year round basis delivered capital city).

We have empirically demonstrated that buckwheat produced in the Northern Hemisphere is chemically and functionally comparable to that produced in Australia. To demonstrate this fact we retained the services of the Victorian State Chemistry Laboratory to analyse multiple buckwheat samples grown in Australia and then compared these results to published data from buckwheat grown in the Northern Hemisphere.

Following is a brief explanation of the Australian sample numbers analysed in *Appendix K:*
0305099-01A : Japanese landrace grown in Queensland for Kialla Pure Foods (KPF) during Autumn 2003
0305099-02A : Tasmanian sample A grown during the 2002/2003 season (H'wood A)
0305099-03A : Tasmanian sample B grown during the 2002/2003 season (H'wood B)
0305099-04A : Kitawase variety grown in Victoria for Australian Specialty Seeds from the 2000/2001 season (ASS00/01)

The most deficient essential amino acid in plant proteins is lysine. Buckwheat has a high level of lysine (especially when compared to cereals), that approaches levels found in pork meat and as such is highly regarded in diets that contain little or no meat, eggs and/or fish. Lysine levels in buckwheat do not diminish over time and comparative results from four Australian grown buckwheat samples exhibit levels of lysine that approximate the same levels as buckwheat grown in North America. [*see Appendix K Table 1:001(a)]*

Linolenic Acid levels were compared between current season grain and 2 year old Australian grown buckwheat. This comparison was carried out in order to simulate the effects of aging on grade standard of entire buckwheat grain (*grain with entire hull*). The conclusion from this work would suggest that if the seed is left entire then there is very minimal degradation in fatty acid profiles due to the effects of oxidative rancidity [*see Appendix K table 1:001 (b*)].

Storage conditions will influence the degree of degradation in buckwheat grade standard over time. High temperatures (plus a large diurnal range in temperatures), exposure to sunlight and high moisture, will all increase the rate of oxidative rancidity and general reduction in buckwheat grade standard.

However the samples analysed [see *results in Appendix K table 1:001(a) & (b)]* were all stored in ambient conditions, with sample ASS00/01 stored under ambient conditions for 2 years following harvest during the 2000/2001 Victorian growing season.

Chapter Three

Nutraceuticals and Functional Food Ingredients

Investigation into the potential for buckwheat derivatives such as flavanoid rutin and D-chiro-inositol into nutraceuticals or as functional food ingredients.

Significant work has been done on the analysis of buckwheat fractions at Cornell University, New York. The link between type 2 Diabetes and a deficiency of D-chiro-inositol appears well documented. (*Source: Kathryn J Steadman et.al. J. Agric. Food Chem. 2000. 48, 2843-2847*)

MinnDak Growers have taken out a patent over the fagopyritols (similar in structure to a galactosamine D-chiro-inositol) discovered in buckwheat.

To date there have not been any commercial releases of nutraceuticals from this programme in the Western world, due in large part to the fact that more epidemiological studies need to be done, especially to determine the effect the human gut has on the extracted fagopyritols. MinnDak growers fagopyritol patent means product development outside North America is unlikely.

Flavonoid rutin is also an extract available from buckwheat. However there are many more commercially competitive sources of rutin for extraction.

Some sources are:
a) Aspalathus linearis, [commonly known as "Rooibos" (Red Bush), found in the Cedarberg region of the Western Cape, South Africa].

b) Citrus Fruits (especially in the pith)

c) Nicotiana glauca (Tree Tobacco – Solanaceae Family)

d) Capparis spinosa L. (caper) possesses flavonoids, in particular rutin - the most abundant flavonoid in the plant.

e) Eucalyptus: E. youmanii, E. macrorhyncha and E. globulus (Labille): (blue gum, stringy bark tree, Tasmanian blue gum) are all utilised. The leaves are collected from the 4th year of plantation and rutin levels remain high for at least 20 years (*source: Whitman, B.W.)*

f) Dimorphandra mollis Benth (a native of Brasil) is also a valuable source of rutin. (*see Appendix J*)
It is most unlikely that nutraceutical developments using rutin and fagopyritol extracts from buckwheat will use Australian grown buckwheat. International marketing success with buckwheat extracts may see an increase in demand for Australian buckwheat, but this is problematic.

Chapter Four
Communications Strategy

Detailed report on future industry links and networks improved by the implementation of a communications strategy [i.e. web site plus Australian Buckwheat Industry Directory made up of a) Export Operators b) Domestic Manufacturers, Processors and Re-Packers c) Government Agencies d) Importers].

1 - The Australian Buckwheat Industry Directory has been completed and distributed to interested parties. (*see Appendix A*)

2 – The web site has been developed and is being installed on the external DPI site.

Chapter Five
Crop Modelng and Climate Prediction

Climate prediction has been demonstrated to impact on the future of buckwheat production in Australia (this report uses detailed analysis in Victoria to support this position).
Detailed crop modeling has been employed to determine the most appropriate sites in Victoria for buckwheat production. The areas that are most suitable on a crop physiology basis are also the areas that are generally least suited to mechanisation and are also most suited to competitive high value intensive horticultural/agricultural and tourist/commercial pursuits.

Buckwheat Suitability
Project Brief

Part 1
Description
The purpose of this project is to identify the capability of Victoria to produce consistent high-grade buckwheat crops. *Part 1* of the project involved an analysis of Buckwheat suitability across Victoria. The Land Suitability Model (LSA), developed by the Strategic Resources Planning Unit has been adjusted for buckwheat in consultation with the Author to ensure that the model is appropriate to the project requirements, and also the scale and availability of input data. This part of the project provides a first cut analysis of buckwheat suitability across the State. This analysis is then used to identify areas that are potentially suited to buckwheat production, which are further investigated in the second stage of the project. Due to the broad scale of the analysis, existing climate data has been used, which has a spatial resolution of 2.5km (map scale 1:250,000). Areas of public land have been super-imposed over the final output.

The two climate variables that are most critical to buckwheat production are the lack of reliable summer rainfall and the number of days during the flowering period that are greater than 28° Centigrade. Both these variables have been investigated to determine likely changes under both moderate and extreme climate change scenarios for the years 2020 and 2050. The investigation of these climate variables highlights the potential for buckwheat suitability to be impacted by climate change. This is further investigated in *Part 2.*

Outputs
- A3 colour map that depicts buckwheat suitability across Victoria. A four level suitability index from high to low has been used.
- Brief description and interpretation of the final map that describes the main factors that influenced the overall outcome.
- Change detection maps show the projected change in the occurrence of days greater than 28° Centigrade for December, January and February under both a moderate and extreme climate change scenarios. The change has been analysed for 2020 and 2050 relative to a base year of 2000.
- Change detection maps show the projected change in the occurrence of frost days (<2° Centigrade for December, January and February) under both moderate and extreme climate change scenarios. The change has been analysed for 2020 and 2050, relative to a base year of 2000.

Part 2
Description
Part 2 of the project will focus on the areas of interest identified in *Part 1* at a finer spatial resolution. The LSA model developed for *Part 1* will be applied with an adjustment to the definition of extreme heat days (reduced to 28° Centigrade from 30° Centigrade). A significant component of this project was the development of fine scale climate data using satellite images from the MODIS sensor.

