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Feasibility of a sustainable

Bush food industry in Western Queensland

A pre-feasibility study for the
Rural Industries Research and Development Corporation
by
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"Feasibility of a Sustainable Bushfood Industry in Western Queensland"

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EXECUTIVE SUMMARY

A small but rapidly expanding bush food industry is already established in western Queensland, with two companies identified as being directly involved and at least two traditional grazing properties supplying raw produce. The current farm gate value of bush foods in western Queensland is estimated to be $37 350 and predicted to increase to almost $345 000 in the year 2000. The industry has been established since 1991, when Longreach Bush Tucker began trading with a major Sydney based company.

Nationally, the bush food industry is worth $5 million at the farm gate and $14 million retail and is predicted to increase to $100 million retail in the year 2000. The major arid zone, or outback, plants presently used provide wattleseed, dried bush tomato fruit and dried or fresh quandong fruit. These are harvested from gundabluey wattle, bush tomato and quandong plants. The major plants currently harvested in western Queensland are desert lime, native thyme, kurrajongs and bottletrees and wild orange. These seven plants have provided the focus for this report.

The bush food industry sees the establishment of plantation based production systems as essential to its future. Wild harvest production has been effective whilst the volume of demand is small, but as demand increases a reliable supply of high quality produce will be required. Bush food manufacturers have needed to cease production of some products, or reduce promotion efforts due to the unavailability of raw produce.

Over 50% of graziers in 14 of the 21 shires in western Queensland have indicated an interest in either wild harvest or plantation production of bush foods. This contrasts markedly with surveys conducted in the late 1980's where there was little or no interest in alternatives to grazing enterprises. The increasing profile of the bush food industry coupled with high potential gross returns and the perception after 5 years that the industry is here to stay may have influenced this increase in interest, but the prolonged slump in returns from both cattle and sheep would have contributed substantially.

Unfortunately not every property will be able to benefit from gross returns which range from $5 000/ha for wattleseed to $55 000/ha for native thyme leaf. Current levels of demand are basically fulfilled by wild harvest from various parts of Australia. Even the rapid increase in demand predicted over the next 3 to 4 years (74%) would only require 2.5 to 75ha of each species to be grown under plantation conditions to fill supply.

In the case of desert lime and native thyme, wild augmented production (the watering of plants in the wild) may suffice for the next 5 to 10 years. In the case of wattleseed, densities of gundabluey wattle (which bears the edible wattleseed) are so high that wild harvest may suffice for many years to come. Industry rumours suggest that bush tomato plantings on South Australia's southern York Peninsula are sufficient to meet current demand, and at least one plantation of arid species will soon be established in South Australia's riverland. The feasibility of 3 plantations in far western New South Wales are also being investigated. These

would concentrate on arid zone species and potentially be in direct competition with production from western Queensland.

Given this activity, western Queensland needs to act quickly and strategically to develop a coordinated bush food industry. This needs to be within the next 18 months if the region is to compete successfully with the other plantations being established around Australia. Effective regional research, development and marketing strategies (eg regional labelling and quality assurance programs) need to be developed cooperatively between government agencies and those companies and properties already involved in the industry in western Queensland. This will most urgently need to address marketing, production and supply issues.

The region also needs to define how it wishes to produce bush foods, and what area of Queensland should be involved in the industry as part of western Queensland. The shires of Waggamba, Tara, Chinchilla, Murilla and Taroom in the southern and western Darling Downs for instance, have desert lime present as regrowth in cleared grazing land and could therefore contribute positively to a regional strategy involving desert lime.

A decision tree approach (preferred species analysis) was developed to allow the selection of preferred species for use within a western Queensland bush food industry. This approach has applicability at any level, from states to regions to individual properties, and should also be applicable to any plant with bush food potential.

Desert lime, kurrajong, native thyme and quandong are worth investigating further, as may be wild orange, gundabluey and bush tomato. A survey of graziers identified other plants with food potential within western Queensland. These should also be investigated through the preferred species analysis for further consideration.

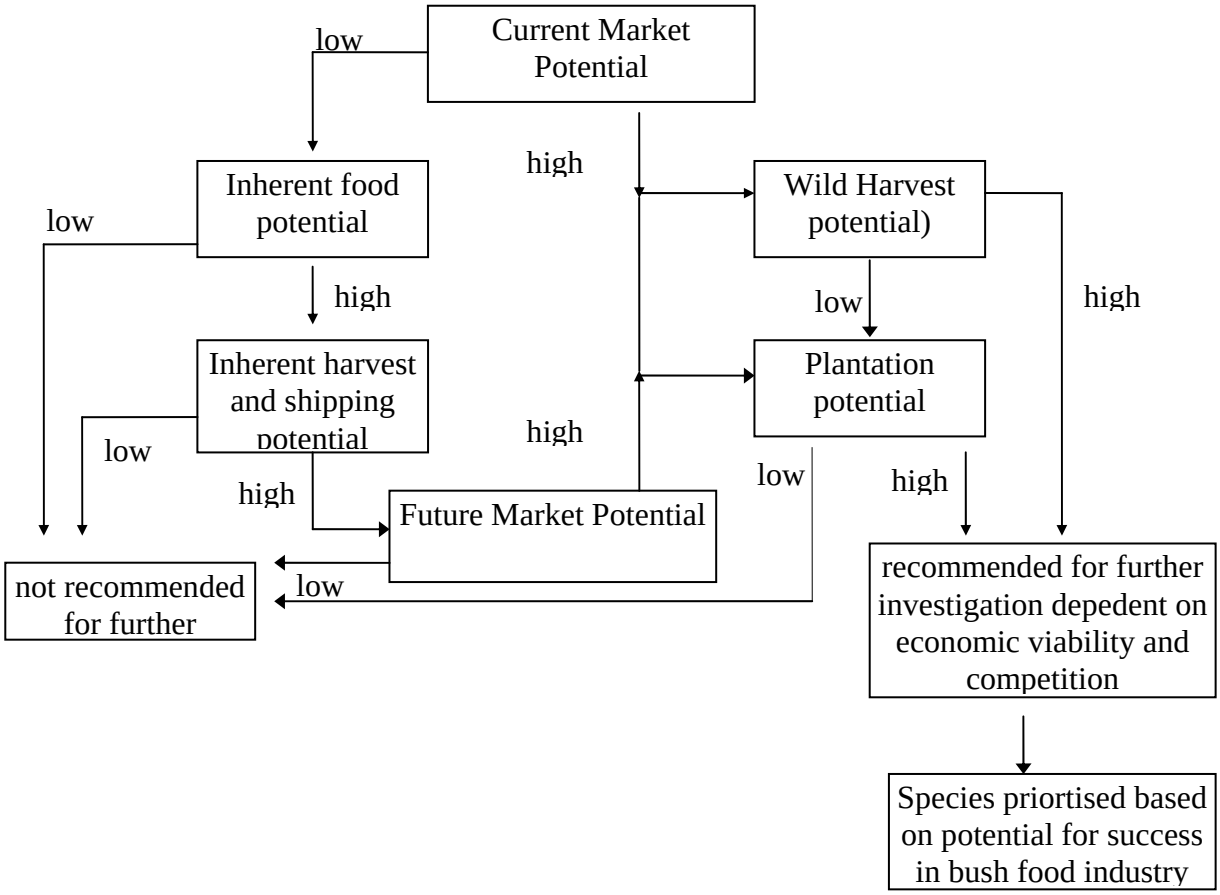
Further research is required in a number of areas, most notably:

- soil and water requirements (quality and quantity) need to be determined for the most promising bush food plants in western Queensland;
- the soil and water resource base available in western Queensland, possibly utilising a bioclimatic modelling approach, to define the areas suited to bush food plantations;
- innovative plantation design based on polycultural and organic principles that maximise efficiency of water use and maximise use of erratic rainfall patterns;
- case study analysis of the existing bush food companies and properties supplying raw produce in western Queensland to allow full cost benefit and economic analyses to be undertaken, and to provide comparisons with existing enterprises;
- actual plantation establishment costs, maintenance costs, water usage and cost and harvesting and associated costs is required to determine realistic returns on each species with potential; and;

- an indication of the current level of horticultural skills in western Queensland, and the development of training programs to increase these skills for effective plantation establishment and maintenance.