The spatial resolution of the MODIS sensor is 1km, which will enable a better resolution for input into the buckwheat suitability model. The final result will be super-imposed with public land layer, and also where appropriate a data layer that shows areas of timber plantations on private land. The removal of these areas from consideration will significantly improve the usefulness of the final output.

Furthermore, the potential impact of climate change on buckwheat suitability will be further investigated. This will involve running the buckwheat suitability model using the climate data generated *OzClim*, which was developed by CSIRO. This tool allows the development of climate data based on both extreme and moderate climate change scenarios. The climate data generated will be used as inputs to the model to determine the potential impact on suitability for the years 2020 and 2050. The spatial resolution of this data is 5km.

This data from Part 2 is not available for inclusion in this final report, but should be available from Chris Bluett, DPI Ballarat Office (402-406 Mair Street, Ballarat VIC 3350. Phone +61-3-53336790) by late August.

Outputs
- Set of A3 colour maps depicting land suitability for selected areas in Victoria. The suitability maps are displayed using a four level hierarchy.
- Set of A3 colour maps show impact of both extreme and moderate climate scenarios on buckwheat suitability across Victoria over the period 2000 to 2050.
- Brief explanations and interpretations of map outputs focusing on the main contributing factors to the final outcome.

Methodology Adopted:
The methodology used to assess land suitability for buckwheat production focused on innovative approaches such as *Multiple Criteria Evaluation* (MCE) and the *Analytic Hierarchy Process* (AHP).

MCE methods have been developed to improve decision making when considering multiple objectives/criteria and conflicting preferences or priorities (*Source: Bojorquez-Tapia, et al, 2001; Bantayan and Bishop, 1998*). MCE is an effective decision-making tool for complex issues that uses both qualitative and quantitative information. MCE, as applied in this study, results in a spatial map that combines all the necessary criteria information to form a single, composite index of evaluation.

The AHP is a MCE method that orders critical factors into a hierarchy of importance (*Source: Saaty, 1995*). This improves the reliability of the mapping because not all factors have equal importance (or weighting). AHP also allows criteria to trade-off against one other, depending on the importance of the weights assigned to them. Furthermore, AHP can deal with criteria that are interdependent, both from the effect on land and in the interaction between spatial units. (*See Appendix D*)

Interpretation of Results:
The data presented from stage 1 shows that buckwheat is suitable for areas in proximity to the coastal strip and the higher parts of the North Eastern ranges plus parts of the Central Highlands. The state wide statistics show the following areas that are suitable and unsuitable for buckwheat production in Victoria as at calendar year 2000:

Area Calculations for **Victoria**
(Including public land).
Current Total Land Suitability for Buckwheat
Relates to suitability map June 2003

Restricted =	20,610,716 ha
Very Low =	0 ha
Low =	0 ha
Moderate =	1,008,625 ha
High =	1,127,509 ha

As can be seen from the map in *Appendix E*, much of the area deemed as suitable according to the model is well suited to alternative uses. Stage 2 will show the results with private forestry removed, thus providing a much more appropriate assessment of land suitable for Victorian buckwheat production.
As can be seen from two selected critical climate prediction factors (extreme temperatures and rainfall) there is a significant decline in areas that exhibit high suitability for buckwheat production in Victoria between 2000, 2020 & 2050. The maps in *Appendices F, G, H & I* do not exclude public land or private forestry.

The Australian production area that is predicted to increase most in the future is the Darling Downs area of southern Queensland (production occurs in the Autumn months in southern Queensland and this reduces the effects of high temperatures and reduced summer rainfall). From the 2002/2003 season, the Darling Downs constituted more than 60% of the total Australian buckwheat production.

In addition to the climatic advantages offered by Autumn production in the Darling Downs, this region also posseses the following:
i) It is a broad acre grain producing area with excellent soils and large individual farms
ii) There are growers with traditional broad acre grain growing expertise and
iii) There is ready availability of appropriate grain production equipment.

Chapter Six
Where to From here?

Suggestions for the future involvement of Government Agencies in the development of buckwheat in Australia.

Recommended support for the buckwheat value added food industry could come in the form of Government support measures that are currently operating (examples of Government support are listed in A*ppendix L*).

The processed food sector is a major contributor to Australia's manufacturing industry. It is the second largest value added industry in the Australian manufacturing sector, with a share of 18.8%. The Australian processed food and beverage industry had a turnover of A$46.6 billion in 1998-99 and this is almost double that of agriculture. (*Source: ABS Cat No. 8221.0).* The Federal and State Governments support agribusiness innovation and development with the programmes exhibited in *Appendix L.*

Future Directions:
In order to ensure that buckwheat maintains "information currency" from an agronomic perspective, there are two recommendations for future Government involvement in the industry:

a)The Agronomy and Soil Science Unit of the University of
New England (UNE) should be retained to carry out bi-annual reviews of plant breeding developments in North America, Eastern Europe and China.
The reviews would take the form of desktop research based on the parameters that we know to be important to the Australian agronomic environment. Any worthwhile developments emanating from the desk research would then be recommended for field trials in the appropriate geographic location in Australia.

b)Australia wide published data be maintained in a
contemporary state, as developments arise from Industry programmes and also from the proposed UNE agronomic programme. This would require the appointment of a "focal point" person within Government departments. The Victorian Department of Primary Industries (DPI) has been the lead Government player in Buckwheat R&D in Australia and as such has amassed a great breadth of knowledge. It is recommended that DPI therefore be involved in any discussion with regard to any potential industry "focal point".

Appendices:

APPENDIX A) Australian Buckwheat Traders/Processors/Importers:

1. *Australian Specialty Seeds*
RMB 182,
Smeaton VIC 3364
Phone 03-53456431 Fax 03-53456442
Email: highleaz@netconnect.com.au
Attention: David Toose or Bill May

2. *Bartlett Grain Pty Ltd*
Suite 2, Level 3, North Tower Chatswood Central
1-5 Railway Street,
Chatswood NSW 2067
Phone 02-99046699 Fax 02-99046188
Email: bwb@bartlettgrain.com
Attention: Brian or Carolyn Bartlett

3. *Buckwheat Enterprises Pty Ltd*
Goobang Junction
PO BOX 71
Parkes NSW 2870
Phone 02-68625954 Fax 02-68623580
Email: bio-oz@bigpond.net.au
Attention: Geoff Brown and Bevan Johnson

4. *HakuBaku Australia Pty. Ltd.*
7 Waringa Drive
Wendouree VIC 3355
Phone 03-53399534
Fax 03-53395789
Attention: Hiro Miyaji

5. *Kialla Pure Foods*
342 Greenmount Etonvale Road,
Greenmount QLD 4359
Phone 07-46970300
Fax 03-46971261
Kiallafoods@bigpond.com
Attention: Graham McNally

6. *Lidgerwood Seeds Pty Ltd*
3810 Cape Otway Road,
Birregurra VIC 3242
Phone 03-52362015 Fax 03-52362383
Email: lidseed@gsat.net.au
Attention: Don & Jane Lidgerwood

7. *Micronised Foods*
15 Catalina Drive
Tullamarine VIC 3043
Phone (03) 9338 3911
Attention: Phil Delacretaz

8. *Peters Commodities*
Level 14, 520 Collins Street,
Melbourne
Phone 03-96145000
Attention: Michael Oxley

9. *Scalzo Food Industies*
160-174 Kensington Road
Kensington VIC 3031
Phone 03-92457000
Fax 03-92457050
Email: sales@scalzofoods.com.au
Attention: Michael Scalzo