TECHNICAL SUMMARY

A decision tree approach was used to develop a method to define the preferred species to be further investigated. The approach reviews 6 major aspects of a species' potential within the bush food industry. These are: Current Market Potential; Inherent food potential; Inherent harvest and shipping potential; Future Market Potential; Wild Harvest potential; and Plantation potential. These aspects are then summarised through economic viability and competition aspects to determine if a species should be recommended for further investigation. Those species recommended are then priortised based on potential for success in the bush food industry.



The report uses a number of arid zone plants as an example of the way the decision tree operates, with desert lime, kurrajong, native thyme and quandong worth investigating further, and possibly gundabluey, wild orange and bush tomato.

1. INTRODUCTION

1.1 Background to the Project

Graziers and other sectors of society within the rangelands (Box 1.1) are currently facing increased economic pressures through low and erratic beef and wool prices. This often means that increased debts lead to increased stocking rates and land degradation. Extra income is needed through alternative enterprises to relieve grazing pressure on the country and financial pressure on rangeland residents.

Opportunities to diversify beyond sheep and cattle are limited, although there are some new industries emerging that may be well suited to these areas. These include kangaroo meat for human consumption, emu farming, aquaculture industries and the bush food industry.

According to the Draft National Strategy for Rangeland Management (ANZECC and ARMCANZ 1996), the rangelands occupy nearly 75% of Australia. They include arid and semi arid areas, well as some as higher rainfall areas north of the Tropic of Capricorn. Rainfall within the rangelands is generally low and erratic, with 58% of the rangelands used for grazing.

The rangelands contribute almost $15 billion to the nation's GDP from pastoralism, mining and tourism activities. Perhaps even more importantly, the rangelands have strongly contributed to Australia's identity. The rangelands are "the outback" or "beyond the black stump" with natural icons such as Ularu, the Olgas, Katherine Gorge and Kakadu co-existing with human tributes to Australia such as the Australian Stockman's Hall of Fame. In many people's eyes, the rangelands are Australia.

However, , the Draft National Strategy for Rangeland Management cites a number of problems within the rangelands, including the movement of young people out of the rangelands and a general decline in the population. More recently, this has been coupled with erratic beef and wool prices as well as drought, creating particular problems for the grazing industry and for towns reliant upon the grazing industry.

Box 1.1. Overview of Australia's rangelands.

Australia's bush food industry in currently worth $5 million at the farm gate and $14 million retail, with industry aiming to increase the retail value to $100 million in the year 2000 (Econsult 1996). Interest in harvesting and growing bush foods has been increasing in the semi-arid and arid rangelands of Australia over the last 5 years, with a wild harvest based industry increasing rapidly in size since its establishment in 1991. In 1994/95 a total of 0.9t of desert lime fruit was sourced in western Queensland and marketed to companies in Sydney and Adelaide. The demand in 1995/96 was 3.0t. Wattleseed, primarily the seed of gundabluey (Table 1.2) is also in strong demand, with a total market demand of approximately 7.5t. This is supplied primarily through wild harvest throughout Australia, particularly New South Wales and South Australia.

In addition to gundabluey and desert lime, there is a wide range of native plants with commercial potential in Australia's northern rangelands, and western Queensland in particular. These include bottletrees and kurrajongs, wild oranges, bush cucumbers, native thyme, quandongs, plumwood, bush tomatoes and warrigal greens. It is expected that a bush food plantation would increase individual property income significantly, with on farm prices ranging from $7 000/t for wild lime fruit to $55 000/t for native thyme leaf.

A feasibility study was required to test the true economic potential of establishing a bush food industry in the northern rangelands of Australia, focusing on western Queensland.

1.2 Study Terms of Reference

The objective of this study was to determine the economic viability of establishing a plantation or wild harvest based bush food industry in Australia's northern rangelands, focussing on western Queensland. Western Queensland has been defined as encompassing the 21 shires (Mt. Isa, Cloncurry, McKinlay, Richmond, Flinders, Boulia, Winton, Longreach, Aramac, Ilfracombe, Barcaldine, Jericho, Diamantina, Barcoo, Isisford, Blackall, Tambo, Quilpie, Murweh, Bulloo and Paroo) west of the Darling Downs and the Great Dividing Range, and south of the gulf (Fig. 1.1). Arbitrary groupings were made for recommending species for plantations (Table 1.1). The total number of rural holdings in each shire is also provided in Table 1.1.

The initial terms of reference were to compile a desk-top pre-feasibility study, but this work has developed beyond those terms as a result of the obvious potential importance of the bush food industry to the rangelands. The report now includes information gathered from face to face interviews with major industry participants, from attendance at a bush food conference held in May 1996, and from a study tour through Queensland, South Australia and New South Wales completed in October 1996.

The completed study incorporates:

1. a brief overview of Australia's bush food industry, including structure, size and limitations, with the focus on western Queensland;

2. the marketing potential of rangeland bush food products, including the potential product range, market share, price structure and limitations to market expansion;

3. the availability of raw materials, including a brief comparison of wild harvest production with the production potential from plantations;

4. a brief overview of the plants most suited to rangeland areas, on a regional basis; and

5. the conclusions and recommendations resulting from the study.

This was achieved through three major stages of research (Box 1.2).

Figure 1.1. The area encompassed by this study, showing the 21 shires within western Queensland.

Table 1.1. The number of rural holdings in each shire of western Queensland[1].

Shire	number of properties	Shire	number of properties	Shire	number of properties
Northern		**Central**		**Eastern**	
Mt Isa	65	Winton	189	Aramac	84
Cloncurry	100	Longreac	182	Jericho	102

[1] source: Australia Post rural mailing lists, DPI internal database.

		h			
McKinlay	30	Ilfracombe	38		
Richmond	120	Barcaldine	57	**Southern**	
Flinders	220	Isisford	31	Quilpie	109
		Blackall	151	Murweh	308
Western		Tambo	67	Bulloo	60
Boulia	36			Paroo	145
Diamantina	90				
Barcoo	51			**Total**	2235

Box 1.2. Overview of the methods employed for the feasibility study of the potential of bushfoods in western Queensland.

Stage I

Seven "best bet" products (Table 1.2) based on rangeland plants were initially determined through consultation with local industry and background research to allow the report to be focused. These products have been termed the Key Regional Products throughout the report. The plants which these products are harvested from have been termed the Key Regional Species. Agribusiness Marketing Services within the DPI conducted a preliminary market analysis and brief overview of the industry. This included face to face and telephone interviews with the key industry informants including Longreach Bush Tucker, Bush Tucker Supply Australia, Australian Native Produce Industries, Gundabluey Bush Foods, Robins Bush Foods and Bush Foods of Australia. A full participant list is attached (Appendix I).

Stage II

Information on the distribution and abundance of species was gathered by staff based at the DPI, Longreach in conjunction with local experts. Existing botanical records (eg. published botanical surveys and herbarium records) provided details on the distribution of the species. A survey of landholders throughout western Queensland was also conducted to allow an estimation of the abundance of the plants, and an estimate of the potential wild harvest yield and interest. The survey was distributed after the summer growing season when plants were more likely to be in flower or fruit, allowing for better identification and a greater level of co-operation from land-holders. A plant identification sheet was prepared and distributed with the survey to assist respondents in correctly identifying the major species of interest.

Stage III

These two major sections of research have been drawn together and combined with recent published material in this report to form the final recommendations of the pre-feasibility study.

The specific objectives of each stage of research were to:

- assess the size of the bushfood industry in Australia and the market potential of the Key Regional Products;

- determine the natural distribution and preferred soil types of a number of native plants with bush food potential;

- use this information to recommend species to trial in demonstration plantations; and

- estimate potential wild harvest and plantation yields from western Queensland.

Plantations are envisaged to be based on organic and polycultural techniques, with limited (if any) use of inorganic chemicals. Membership within organic growers cooperatives is not seen as essential at this stage, although individual plantations, if established, may wish to seek certification. Due to the limited supply of good quality water in western Queensland, efficient irrigation practices are seen as essential to the success of a plantation based industry. The growing of plants in a polyculture, rather than a monoculture, is seen as important in the long term marketing and sustainability of a western Queensland bush food industry, with growing conditions mimicking those of the wild as much as practicable. This should not exclude the potential use of mechanisation of plantations at any future stage. The bush food industry is trying to base production on sound ecology and economics, to succeed where other agricultural industries have failed in preserving the environment whilst still being viable. The industry does not see this as precluding the development of superior varieties of plants for cultivation, as both good quality and quantity of production will be essential to the industry's success. Plantations in western Queensland should make use of superior varieties of planting material wherever possible.

1.3 Project Methods

1.3.1 Key Regional Species (KRS) selection

Seven Key Regional Species (KRS) were selected for western Queensland from the large number of plants with some bush food potential (Table 1.2). These were selected based upon local knowledge of the marketability of various products within the bush food industry and an overview of species currently traded commercially (Table 2.1). Each Key Regional Species is synonymous with a Key Regional Product (KRP) which is the saleable portion of the plant. This approach allowed for both the market research and analysis of supply to focussed upon the "best bet" species and products for western Queensland.

Table 1.2 The Key Regional Species and Key Regional Products for western Queensland.

Key Regional Species	*Scientific name:*	*Key Regional Product*	*comments:*
gundabluey wattle	*Acacia victoriae* Benth.	wattleseed (cleaned)	Shrub with widespread use in the bush food industry as wattleseed for flavouring of breads, biscuits, ice cream and other foods.
kurrajong and bottletrees	*Bracychiton* spp	kurrajong seed (cleaned)	A range of trees with potential use of seed similar to wattleseed.
wild orange	*Capparis* spp	wild orange fruit (fresh)	A range of trees with potential use for fruit.
desert lime	*Eremocitrus glauca* (Lindley) Swingle	wild lime fruit (fresh or frozen)	Tree with strong demand for fruit to produce jams, chutneys and sauces.
native thyme	*Ocimum tenuiflorum*	native thyme leaf (dried)	Shrub with weak current demand for leaf as a herb.
quandong	*Santalum acuminatum*	quandong fruit (fresh or dried)	Tree already being grown in plantations, with strong demand for dried fruit in jams and sauces.
bush tomato	*Solanum* spp	bush tomato fruit (dried)	A variety of shrubs with widespread use in the bush food industry as a flavouring.

1.3.2 Market survey

No statistical data on the bushfood industry had been recorded for public use at the time of this study. For this reason, the major commercial players in Brisbane, Sydney, Melbourne and Adelaide were targeted as the best source of market information. Some problems of commercial confidentiality were encountered, but most firms were willing to assist with personal or telephone interviews.

The research methods undertaken included:

- Data searches of Food Science and Technology Abstracts (FSTA) and Aground database of Australian research in progress care of The International Food Institute of Queensland (IFIQ), Hamilton;

- Searches of recent press releases and journal articles on the bushfood industry from 1990 onward, care of Dr Christine Cannon, Information Specialist (IFIQ).

- Personal trade interviews with wholesalers, processors, distributors, packers, chefs and retailers from the Brisbane, Sydney, Melbourne and Adelaide markets. Other interviewees included industry persons from other markets in New South Wales.

- telephone interviews with the bush food industry body, ANBIC, who supplied information on the retail value of the industry and its expected growth up to 2000.

- interviews with Econsult, Melbourne, who are researching the feasibility of establishing a bushfood industry in the Broken Hill region.

1.3.3 Species distribution and abundance

Three major sources of information and knowledge were utilised to determine the distribution and abundance of the Key Regional Species. These were:

- Queensland Herbarium records were accessed for the Australia wide distribution of the Key Regional Species and other species with some potential (Table 1.3). More species were included, and more detail sought for the distribution of species, through this method for future reference. It was not as critical to shorten the species list in this case as it was where individuals within the bush food and grazing industries were being asked to make comments on species. Additionally, herbaria data lends itself better to searching for records at the species and sub species level than simply at the genus level. The information of longitude and latitude of the collection site of each specimen was plotted onto a map of Australia to provide a visual interpretation of the plant distribution. Soil type data was analysed to determine the major soil types which each plant grows on naturally.

- Existing published information, including a search of the Internet, was referred to for a general indication of the distribution of the Key Regional Species throughout Australia. This information was used to supplement the results of the Queensland herbaria data.
- A survey consisting of 10 questions relating to the Key Regional Species (Appendix II) was distributed to 446 graziers throughout the 21 shires in western Queensland (Fig 1.1 and Table 1.1) in April 1996. This number was chosen to represent 20% of the properties in western Queensland. Surveys were sent to 20% of the properties in each shire, with at least 1 survey randomly distributed on each Australia Post mail run. This approach was taken to avoid any potential geographic bias and to provide a relatively even coverage of western Queensland. The survey was distributed following summer rains to enhance the probability of plants being present and in flower or fruit. A plant identification sheet was prepared and distributed with the survey to assist respondents in correctly identifying the major species of interest.

Table 1.3. List of plant species accessed through the Queensland Herbarium.

Scientific name:	common name
Acacia victoriae	gundabluey wattle
Bracychiton populneus	kurrajong
Capparis lasiantha	nipan
Capparis loranthifolia	wild orange
Capparis mitchellii	wild orange
Capparis spinosa	wild orange
Capparis umbonata	wild orange
Cucumus melo	bush cucumber
Enchylaena tomentosa	ruby saltbush
Eremocitrus glauca	desert lime
Ocimum tenuiflorum	native thyme
Santalum acuminatum	quandong
Santalum lanceolatum	sandalwood or plumwood
Solanum centrale	bush tomato
Solanum esuriale	bush tomato
Tetragonia tetragonoides	warrigal greens

2. OVERVIEW OF THE BUSH FOOD INDUSTRY

This chapter presents data from the market survey undertaken within this project, as well as drawing on information presented at the Australian Native Bushfood Industry Committee (ANBIC) conference ("Culture of the Land, Cuisine of the People") held in Brisbane in May 1996.

2.1 Industry Size

Until recently there was no existing public data on the bushfood industry. ANBIC commissioned a research paper that has provided a national profile of the industry. This paper (Econsult Australia Pty Ltd 1996) was presented at the ANBIC National Conference in Brisbane in May 1996. The research was supported by the Rural Industries Research and Development Corporation (RIRDC) and the Agribusiness Program of the Commonwealth Department of Primary Industries and Energy (DPIE). This research estimated the current retail value of the bushfood industry at $14 million. These figures also include game meats such as emu, kangaroo and crocodile which are not included in this report. ANBIC also believe the industry has the potential to grow to $100 million by 2000. This figure, although only an estimate, is the best indication of the size of the bushfood industry.

The retail estimates are extended to equate to a current farmgate value of $5 million. The industry target implies a potential farmgate value of some $30 million by the year 2000.

2.2 Industry Structure

Current players in the bush food industry chain include:

- the suppliers of raw bushfood, primarily wild harvesters with a small but growing commercial production sector which includes sales of some fresh produce direct from bushfood nurseries as well as plant sales for commercial plantations;

- buyers of raw bushfood including wild harvest coordinators, wholesalers, food processors, restaurants and food service operators;

- processors of raw bushfood including food processors, small scale cottage industry processors, restaurants, food service operators and wholesalers;

- sellers of processed product including wholesalers, merchandisers, restaurants, food service operators, retailers and tourism hospitality.

The ANBIC paper stated that as an emerging industry the structure is still developing. Various strategic forms have developed including networks and vertically integrated operators which include the whole chain from plant selection and cultivation, commercial growing, processing and packaging of value added bushfood products, and wholesaler/merchandising operations that establish brands and develop the market for these brands.

2.3 Industry Profile

Box 2.1 summarises relevant findings from the ANBIC conference paper.

Box 2.1. The current state of the bushfood industry at a glance.