10. *JR Tokai Australia P/L*
Suite 3301,
AMP Centre
50 Bridge Street,
Sydney NSW 2000
Phone 02-92321833
Fax 02-92234428
Email: tokai-na@magna.com.au
Attention: Hirohide Kawai

11. *University of New England*
Department of Agronomy and Soil Science
Armidale NSW 2351
Phone 02-67732522
Fax 02-67733238
Mfittle@metz.une.edu.au
Attention: Mike Fittler and Robin Jessop

12. *Zizz Industries Pty Ltd*
5A Carinish Road,
Oakleigh South VIC 3167
Phone 03-95435511 Fax 03-95435022
Email: sdtp@hotmail.com
Attention: Alice Lee or Crystal Jia

Although not wanting to be part of a formal Industry group at this stage, there is one significant omission from the list:

13. *Heazlewood Seeds*
558 Whitemore Road
Whitemore TAS 7303
Phone: 03-63973458 Fax 03-63973112 Mobile 0418-133887
Attention: Brenton Heazlewood.

APPENDIX B) Buckwheat Allergens

As indicated by several case reports, buckwheat contains very potent allergens, which may cause various types of allergic reactions, including asthma and anaphylactic shocks. The allergens seem to be a thermostable proteins with a high molecular weight. The pathomechanism is type I, which means it is an IgE mediated immediate type reaction. Because the antigenicity of buckwheat is extremely strong, hyposensitivity treatment with buckwheat extracts should not be applied because of the risk for severe and dangerous reactions (*Source: Wieslander, Gunilla & Norback, Dan*).

APPENDIX C) Buckwheat Sprouts – Market Research

Below is the survey form and summary results that emerged when this survey form was completed by 527 people during December 2002.
If you have any additional comments then please type them under the word COMMENTS in the right hand column and when you have completed all your responses simply hit the reply with history tab at the top of this email.

1 - DO YOU BUY SEED SPROUTS?	If your answer is "NO" then you are finished. THANK YOU. If your answer is "YES" then please go to question 2.
2 - ARE YOU A REGULAR SEED SPROUT BUYER?	If your answer is "NO" then you are finished. THANK YOU. If your answer is "YES" please complete questions 3,4, 5 a or 5 b & 6.
3 - HOW OFTEN DO YOU BUY SEED SPROUTS?	COMMENTS
4 - DO YOU BUY GREEN ONLY,BLANCHED ONLY OR GREEN & BLANCHED SEED SPROUTS?	COMMENTS
5 A- IF YOU BUY GREEN SPROUTS, WHY DO YOU BUY GREEN SPROUTS IN PREFERENCE TO BLANCHED?	COMMENTS
5 B - IF YOU BUY LIGHT COLOURED OR BLANCHED SPROUTS, WHY DO YOU BUY THEM IN PREFERENCE TO GREEN SPROUTS?	
6 - If a new seed sprout product were marketed that tasted great, looked good and cost the same as your current sprouts, but had a high rutin level (rutin is a proven ingredient in reducing vascular disease and the incidence of non insulin dependent diabetes), would you try?	COMMENTS

SUMMARY OF Ballarat RESPONDENTS:

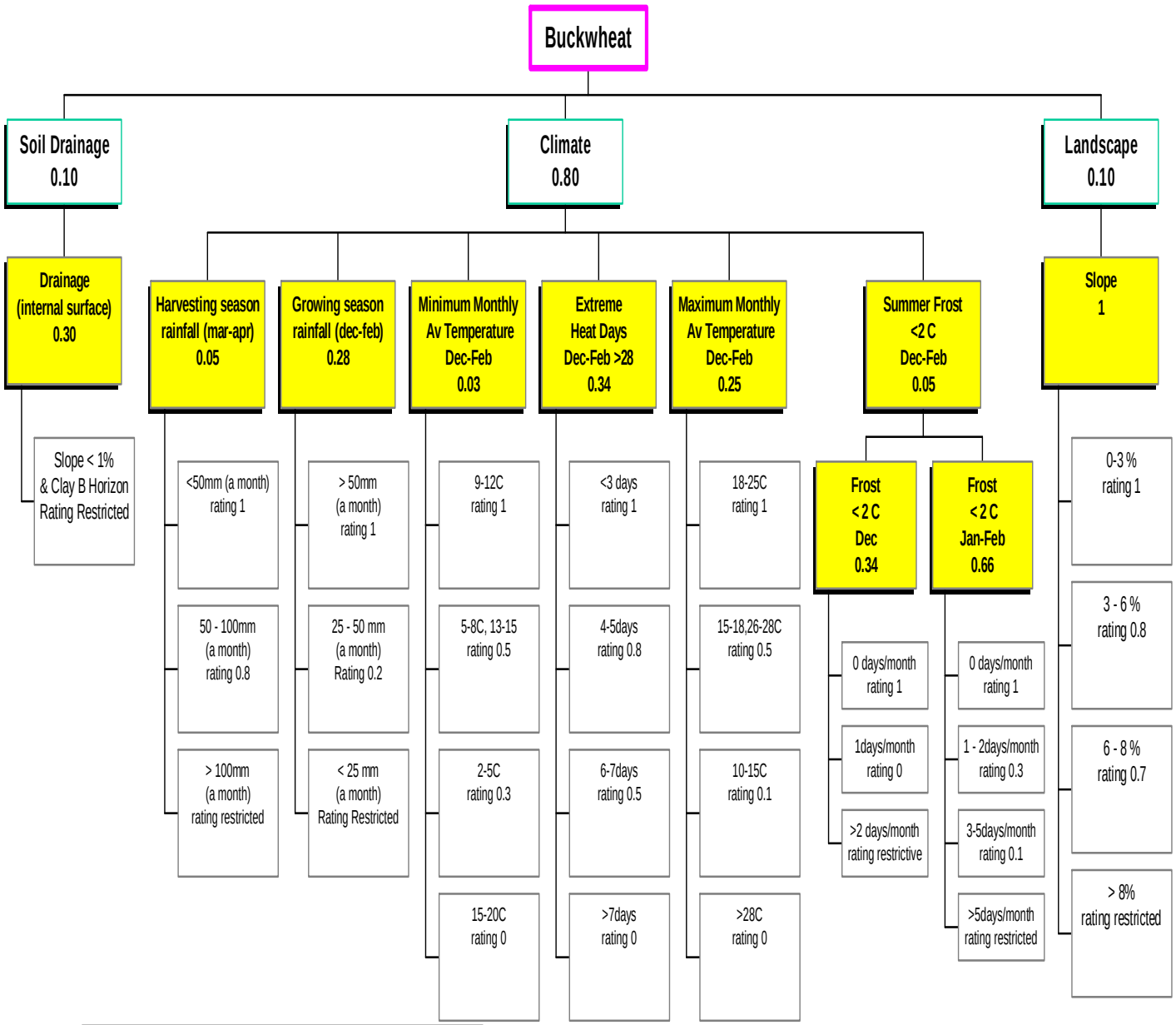
Total respondents	84
Regular sprout buyers	38%
Frequency of purchase for regular sprout buyers:	
a) Weekly:	6 respondents (19% of regular sprout buyers)
b) Fortnightly:	26 respondents (81% or regular sprout buyers)
Occasional sprout buyers	25 respondents (30% of total respondents)
Non sprout buyers	27 respondents (32% of total respondents)
Regular buyers who prefer green sprouts:	80%
Regular buyers who prefer green &/or blanched:	14%
Regular buyers who prefer blanched:	6%
Regular buyers who would try new buckwheat type:	33%