Bushfood Industry profile:

size: approximately 140 operators 54% suppliers; 46% processors and resellers

employment: just under 500 people

Retail equivalent turnover: $14 million

Retail equivalent target for 2000: $100 million

Farm Gate Value: $5 million

Average turnover per grower: $8600

Average anticipated annual industry growth rate: approximately 25%

Required annual industry growth rate: 74%

Top 11 raw products/plant species currently used:

bush tomato	(*Solanum centrale*)
illawarra plum	(*Podocarpus elatus*)
kakadu plum	(*Terminalia ferdinandiana*)
lemon aspen	(*Acronychia acidula*)
lemon myrtle	(*Backhousia citriodora*)
mountain pepper	(*Tasmannia lanceolata*)
muntries (or munthari)	(*Kunzea pomifera*)
quandong	(*Santalum acuminatum*)
riberry	(*Syzygium luehmanii*)
wattleseed	(*Acacia victoriae*)
wild limes	(*Eremocitrus glauca*, *Microcitrus* spp)

2.4 Overview of the current Western Queensland Bushfood industry

2.4.1 General overview

Western Queensland has no plantations at present, with production based solely on wild harvest, or wild augmented production[1]. There are two known bush food companies currently operating out of western Queensland. The major company (Longreach Bush Tucker) act as harvesting coordinators to provide market outlets, packaging materials and transport coordination for wild harvest products. From an industry perspective this is advantageous as any quality assurance can easily be introduced and be maintained through one company. Minimal processing is undertaken, with products checked for quality and contaminants such as dust and foreign plant material which is removed. They also act as distributors for processed goods predominantly to tourist outlets and through mail order catalogues. The other company (Jill's Emu Apple Jam) has a cottage industry basis, providing locally supplied and manufactured emu apple (*Owenia acidula*) jam to tourist outlets such as the Australian Stockman's Hall of Fame.

The current commercial raw products found in western Queensland are listed in Table 2.1. All plants known to be currently, or previously, used in any market segment in any quantity have been listed.

Table 2.1. Commercial bushfood plants found in western Queensland

Commercial bushfood plants	Raw product derived from plant	Form of product
gundabluey*	wattle seed	cleaned seed
desert lime*	lime fruit	frozen fruit
quandong*	quandong fruit	frozen or dried fruit
native thyme*	thyme leaf	dried leaf, with potential for fresh leaf
kurrajong/bottletree*	kurrajong seed	cleaned seed
wild orange*	wild orange fruit	fresh or pulped and frozen fruit
pigweed	pigweed leaf	fresh or frozen fruit
emu apple	emu apple fruit	frozen fruit
bush cucumber	cucumber fruit	frozen fruit, with potential for

[1] wild augmented production refers to plants growing naturally which are supplemented with water, organic fertilisers or in other ways to enhance productivity.

		fresh fruit
outback anise (or aniseed thyme)	aniseed leaf	dried leaf, with potential for fresh leaf
nipan	nipan fruit	fresh fruit

* indicates key regional species

Estimated total tonnage from western Queensland in 1994/95 was approximately 900 for limes, 50kg thyme and negligible quantities (1-10kg) of cucumbers, oranges and pigweed. Estimated total value of raw product at the farm gate was $11000. Demand for desert lime fruit was estimated at 3000kg in 1995/96 (Table 4.18), equivalent to a farm gate value of almost $20 000.

2.4.2 Industry structure

The current industry structure in western Queensland is quite favourable for the sale of raw produce. One company purchases most of the wild harvest and wild augmented production within the area, ensuring consistency of quality and (as much as possible) supply to the major bush food companies in the industry. The major markets for the raw produce are in Sydney, Melbourne and Adelaide.

Transport, packaging and storage costs, as well as the costs of marketing, promotion and quality assurance of the raw produce from the farm gate to the markets is borne by the purchasing company; although the suppliers of raw produce bear the cost of transport from the farm gate to the nearest pick-up point by a commercial transport company. In the case of desert lime fruit, the pick-up point is nearest major road or town serviced by refrigerated transport.

The costs associated with the current cash flow difficulties within the industry are largely borne by the purchasing company, who guarantee payment to suppliers over a shorter time frame than the major bush food companies in the industry can usually guarantee.

Some wild harvesters have marketed direct to individual manufacturers - this strategy has provided higher prices per unit of raw product, but has incurred the additional costs of packaging materials, storage, transport and potential cash flow difficulties. In addition, most of the major companies have indicated a preference to purchase larger quantities of produce from one company, rather than small amounts from a number of suppliers.

3. BUSHFOOD MARKET ANALYSIS

This chapter outlines the findings of a market study undertaken by the DPI in late 1995 and early 1996. The marketing study was undertaken to make a preliminary assessment of the Australian bushfood industry and the market potential of a range of bushfoods grown in western Queensland. Brisbane, Adelaide, Melbourne and Sydney were targeted as centres containing significant commercial bushfood enterprises.

The research identified a number of significant issues including supply, price and promotion that should be addressed if ANBIC's goal that the bushfood industry be worth $100 million by 2000 is to be achieved.

Due to limitations in the number of people interviewed, the results that follow should be treated as an indication of the factors influencing the bushfood trade in Australia and should not be considered conclusive. More detailed research is required to confirm these findings.

3.1 Supply

All but one firm were concerned about the lack of consistent supply of raw product and the limitations this was placing upon the industry (Appendix II). The firm not concerned uses only wattle seed. Wattle seed and most of the other products can be stored in either a dried or frozen state. This alleviates some of the problems associated with the seasonality of bushfoods and lack of consistent supply. Although products can be stored, problems in sourcing sufficient to initially supply a production run or restaurant menu over that storage period have been encountered in many cases.

Some products, eg lemon myrtle and rosella, are contract grown specifically for processors of bushfood products. Quandongs are also grown commercially, although numbers currently in production are limited and they are amongst the products most difficult to source. Most of those interviewed expressed the need for full time commercial production in order to facilitate growth in the bushfood industry. This is particularly the case as more commercial food processors become involved in the bushfood industry.

The current supply of raw product is dominated by wild harvest. This is often cited as the reason for expensive raw product. The cost of time spent sourcing raw product, either directly from outback harvesters or from suppliers, is one area which could be reduced with commercial plantations. Similarly, the cost of freight and storage could be reduced if commercial crops were grown in specific areas. These logistical problems make regular processing both difficult and expensive. The restaurant trade in particular is wary of inconsistent supply, due to menu requirements of up to two months in advance.

Another problem with relying on wild harvest supply is that guaranteed amounts often do not arrive. The failure of the 1995/96 desert lime crop in Queensland (Phelps and Phelps 1996) is a pertinent example of crop failure. This lack of consistency presents a huge problem when orders for products have been made and menus have been printed. This lack of certainty of supply has meant some market opportunities have already been lost. Some of those interviewed have set up their own networks of wild harvesters, but see the need for consistent supply through commercial growers. The bushfood industry has created interest and demand but the supply of raw product, in some instances, has not kept up.

Discussions with some of the wild harvesters at the recent ANBIC conference indicated that shortages of supply are sometimes due to communication problems. Supplies may be available in storage without potential buyers being aware of it as they are supplied by other parts of the industry. The increased cooperation and communication developed through the conference should alleviate some supply shortages. However, this is likely to be only a short term (2-5 years) solution and in the medium to longer term (10-50 years) as the market develops it is unlikely that supply can be maintained through wild harvest alone.

3.2 Price

Price of raw product is seen, along with supply, as a major restricting factor on market growth. Only one of those interviewed was happy with the price structure of the industry. The reasons cited for high prices are the cost of manual labour, hand harvesting, transport from outback areas and storage. There was also concern expressed about price collusion amongst wild harvest groups and wholesale suppliers. This may actually be due to supply shortages which act to force prices up, particularly when firms are concerned about filling orders or menus.

Most firms interviewed saw the need for commercial plantations in order to reduce prices and guarantee consistent supply. The prices paid for inputs have forced some bushfood products into a premium niche market, one which not all firms are happy with. The South Australian firms interviewed in particular see the need for bushfood products to be able to compete on price with traditional products. Then, they believe, substantial market growth could occur.

It was suggested by one of the major wholesalers interviewed that most people in the industry, particularly chefs, have a misconception about the price of native foods. He stated that these people perceived the price of bushfoods to be high because they concentrate on the dollar value of the products; they were not aware that bushfoods were merely flavourings and should only be used in small quantities as their flavours and essences were so strong.

In contrast to most other interviewees, one Sydney respondent was of the opinion that bushfoods are not expensive. He believes there is a misconception about the perceived price of native foods, since consumers and people in the industry do not know what the products really are. 'People are comparing native flavours with conventional fruits [herbs/spices] ... bush foods are accepted as flavourings rather than foods by themselves. If people realised this, they would realise how economical bush foods really are.' He also noted that in any event prices of bushfoods have been falling in the last few years.

3.3 Market Segments

Two distinct domestic segments emerged in this research. The food service segment (restaurants, caterers and other bulk users), and the retail or grocery segment. Most of those interviewed in Queensland, NSW and Victoria supplied substantially more to the food service segment, the reasoning behind this being that chefs are more easily educated to use new products than retail consumers. Most interviewees quoted their supply ratio at 80% food service: 20% retail. Another contributing factor to this phenomenon is bulk packaging; less promotion and product development is needed for this segment.

In South Australia, three of the major bushfood companies all supplied around 90% retail and 10% food service. These companies consider the potential of having their products in

mainstream supermarkets to be enormous. Currently, department stores and gourmet retail stores and Foodland in South Australia and the Northern Territory are supplied. All three companies believe in the 'demand pull' effect created by the retail sector; this demand being created through consumer awareness and promotion at the retail level.

3.4 Consumer Perceptions

Most Brisbane firms interviewed stated that value-added bushfoods are perceived by consumers as gifts or as specialty items. They believed that because of their packaging and the Australiana image they portray, value-added bushfoods could not be perceived as daily household ingredients.

Most of the Sydney interviewees were of the opinion that value-added bushfood products are perceived by most consumers as gourmet products. One interviewee said that for this reason bushfoods will remain a niche market for a long time.

Interviewees varied in their opinions of consumers' perceptions of raw/partially-processed native foods. Some were of the opinion that consumers do not have a very clear perception of these products because they are generally unaware of them or uneducated about them.

One interviewee suggested that there is a negative perception of raw/partially processed bushfoods amongst consumers: the definite trend towards convenient, prepacked foods had succeeded in deterring people from these minimally processed products.

Another interviewee suggested that some consumers have a negative perception of bushfood products, saying that bushfood products were perceived as indigenous items, making market penetration difficult because of inherent racism amongst many consumers.

3.5 Positioning

Interviewees varied in their opinions of product positioning. With regards to raw/partially processed native foods, most interviewees stated that these foods could not be positioned as substitutes for other conventional herbs, spices and fruits, mainly for two reasons:

- lack of education amongst consumers about how and when to use native foods; and
- the trend towards prepacked/convenience foods.

Other interviewees said that raw/partially processed bushfoods could be positioned as substitute products for conventional herbs and spices providing they were appropriately

marketed. One added that if their prices were to come down they could be effectively positioned as alternatives to the flavourings most consumers are used to.

Most interviewees were of the opinion that value-added bushfood products could not be positioned as substitute products for conventional value-added products such as chutneys, salsa's, marinades, jams, mustards, dressings, pastas etc. Some were of the opinion that the prices of these products were too high for this to be feasible: for instance in a gourmet delicatessen in Brisbane city a tomato salsa was priced at approximately $3.50, whereas a bush tomato salsa costs approximately $7.50.

On the other hand, a comparison of bushfood product prices against other gourmet products in the specialty food halls of David Jones and Myers in Melbourne suggests that the pricing was broadly comparable and in one case slightly lower (Econsult 1996b). Table 3.1 provides an example comparison.

Table 3.1. Specialty retail pricing example comparison.

Product type	approximate retail pricing (c/g)			
	major bushfood processors range			non bushfood specialty suppliers range
	1	2	3	
mustards	2.80	-	-	2.75 - 3.47
chutneys	2.80	3.70	3.50	3.00 - 3.25
jams	2.80	3.70	3.50	4.00 - 4.25

Source: Econsult (1996b)

Clearly, however, the price structure is not comparable to standard supermarket products.

Others stated that the current distribution channels for value-added bushfood products (tourism stores, gourmet delicatessens and other specialty stores) inhibit their positioning as daily household products because they are perceived as gifts or specialty items.

It was reported at the ANBIC conference that one of the mainstream supermarkets will be trialing a range of processed bushfood products, and selected products are already available in specialty sections of some supermarkets eg Franklins in Toowoomba. The trial mentioned will also be in the specialty section of selected supermarkets but if successful will open the market for bushfood substantially.

The South Australian firms, and a few from the other states, were of the opinion that these products could be positioned as alternatives to other value-added products based on the fact

that they are prepared, simple and ready-to-use. However they agreed that awareness of the products would need to be raised (via the demand pull effect mentioned above) and their prices reduced considerably for this to eventuate.

3.6 Industry Problems

Price and supply are not the only important issues to consider, although these are seen as the greatest limiting factors to the growth of the bushfood industry; there is also a lack of consumer awareness. If consumers at retail level are going to purchase bushfood products, then they must be educated via marketing campaigns.

The present distribution network is fragmented and consists of numerous industry players who are acting as re-sellers. For example, bush food restaurants often re-sell raw produce to other restaurants and retail stores who may also re-sell the produce themselves. As each re-seller takes a profit margin, the price to the end user will increase substantially. Consumers will be difficult to obtain and retain if they are presented with a high priced product which cannot be justified.

3.7 Industry Potential

Currently the three main end markets where bushfoods being distributed are:

- the food service sector;
- the retail sector; and the
- export market.

It is considered that there is much more scope to further develop bushfoods in these markets.

The domestic retail market is seen by most firms as having the most potential, even though some firms were not currently targeting this segment. The direct marketing area and the condiment market were both seen as having potential for bushfood. Export is also seen as having strong potential, particularly within Europe, and to a lesser extent, Japan.

The potential also exists for marketing on a number of fronts, notably, the unique Australian flavour of the products, the link with Aboriginal culture and the ‘real’ Australia; and the ecological sustainability of bushfood products as opposed to traditional ones. These are all powerful promotional tools which have not yet been fully utilised by the industry.

3.7.1 Food Service Sector

In the initial stages of the industry's development, it is apparent that the food service sector is a viable option for developing the market for native foods. Two major categories within the food service sector that could be considered are large hotel chains and large catering firms.

Another option that could be cost effective would be to introduce bushfoods to well known franchise fast food outlets such as McDonalds or Kentucky Fried Chicken.

One of the advantages with this market is that it has the opportunity to introduce bushfoods to large groups of consumers at any one time. The other advantage is that in the present low awareness stage of the industry, it could be more cost effective to train and educate chefs on the use and preparation methods of native foods, rather to train and educate end-users. Since bushfoods are new products and consumers have low awareness and confidence with them, it could be advantageous to have food service people prepare and present them.

3.7.2 Retail Sector

The benefit of the retail sector is that it can provide industry with the opportunity to improve exposure of bushfoods in the market. Since bushfoods are in the introductory stage of the product life cycle, it is crucial to increase awareness of the products amongst consumers in order to stimulate demand.

One option would be to include bushfoods in products that are already well developed in the market. That is, bushfoods could effectively be 'free riders' on the demand for products such as ice-cream.

It could be argued that it would be better to develop a limited number of products and concentrate the limited industry resources on promoting those few products. An alternative proposal is to promote a wide range of products and tastes although these may be variations on a limited number of species. A wide product range allows consumers to try different tastes and to gradually develop a market for a more limited number of successful products.

At this stage of the industries development greater exposure of bushfood products is important. As an example of the case noted above, one of the major supermarket chains is developing a bushfood range. In order to provide sufficient impetus the company requires the suppliers to provide some 50 product lines.

3.7.3 Export Market

Based on the opinions of most of the interviewees, the potential to develop a potentially viable export market for bushfoods exists. The main author was involved in the promotion of bushfood in Holland and Germany during September 1995 (Phelps and Phelps 1996). The response to the various meats, sauces, dips, jams and other processed products was overwhelming. One importer indicated that to conduct market trials of desert lime in Europe, approximately 20 to 30t would be required. This suggests that export demand would far outstrip current supply levels. The UK supermarket chain Sainsbury has recently included a bushfood range in 80 stores in the UK and promotions in North America, South East Asia and Scandinavia have also demonstrated a strong potential for the export of Australian bushfood.