SUMMARY OF Melbourne RESPONDENTS:

Total Respondents	443
Regular sprout buyers	13%
Frequency of purchase by regular sprout buyers:	
a) Weekly	19 respondents (32% of regular sprout buyers)
b) Fortnightly	39 respondents (68% of regular sprout buyers)
Occasional sprout buyers	120 respondents (27% of total respondents)
Non sprout buyers #	270 respondents (60% of total respondents)
Regular buyers who prefer green sprouts:	57%
Regular buyers who prefer green &/or blanched:	37%
Regular buyers who prefer blanched:	6%
Regular buyers who would try new buckwheat type:	15%

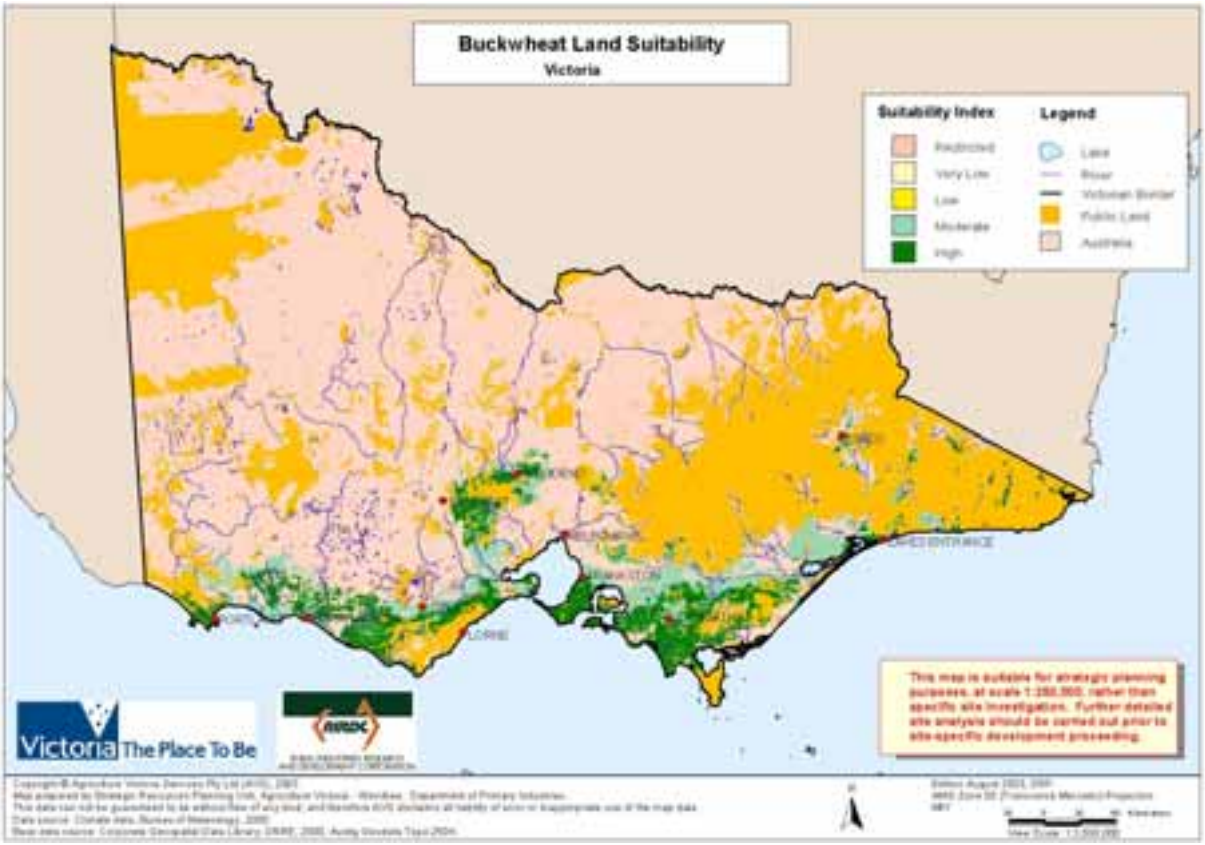
APPENDIX D)

BUCKWHEAT LAND SUITABILITY
Biophysical AHP Model
Best Managed at 1 -2 tonne/ha/yr