3.8 Market Strategy Options

Bushfoods have already been introduced in the end markets mentioned but there is scope to further expand these markets and therefore further develop the bushfood industry.

The bushfood industry should undertake further research if they are to design and select marketing strategies aimed at further developing these markets. This research should include:

- further market research and detailed consumer research;
- development of marketing strategy options; and
- a comparison and selection process of the marketing strategies.

Co-ordinating these steps may allow industry to select the most appropriate marketing strategies aimed at the development of the industry.

Two examples of marketing strategy options that industry may consider in the process are discussed below.

Example strategy 1. Develop bushfoods in all three end markets (food service sector, retail sector and export market) but on a small scale.

This would require that industry introduce bushfoods to all three markets in small amounts, even if it means they are launched at a premium price. Since bushfoods are in the introduction phase of their product life cycle, it is important to create awareness of the products. Introducing bushfoods in all three markets, even on a small scale, could achieve high exposure of the products across a large cross-section of consumers.

One of the advantages of this strategy is that if a greater and consistent supply of bushfoods is achieved, it may be easier to further develop the markets because the industry would have developed consumer awareness and therefore a foothold in each market.

Development of the food services market is likely to need parallel development of at least sectors of the retail market to ensure consumers who have been made aware of the possibilities of bushfoods can obtain products for home use readily.

Example strategy 2. Focus all efforts on one of the end markets instead of all three.

In light of the small quantities of bushfoods being produced, one option is that industry concentrate most of its efforts into one market. However, this does not suggest that industry should completely disregard the other markets.

The industry should concentrate its efforts in the market that proves to be potentially the most profitable. This would allow industry to develop that market thoroughly and cost effectively (through for example, concentrated promotions) and then later when supply is greater and more reliable, to move into the other markets.

Although the above two marketing strategy options have been developed with industry as a whole in mind, they may also be applicable to individual companies in the industry.

3.9 Market Potential of the Key Regional Products

3.9.1. Market potential in relation to market information from interviews

Wattleseed, desert lime fruit, bush tomato fruit, native thyme leaf, kurrajong seed, wild orange fruit and quandong fruit are all being used by a number of bushfood manufacturing and wholesaling companies nationally (Table 3.2).

Table 3.2. Current key regional product usage by the bushfood companies interviewed.

Key Regional Product	proportion of companies using[1]					total use (kg/annum)					
	Qld	NSW	Vic	SA	average	Qld	NSW	Vic	SA	total	other*
wattleseed	83	100	100	75	90	N/A	>2	>500	1155	>1655	7500
desert lime fruit	33	25	0	50	27	N/A	N/A	0	2004	>2000	3000
bush tomato fruit	67	50	50	75	61	N/A	>0.5	>1500	2160	>3660	6200

native thyme leaf	17	25	0	25	17	N/A	N/A	0	1	>1	270
kurrajong seed	0	25	0	25	25	N/A	N/A	0	200	>200	-
wild orange fruit	0	25	0	0	6	N/A	N/A	0	0	>0	-
quandong fruit	83	75	0	75	58	>150	>1	0	1050	>1200	-

[1] numbers of interviewees: Qld = 6; NSW = 4 (excluding one interviewee who did not provide detailed information); Vic = 4; SA = 4 (excluding one nursery interviewed).

* other sources of estimated total use (Table 3.5).

The increasing exposure of these products to the marketplace should lead to increasing demand in line with industry growth as outlined in section 2. This will probably depend on the actual growth recorded in each of the market segments. Table 3.3 outlines the activities and markets serviced in Qld, NSW, Vic and SA. There is a slight leaning towards the food service sector over the retail market segment overall, with Qld, NSW and Victoria predominantly food service and SA focusing on the retail sector.

Table 3.3. Statewide company breakdown, showing the major activities reported and the domestic and export markets serviced.

State	number of companies interviewed	activities reported	domestic market serviced (average %)	export markets serviced
Qld	6	wholesaling, retailing, restauranting	65% food service, 35% retail	not stated
NSW	5	processing, wholesaling, retailing, exporting, restauranting	60% food service, 40% retail	not stated
Vic	4	processing, wholesaling, retailing, exporting	70% food service, 30% retail	Japan, Korea, USA, Middle East, SE Asia
SA	5	processing, wholesaling, retailing, exporting, nursery production, restauranting	35% food service, 65% retail	not stated
average	N/A	N/A	60% food service, 40% retail	N/A

Table 3.4 indicates the activities and markets which the KRP are entering. It appears that desert lime fruit, bush tomato, native thyme leaf, kurrajong seed and wild orange fruit may have the most potential if the retail sectors grows most strongly, whilst wattleseed and quandong fruit are well positioned to capitalise on growth in either sector. All products are being exported to some extent, but it is difficult to predict from the information obtained which are likely to succeed if export demand increases. The one exception is wattleseed, which seems well placed to take advantage of any increases in demand from Japan, Korea or the USA.

Table 3.4. National breakdown of the major activities and the domestic and export markets serviced by companies using each of the Key Regional Products.

KRP	company activities reported	company domestic market serviced (average	export markets serviced

		%)*	
wattleseed	wholesaling, retailing, processing, restauranting, exporting	50%food service, 50% retail	Japan, Korea, USA
desert lime fruit	wholesaling, retailing, processing, restauranting, exporting	25% food service, 75% retail	not stated
bush tomato fruit	wholesaling, retailing, processing, restauranting, exporting	40% food service, 60% retail	not stated
native thyme leaf	wholesaling, retailing, processing, restauranting, exporting	35% food service, 65% retail	not stated
kurrajong seed	wholesaling, retailing, processing, exporting	10% food service, 90% retail	not stated
wild orange fruit	wholesaling, retailing, processing, exporting	10 food service, 90% retail	not stated
quandong fruit	wholesaling, retailing, processing, restauranting, exporting	50% food service, 50% retail	not stated

* as an average of the number of companies using each product

3.9.2 Implications of the Industry Target on Key Regional Products

Table 3.5 estimates the likely demand for, and value of, the key regional products if the industry realises its target by the year 2000. It has been assumed that the increase in demand for raw product will match the increased retail value of the industry. The required growth rate of 74% per annum has been used to estimate the amounts of the relevant Key Regional Species.

Table 3.5. Estimated demand and farm gate value in the 1995/96 season and in 2000 for regional products based on the ANBIC targets.

Key Regional Product	estimated demand 1995/96		implied target demand for 2000	
	kg	$[d]	kg	$ [d]
wattleseed	7 500[a]	37 500	68 700	343 500
desert lime fruit	3 000[b]	19 500	27 500	178 750
bush tomato fruit	6 200[a]	74 400	56 800	681 600

native thyme	270[a]	14 850	2 500	137 500
kurrajong seed	200[c]	3 000	1 800	27 000
wild orange fruit	>0[c]	>0	>0	>0
quandong fruit	1 200[c]	36 000	11 000	330 000
Total value		$185,250		$1,698,350

Source: [a] ANBIC 1996, [b] Phelps and Phelps 1996, [c] market survey, [d] based on estimates in Table 4.19.

If it assumed that desert lime fruit, native thyme and kurrajong seed are, and will continue to be, the major products from western Queensland then the total farm gate value in the 1995/96 season would have been $37350. This would increase to $343 250 in the year 2000, assuming that prices remain at the current level. This represents a 20% market share (based on the farm gate value) of the total arid zone production.

3.10 Marketing Issues for Further Investigation

3.10.1 Supply

The supply constraint is an issue that needs to be considered on its own. It is apparent that the lack of consistent supply is inhibiting the commercial development of the Australian bushfood industry; therefore it is an issue that should be addressed as a component of an Industry Strategic Marketing Plan.

Limited supply may also encourage processors to reduce the proportions of bushfood in products. Consideration will need to be given to labelling bushfood products to ensure its authenticity.

3.10.2 Consumer Research

Consumer research might be required to allow industry to segment the market. For example it may be possible to segment the market based on consumers' behavioural traits, such as the increase in demand for some bushfoods in summer.

Traders have indicated that their initial target market may consist of people from a certain socioeconomic status. The target market characteristics identified from interviews with industry people are outlined in Table 3.6. It is important to note that these were not identified direct from consumers, therefore they are only an indication of the possible target market. Detailed consumer research is required to validate these findings.