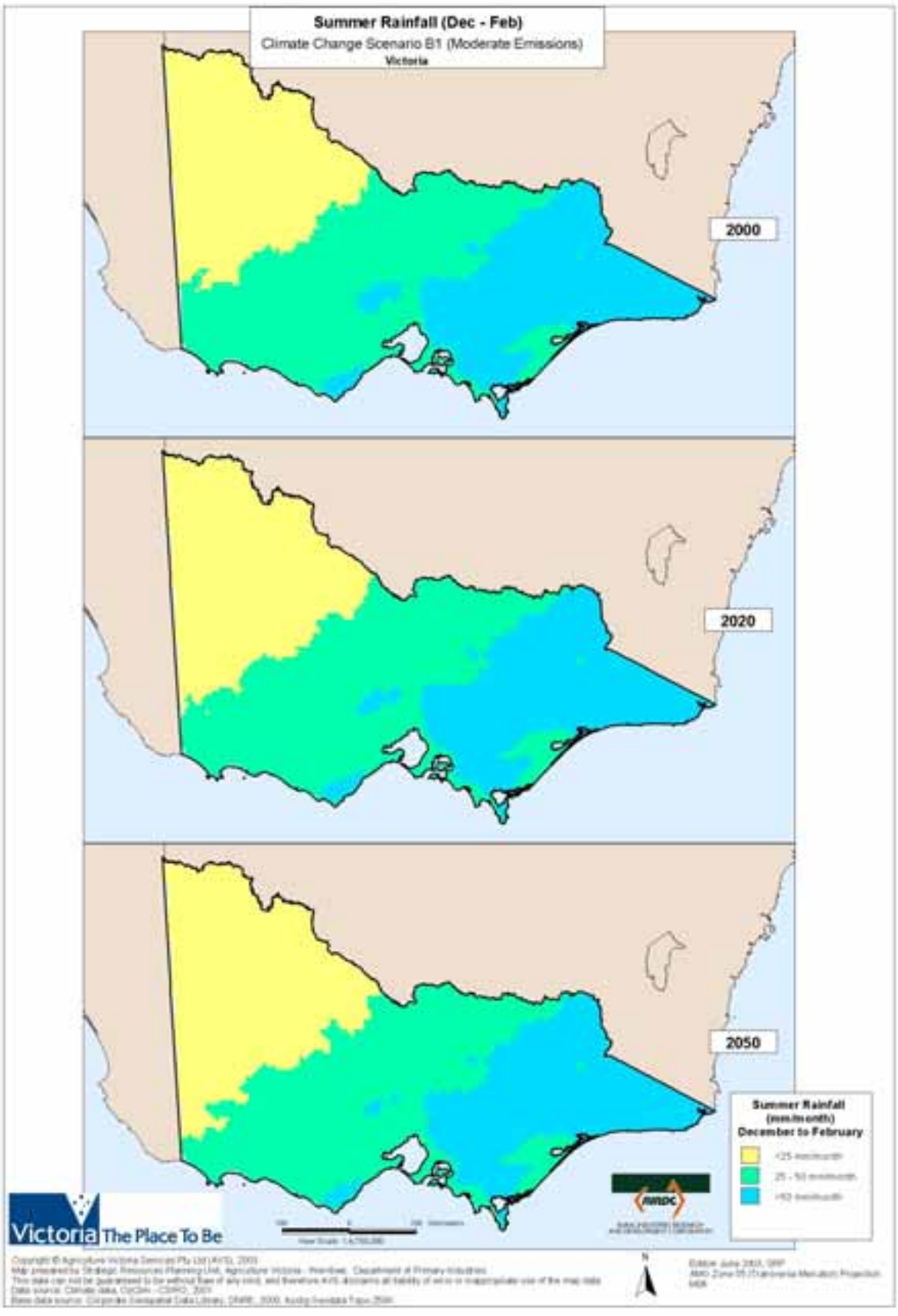


Model Updated: 18-03-2002
Experts: Rob Death
Edited: SC 28/05/03

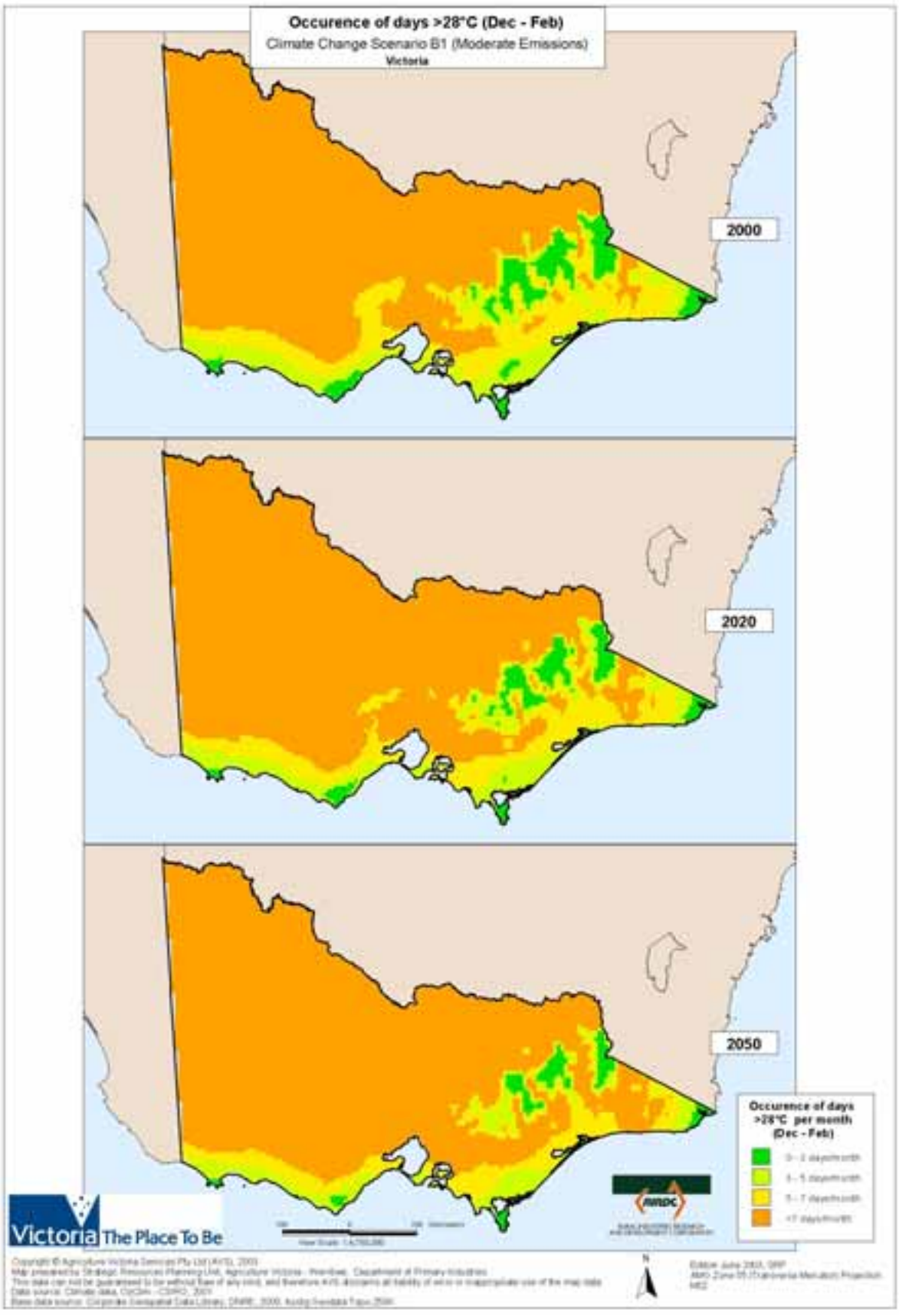
APPENDIX E)


Buckwheat Land Suitability
Victoria
Suitability Index
Legend
Victoria The Place To Be

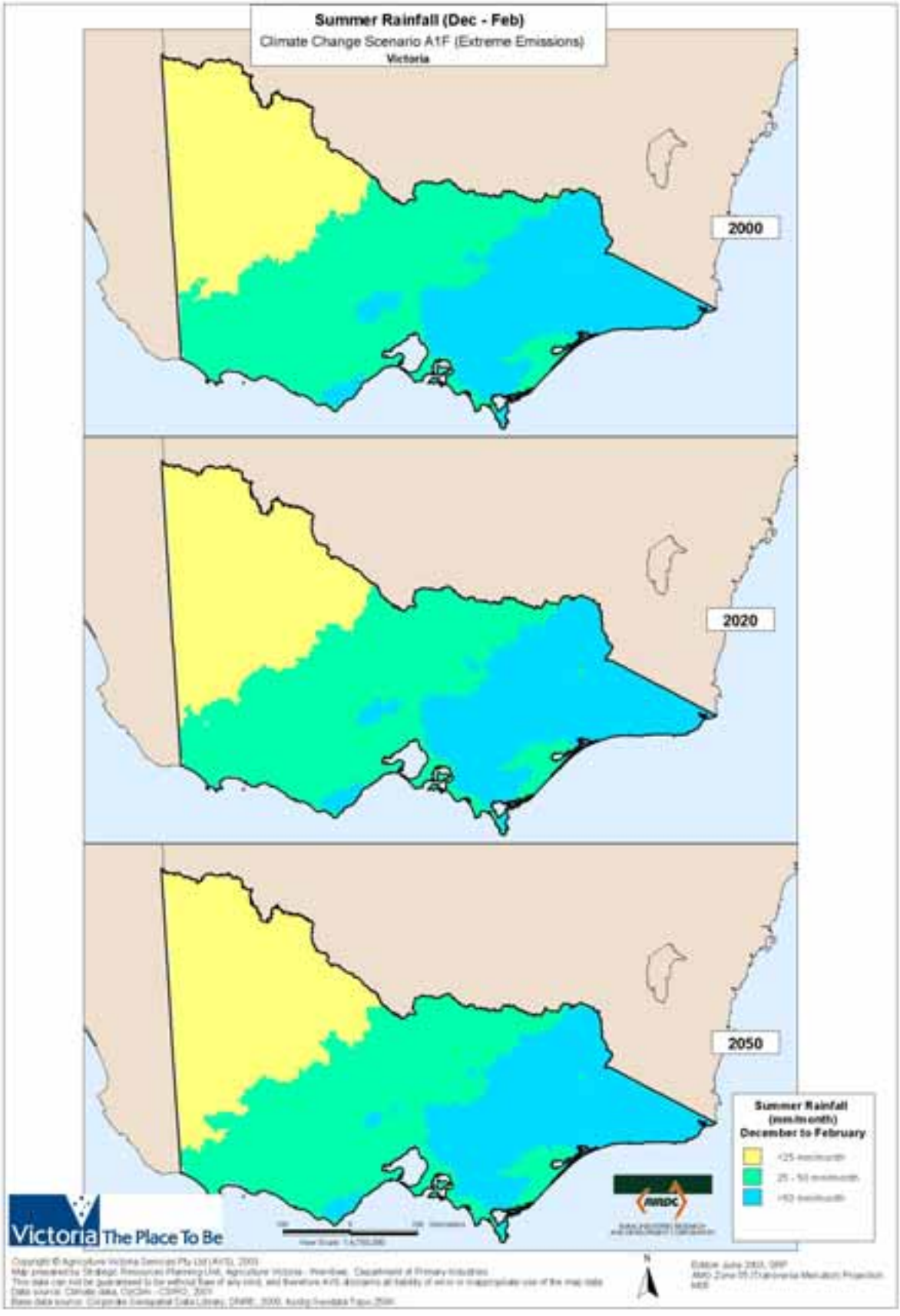
APPENDIX F)


Summer Rainfall (Dec - Feb)
Climate Change Scenario B1 (Moderate Emissions)
Victoria
2000
2020
2050
Summer Rainfall
(mm/month)
December to February
Victoria The Place To Be

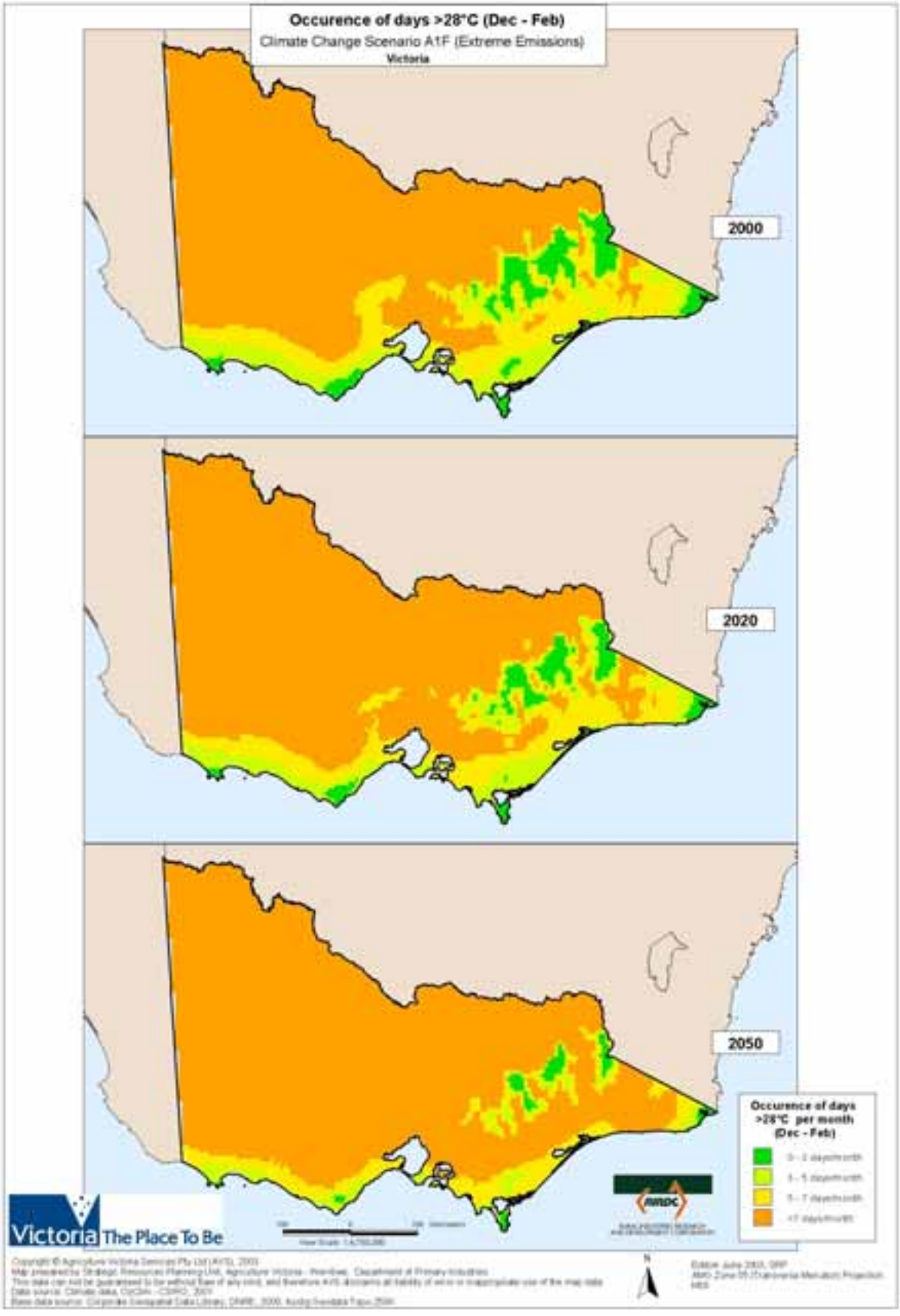
APPENDIX G)


Occurence of days >28°C (Dec - Feb)
Climate Change Scenario B1 (Moderate Emissions)
Victoria
2000
2020
2050
Occurence of days >28°C per month (Dec - Feb)
Victoria The Place To Be

APPENDIX H)


Summer Rainfall (Dec - Feb)
Climate Change Scenario A1F (Extreme Emissions)
Victoria
2000
2020
2050
Summer Rainfall
(mm/month)
December to February
Victoria The Place To Be

APPENDIX I)


Occurence of days >28°C (Dec - Feb)
Climate Change Scenario A1F (Extreme Emissions)
Victoria
2000
2020
2050
Occurence of days >28°C per month (Dec - Feb)
Victoria The Place To Be

APPENDIX J)

Below is an example of a rutin based product produced in Xi'an, China, from a local vegetative source (China is the worlds largest producer of buckwheat however they do not generally use buckwheat to extract Vitamin P – rutin).