Table 3.6 Target Market Characteristics Identified by Industry Members

Demographic Variables	Psychographic Variables
• high income earners (preferably double income) • high disposable income	• adventurous people (in terms not only of dining but also in other activities) • fine diners

This target market is similar to that targeted for the retail supermarket trial.

3.10.3 Promotion

Industry will need to consider creative promotional campaigns that will promote awareness and education and therefore stimulate demand for native foods.

3.10.4 Competition

Bushfood products will be competing with a range of specialist foods and cuisines. As noted it is important that products are distinctive and attractive, are priced competitively with those other products and supported with attractive meats and recipes as part of a distinctive national cuisine.

4. OVERVIEW OF SUPPLY OF RAW MATERIAL

This chapter outlines the distribution and preferred soil types of a number of plants with potential in a western Queensland bush food industry. It draws on researched and published information from a number of sources.

A total of 16 species were initially chosen to investigate the distribution of potential bushfood plants from published sources and from herbaria data (Table 1.3).

This list was revised and shortened after initial marketing investigations, with 7 Key Regional Species identified (Table 1.2).

A plant would need to be abundant in the region to have any wild harvest potential and it is assumed that the success in a plantation would be enhanced if the plant is already present in the region.

4.1 National and International distribution

All of the Key Regional Species are, by definition of the term bush food, native to Australia. Native thyme also occurs naturally overseas (Table 4.1). The desert lime has been the subject of research in the USA since the 1940's (Walker 1985), with particular interest focussing on hybridisation with commercial citrus (Rahman and Nito 1994). Many of the other species (eg native thyme) have also received overseas research attention (eg Ganguly 1994). Research into growing Australian Acacias overseas has been conducted as part of aid efforts in many African nations since the early 1970's (Souvannavong and de Framond 1992).

International research and plantation establishment may pose a threat to the successful establishment of a bush food industry in Australia. There are many examples of other Australian plants and animals which have become more successful industries overseas than in our own country. Australia only provides around 2% of the world's industrial Eucalyptus oil, there are more emus farmed in the USA than there are in Australia (Emu farming is also being promoted throughout Europe), warrigal greens were once popular in England and are now grown extensively in Portugal and Spain, and the emblem of NSW - the Waratah- is reputedly now being marked by New Zealand as the "Kiwi Rose". Australia's first bush food crop was the Macadamia nut, which was subsequently developed into Hawaii's major export. There are undoubtably many other examples of opportunities that Australia has lost to make the best use of our native flora and fauna.

Table 4.1. The distribution of the Key Regional Species throughout Australia and the world, including known overseas plantings.

Key Regional Species	Australian distribution	International distribution	overseas plantings	
			country/region	source
gundabluey	all states except Tasmania	none	possibly Africa and the Middle East	(Souvannavong and de Framond 1992), industry rumours
desert lime	Qld, NSW, SA	none	USA - California	(Walker 1985)
bush tomato	Qld, NSW, NT, WA, Vic	none	none known	
native thyme	Qld, NT	Southern Asia	none known	
kurrajong	Qld, NT, NSW	none	none known	
wild orange	Qld, NT, NSW	none	none known	
quandong	Qld, NSW, SA, NT, WA	none	none known	

Some of the KRS are more prevalent in other states than in Queensland (Table 4.1 and Appendix III). Gundabluey, for instance, has an extremely high density throughout the Flinders ranges of South Australia, and can also be found in dense patches in far western NSW (eg between Pooncarie and Menindee). Quandong trees are highly regarded in South Australia, where there is a long tradition of preserve making from quandong fruit. They can be found in the Flinders ranges, across the Nullarbor and in other southern areas of the state. The preferred type of bush tomato (*Solanum centrale*) is found primarily in central and western Australia, although the possible substitute, *Solanum esuriale*, is abundant in Queensland and NSW. Native thyme is found in northern Queensland and into the Northern Territory. Desert lime is found in only small patches outside of Queensland, with some in far western NSW (in the Broken Hill/Menindee area). Desert lime is regarded as very rare in South Australia, where the few trees are treasured. The various types of wild orange can be found throughout Queensland and NSW, with some also in the Northern Territory.

4.2 Queensland distribution

Distribution maps (Appendix III) and details of the natural soil preferences (Appendix IV) of the major species are attached. Each map presents the distribution of a separate plant species, as indicated by the plot of each record on the maps. It should be noted that older records supplied coarse latitude and longitude data, which has lead to inaccurate placement of some records. In addition, the Queensland herbarium does not hold all of the records for Australia. This means there could be a greater distribution of species in other states than is indicated.

All of the Key Regional Species except the preferred type of bush tomato (*Solanum centrale*) grow throughout western Queensland. The closely related *Solanum esuriale* is widespread throughout western Queensland and may be able to substitute. As mentioned, some KRS are more prevalent in other states, and some are also more prevalent in other areas of Queensland than they are in western Queensland as defined in the study. Desert lime density, for instance, is so high in the southern and western Darling Downs that it is regarded as a weed in cleared country (Csurhes 1993). It is estimated that there is almost 100 000ha of desert lime in the southern and western Darling Downs (an area of nearly 1 000 000ha), although it is predominantly sucker regrowth and may not be suited to wild harvest. Almost 10% is growing in dense and impenetrable thickets which would be difficult to harvest and a further 80% consists of scattered trees which may entail excessive travel to harvest. The remaining 20% may be suited to wild harvest and it is suggested that the development of any strategic plans for wild harvest from western Queensland also include this area.

4.3 Local distribution and abundance

This section discusses the findings on the incidence of bushfood plants in western Queensland from a survey of graziers in twenty-one local government areas (Fig 1.1).

Responses were received from 64 graziers (16% of the sample) and from sixteen of the twenty-one local government areas (76%). No responses were received from the three far western areas of Mount Isa, Boulia and Diamantina and from the southern Shire of Paroo. There were also no responses from the Shire of Barcaldine, whilst there were responses from surrounding shires. Seven respondents did not indicate a property location and may have been from one or more of these shires.

4.3.1 Respondent Characteristics

The location of the 64 respondents is shown in Table 4.2 by frequency and percentage.

TABLE 4.2: Respondent Characteristics

SHIRE	NUMBER OF RESPONDENTS	PERCENTAGE
Cloncurry	5	7.8
McKinlay	1	1.6
Richmond	3	4.7
Flinders	6	9.4
Winton	7	10.9
Longreach	4	6.3
Aramac	5	7.8
Ilfracombe	2	3.1
Jericho	2	3.1
Barcoo	1	1.6
Isisford	1	1.6
Blackall	6	9.4
Tambo	2	3.1
Quilpie	5	7.8
Murweh	5	7.8
Bulloo	2	3.1
Not Indicated	7	10.9
TOTAL	**64**	**100.0**

The respondents property size varied significantly from a low of 6,700 hectares to a high of over 2.8 million hectares. Figure 4.1 indicates size grouped by broad bands.