Rutin

Herbal source: Dry bud of Chinese Sophora
Latin name: Sophora flavescens Ait
Molecular formula and Molecular weight: C27H30O16 ; 610.51
Constitutional formula:
Description:
Rutin is a natural bioflavonoid, listed in the US Pharmacopoeia (USP) which is extracted in Brazil from Dimorphandra mollis. Bioflavonoids are reported to have antioxidant properties and to be vital in their ability to increase the strength of the capillaries (blood vessels) and to regulate their permeability.
Bioflavonoids such as Quercetin, Rutin, and Hesperidin are vital in their ability to increase the strength of the capillaries (blood vessels) and to regulate their permeability. They assist Vitamin C in keeping collagen, the intercellular "cement" in healthy condition; are essential for the proper absorption and use of vitamin C; prevents Vitamin C from being destroyed in the body by oxidation; beneficial in hypertension; helps hemorrhages and ruptures in the capillaries and connective tissues and builds a protective barrier against infections.

http://www.huikes.com
Tel:029-2607541 2607816 7585420
Fax:029-2606529
E-mail: market@huikes.com huike@public.xa.sn.cn

APPENDIX K)

TABLE 1:001(a)

SAMPLE NUMBER		**1 QLD**		**2 TAS**		**3 TAS**		**4 VIC**	Nth America
Test	0305099-01A	0305099-01A	0305099-02A	0305099-02A	0305099-03A	0305099-03A	0305099-04A	0305099-04A	Public Data
	KPF	KPF	H'wood A	H'wood A	H'wood B	H'wood B	ASS 00/01	ASS 00/01	
Amino Acids	**g/100g**	**g/16gN**	**g/100g**	**g/16gN**	**g/100g**	**g/16gN**	**g/100g**	**g/16gN**	**g/100g**
Alanine	0.53	4.61	0.47	4.35	0.50	4.42	0.49	4.62	
Ammonia	0.33	2.87	0.31	2.87	0.32	2.83	0.38	3.58	
Arginine	1.26	**11.0**	1.21	**11.2**	1.26	**11.2**	1.18	**11.1**	**0.9**
Aspartic acid	1.13	9.83	1.04	9.63	1.10	9.73	1.05	9.91	
Glutamic acid	2.02	17.6	1.91	17.7	1.98	17.5	1.92	18.1	
Glycine	0.73	6.35	0.66	6.11	0.69	6.11	0.67	6.32	
Histidine	0.38	**3.30**	0.36	**3.33**	0.37	**3.27**	0.35	**3.30**	**0.33**
Isoleucine	0.48	**4.17**	0.43	**3.98**	0.46	**4.07**	0.45	**4.25**	**0.46**
Leucine	0.80	**6.96**	0.73	**6.76**	0.77	**6.81**	0.75	**7.08**	**0.84**
Lysine	0.70	**6.09**	0.66	**6.11**	0.68	**6.02**	0.66	**6.23**	**0.77**
Phenylalanine	0.56	**4.87**	0.50	**4.63**	0.54	**4.78**	0.53	**5.00**	**0.56**
Proline	0.50	4.35	0.41	3.80	0.47	4.16	0.46	4.34	
Serine	0.65	5.65	0.60	5.56	0.63	5.58	0.61	5.75	
Threonine	0.48	**4.17**	0.44	**4.07**	0.46	**4.07**	0.44	**4.15**	**0.49**
Tyrosine	0.34	2.96	0.31	2.87	0.34	3.01	0.33	3.11	
Valine	0.68	**5.91**	0.59	**5.46**	0.63	**5.58**	0.62	**5.85**	**0.6**
Fat (Acid Hydrolysis)	3.1		3.1		2.9		3.1		
Protein (N x 6.25)	11.5		10.8		11.3		10.6		
Selenium ug/kg	45		21		27		15		
ICP Elements									**** USA**
Calcium %	0.05		0.05		0.03		0.03		0.02
Copper mg/kg	5.8		6.3		5.9		5.3		7.1
Iron mg/kg	20		190		58		31		30
Magnesium %	0.23		0.20		0.22		0.19		0.27
Manganese mg/kg	20		35		21		26		16.4
Phosphorus %	0.34		0.37		0.31		0.26		0.49
Potassium %	0.49		0.48		0.46		0.49		0.57
Sodium %	<0.01		<0.01		<0.01		<0.01		n/a
Zinc mg/kg	18		19		25		26		29

*** SOURCE: J. Sci. Food Agric. 81 1094-1100 Kathryn J Steadman et.al.*** SOURCE: Buckwheat: Pseudocereal and Nutraceutical by Steven Edwardson. Progress in New Crops: proceedings of the third national symposium. Indianapolis 1996*

TABLE 1:001(b)

SAMPLE #		**1 Q'LD**		**2 TAS**		**3 TAS**		**4 VIC**
SCL ID	0305099-01a	0305099-01a	0305099-02a	0305099-02a	0305099-03a	0305099-03a	0305099-04a	0305099-04a
Client ID	KPF	KPF	H'wood A	H'wood A	H'wood B	H'wood B	ASS00/01	ASS00/01
Name	%Area	**g/100g**	%Area	**g/100g**	%Area	**g/100g**	%Area	**g/100g**
C12:0	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1
C14:0	**0.2**	<0.1	**0.2**	<0.1	**0.2**	<0.1	**0.1**	<0.1
C15:0	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1
C16:0	**15.7**	**0.4**	**15.9**	**0.4**	**15.5**	**0.4**	**15.8**	**0.4**
C16:1	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1
C16:1 cis-9	**0.3**	<0.1	**0.2**	<0.1	**0.3**	<0.1	**0.2**	<0.1
C16:1 (total)	**0.4**	<0.1	**0.3**	<0.1	**0.3**	<0.1	**0.3**	<0.1
C17:0	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1
C18:0	**2.0**	**0.1**	**1.9**	**0.1**	**1.7**	<0.1	**2.1**	**0.1**
C18:1 cis-9 - Oleic	**36.8**	**0.9**	**36.1**	**0.9**	**34.1**	**0.8**	**37.8**	**1.0**
C18:1	**1.2**	<0.1	**1.2**	<0.1	**1.3**	<0.1	**1.1**	<0.1
C18:1 (total)	**38.0**	**0.9**	**37.3**	**0.9**	**35.3**	**0.8**	**38.9**	**1.0**
C18:2 cis-9 12 Linoleic	**32.3**	**0.8**	**33.9**	**0.9**	**35.5**	**0.8**	**32.2**	**0.8**
C18:3 cis-9 12 15 Linolenic	**2.0**	**0.1**	**2.1**	**0.1**	**2.3**	**0.1**	**1.8**	**<0.1**
C20:0	**1.4**	<0.1	**1.3**	<0.1	**1.3**	<0.1	**1.5**	<0.1
C20:1 cis-11	**2.9**	**0.1**	**2.7**	**0.1**	**2.9**	**0.1**	**2.5**	**0.1**
C20:2 cis-11 14	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1
C22:0	**1.6**	<0.1	**1.6**	<0.1	**1.7**	<0.1	**1.7**	<0.1
C22:1	**0.3**	<0.1	**0.2**	<0.1	**0.2**	<0.1	**0.1**	<0.1
C22:2 cis-13 16	**0.2**	<0.1	**0.2**	<0.1	**0.2**	<0.1	**0.2**	<0.1
C24:0	**1.4**	<0.1	**1.2**	<0.1	**1.4**	<0.1	**1.4**	<0.1
C24:1 cis-15	**0.1**	<0.1	**0.1**	<0.1	**0.1**	<0.1	**0.0**	<0.1
Others	**0.9**	**0.2**	**0.8**	**0.1**	**0.8**	**0.2**	**0.8**	**0.2**

Note: Highly Saturated Fats, especially Linolenic, will be subject to oxidative rancidity, especially after the hull is broken, removed, exposed to high temperature and/or other oxidative catalysts are present.

Linolenic breaks down to form peroxides that creates secondary rancidity - ends up as Hexanal - C6

APPENDIX L)

Government support initiatives for agribusiness

NFIS Food Chain Program (FCP)	The Food Chain Program (FCP) aims to build food industry skills, capability and knowledge in value chain management to drive the international competitiveness of the Australian food industry. Funding of up to $200,000 will be provided on a matching basis for food chain demonstration projects that meet the eligibility criteria. Funding will normally be provided in two stages: Up to $30,000 for the chain development phase Up to $170,000 for the chain implementation phase **Agency**: National Food Industry Strategy Limited (NFIS Ltd.) **Information**: www.nfis.com.au/business_foodchains.asp **Contact**: Ph: 1300 130 360
DIIRD Supply Chain Capital Program	The Supply Chain Capital Program aims to benchmark Victoria's performance, encourage businesses to adopt international best practices and improve performance across the whole value chain through collaboration. Two types of project funding is available under this Program: Benchmarking Supply Chain Performance projects are designed to help local companies increase their international competitiveness by adopting world best practice in supply chain management. The cost of participating is $8,000 with a grant of $5,000 available. Contact: Ph: 9651 9037 Supply Chain Collaboration projects will demonstrate how the collaborative use of supply chain tools can enhance processes along supply chains to reduce costs, improve business relationships, save time and expand sales. A grant of 50% of eligible project costs to a maximum of $25,000 is available. **Contact**: Ph: 9651 8006 **Agency**: Department of Industry, Innovation and Regional Development, Victoria **Information**: www.business.vic.gov.au/supplychaincollaboration/
AFFA New Industries Development Program (NIDP)	The New Industries Development Program (NIDP) is part of the Prime Minister's 'Backing Australia's Ability' strategy to support innovation, and accelerate agribusiness development and the revitalisation of regional Australia. The main activity of the NIDP is to provide competitive-based funding assistance for 'pilot commercialisation projects' (PCP) of new agribusiness products, technologies and services. Funding for PCPs is provided on a matching dollar-for-dollar basis with tha applicant, to a maximum NIDP contribution of $100 000 (net of GST). Three funding rounds are held each year. **Agency**: Agriculture, Fisheries and Forestry - Australia (AFFA) **Information**: www.affa.gov.au/agribiz **Contact**: Email: nidp@affa.gov.au or Ph: 1300 884 588

AFFA NIDP In-Market Scholarship	The New Industries Development Program (NIDP) is offering up to 15 In-Market Experience Scholarships to innovative Australian agribusinesses to enhance the rate of commercialisation of new niche agribusiness products, technologies or services. New, for the purpose of the Scholarship is defined as: where no significant capacity currently exists in Australia for the specified product, service or technology (that is, less than $1 million total sales per annum from Australian sources). **Agency**: Agriculture, Fisheries and Forestry - Australia (AFFA) **Information**: www.affa.gov.au/agribiz **Contact**: Email: nidp@affa.gov.au or Ph: 1300 884 588
AUSTRADE Export Market Development Grants (EDMG)	Austrade offers a range of export assistance programs to support export initiatives. The Export Market Development Grants (EDMG) scheme encourages Australian exporters to seek out and develop overseas markets. Under the scheme, eligible businesses are reimbursed for part of the exporting marketing costs incurred. The eligible expenditure categories are overseas representation; market visits; communications; free samples; trade fairs, literature and advertising; consultants and overseas buyers. The scheme provides a rebate of up to 50 per cent on eligible overseas marketing expenditures exceeding the first $15 000 per annum, to a maximum of eight grants. The maximum grant is $200 000 a year. To be eligible for a rebate a company must spend a minimum of $15 000 per annum on export marketing (first-time claimants can accumulate expenses over two years). Income must be less than $50 million in the grant year, and export earnings must be less than $25 million per annum. **Agency**: Australian Trade Commission (Austrade) **Information**: www.austrade.gov.au
AUSTRADE New Export Development Program (NEDP)	Under the New Export Development Program (NEDP) scheme, Austrade can identify up to five relevant contacts on the company's behalf for ONE selected market. Depending on what types of contacts specified, Austrade could report on potential buyers, import agents, distributors, manufacturers seeking licensing rights, etcetera. The scheme encourages participants to adopt a planned approach to export including careful readiness planning, as well as a subsequent visit to follow up with identified contacts. **Agency**: Australian Trade Commission (Austrade) **Information**: www.austrade.gov.au
DOTARS Regional Assistance Program (RAP)	The fundamental purpose of the Regional Assistance Program (RAP) is to generate employment in metropolitan, regional and remote Australia by encouraging local community action to boost business growth and create sustainable jobs. It provides seed funding for innovative, quality projects of value to the community. An amount of $30 million will be available annually to fund RAP projects nationally. This comprises different elements including: community-based projects, an amount for nationally significant projects and projects submitted in response to natural disasters, business incubators and the Indigenous Small Business Fund. **Agency**: Department of Employment, Workplace Relations and Small Business **Information**: www.dotars.gov.au/regional/rap/index.htm

DOTARS Foundation for Rural and Regional Renewal	The Foundation for Rural and Regional Renewal will provide a mechanism for the private sector to work with communities in regional Australia through grants for community capacity building, project facilitation and seeding grants for community and economic development initiatives. **Agency**: Department of Transport and Regional Services (DOTARS) **Information**: www.dotars.gov.au/regional
AUSINDUSTRY Commercialising Emerging Technologies (COMET)	This is the Commercialising Emerging Technologies (COMET) program of AusIndustry, within the Commonwealth Department of Industry, Science and Resources. The COMET Program focuses on innovation and its commercialisation. COMET is designed to increase the commercialisation of innovative products, processes and services, by providing individuals, early-stage growth firms and spin-off companies with a tailored package of support to improve their potential for successful commercialisation. **Agency**: AusIndustry **Information**: www.ausindustry.gov.au
AFFA FarmBis	FarmBis aims to enhance the business management skills of Australia's primary industry sector through education and training projects. Financial assistance will be provided through a discretionary grants program. FarmBis Australia will seek project proposals that aim to enhance the business management skills of Australia's agricultural industries through education, training and skills development. These projects should seek to improve the competitiveness, profitability and sustainability of agricultural, horticultural, pastoral, aquacultural and commercial fishing or apicultural industries within Australia. **Agency**: Agriculture, Fisheries and Forestry – Australia (AFFA) **Information**: www.farmbis.gov.au
DIIRD Generic Diagnostic Report (GDR)	The Generic Diagnostic Report (GDR), is an important first point of entry into the Enterprise Improvement process and is conducted by skilled consultants adequately qualified to address all business issues. The objective of the GDR is to analyse the enterprise and to identify and prioritise areas that require attention or change. The final report should establish a foundation from which to develop a strategic business plan. The GDR will: identify the key issues in priority order, to be addressed by the company; be part of an educational process to help facilitate attitudinal change; assist the company and client manager to assess the need of the business for further assistance; assess the readiness of the company and its management to undertake further enterprise improvement programs. The duration of the diagnostic review by the consultant will be approximately five days. A subsidy of 75% of the total cost to a maximum of $4,000 is available for eligible companies. **Agency**: Department of Industry, Innovation and Regional Development, Victoria **Information**: www.dsrd.vic.gov.au

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