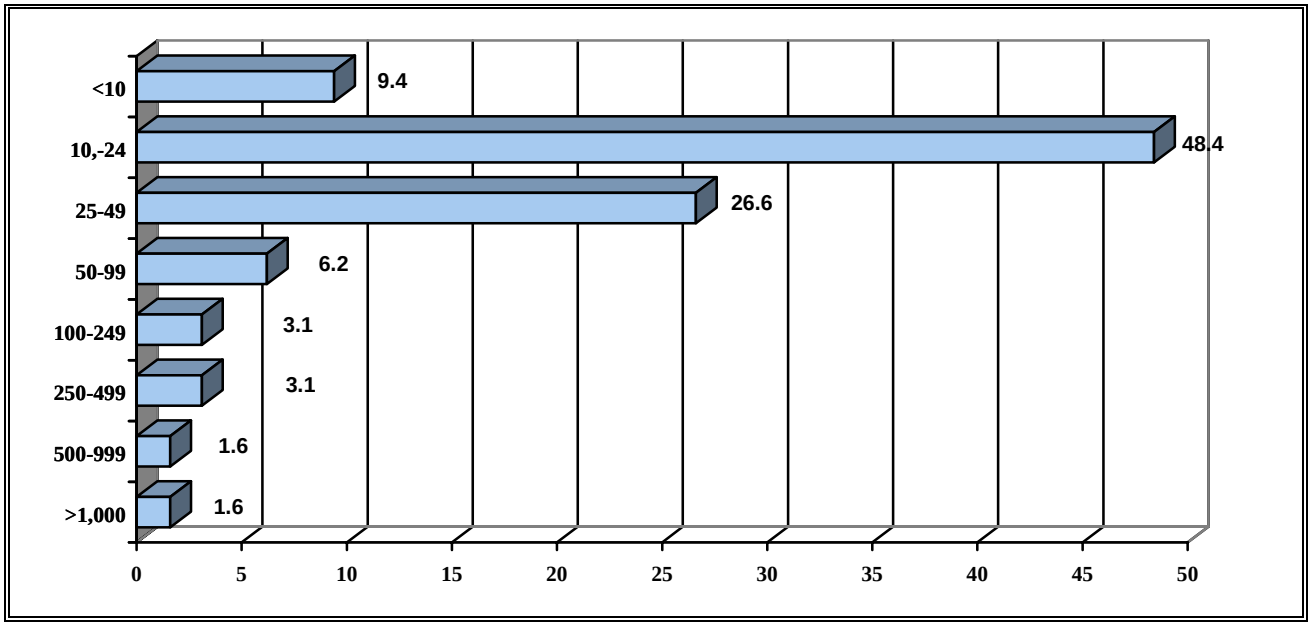


Figure 4.1: Respondent's Property Size ('000) hectares

The type of country varied with the largest proportion including some Mitchell grass followed by Gidyea and Channel Country. Mitchell grass covered over 50% of 55% of the respondent's properties, whereas the proportion of gidyea and channels were smaller. Table 4.3 shows the frequency and percentage of types of country.

Table 4.4 indicates the number and type of bush food plants currently growing on properties. Figure 4.2 illustrates the responses for the key species, highlighting the high proportion of properties with limited numbers of plants.

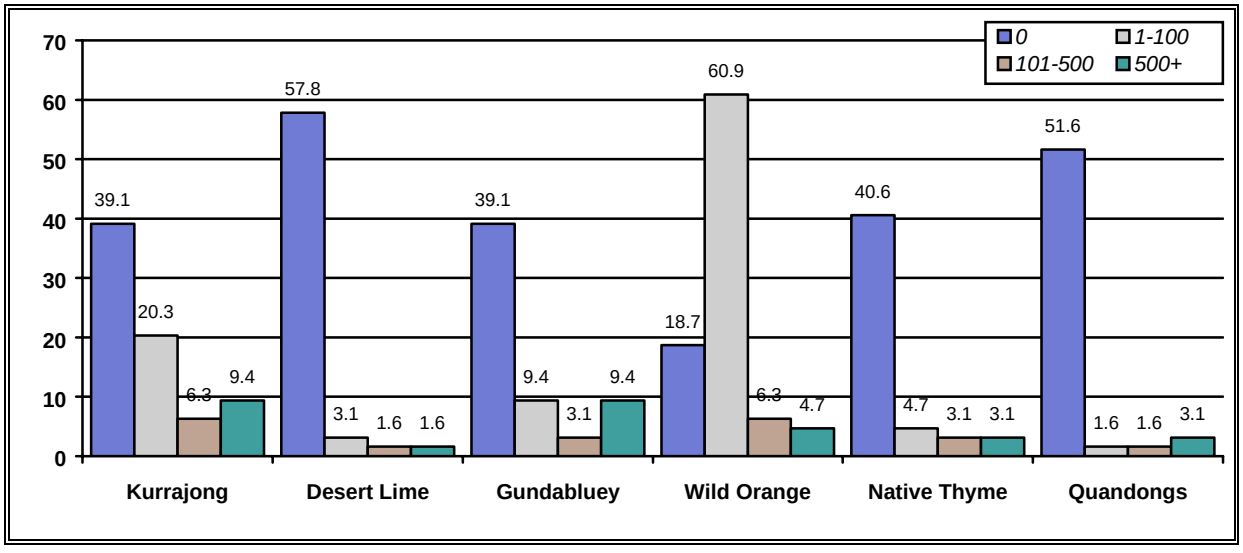


Figure 4.2: Percentage of Properties by Key Bushfood Species by Number of Plants

Wild orange is the most prolific with 72% of respondents indicating at least one plant and just over 10% of properties indicating more than 100 plants.

Table 4.3: Respondent's Type of Country

	FREQUENCY							***PERCENTAGE***						
percentage of country type on property	mitchell	gidyea	mulga	desert	brigalow	channel	other	mitchell	gidyea	mulga	desert	brigalow	channel	other
0-9	2	7	3	2	4	14	4	3.1	10.9	4.7	3.1	6.3	21.9	6.3
10-19	6	13	--	2	--	9	3	9.4	20.3	--	3.1	--	14.0	4.7
20-29	2	8	2	--	1	7	5	3.1	12.5	3.1	--	1.6	10.9	7.8
30-49	3	5	2	1	--	1	4	4.7	7.8	3.1	1.6	--	1.6	6.3
50-74	16	3	4	1	2	1	--	25.0	4.7	6.3	1.6	3.1	1.6	--
75-100	19	4	4	3	--	--	2	29.7	6.3	6.3	4.7	--	--	3.1
Q not answered	16	24	49	55	57	32	46	25.0	37.5	76.5	85.9	89.0	50.0	71.8
TOTAL	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 4.4: Incidence of Bushfood Plants on properties by frequency and percentage of responses														
NO. OF PLANTS:	**0**		**1 - 50**		**51 - 100**		**101 - 500**		**More than 500**		**No Response**		**TOTAL**	
	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**
KEY SPECIES														
kurrajong	25	39.1	11	17.2	2	3.0	4	6.3	6	9.4	16	25.0	64	100.0
desert lime	37	57.8	2	3.1	0	0	1	1.6	1	1.6	23	35.9	64	100.0
gundabluey	25	39.1	6	9.4	0	0	2	3.1	6	9.4	25	39.1	64	100.0
wild orange	12	18.7	29	45.3	10	15.6	4	6.3	3	4.7	6	9.4	64	100.0
native thyme	26	40.6	1	1.6	2	3.1	2	3.1	10	15.6	23	35.9	64	100.0
quandong	33	51.6	1	1.6	0	0	1	1.6	2	3.1	27	42.2	64	100.0
OTHERS														
sandalwood	0	0	1	1.6	0	0	0	0	2	3.1	61	95.3	64	100.0
emu apple	0	0	8	12.5	3	4.3	4	6.3	4	6.3	45	70.3	64	100.0
bush banana	0	0	0	0	0	0	1	1.6	2	3.1	61	95.3	64	100.0
cucumber	0	0	0	0	0	0	3	4.3	4	6.3	57	89.1	64	100.0
nipan	0	0	2	3.1	1	1.6	2	3.1	3	4.7	56	87.5	64	100.0
yams	0	0	0	0	0	0	0	0	2	3.1	62	96.9	64	100.0
water lilies	0	0	0	0	0	0	0	0	2	3.1	62	96.9	64	100.0

porcupine seeds	0	0	0	0	0	0	0	1.6	1	1.6	63	98.4	64	100.0
black currant	0	0	0	0	0	0	1	0	1	1.6	62	96.9	64	100.0
spinifex seed	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
wild gooseberry	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
leichardt	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
fig	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
nardoo	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
mulga apples	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
bloodwood	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
yapunyah	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
wild mint	0	0	0	0	0	0	1	1.6	0	0	63	98.4	64	100.0
mimosa pods	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
conkerberry	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0

A number of properties indicated an abundance of native thyme, with 15.6% noting they had over 500 plants. Similarly, around 10% indicated more that 500 kurrajong and gundabluey plants.

The incidence of the other key plants was quite low, with only 6.3% noting that they had any desert limes on their property and with half of these having 500 or less plants and a similar proportion of properties with quandong.

In addition to the major plants, twenty other edible plants were noted, although with the exception of emu apples (30% of properties), nipan (12.5%) and cucumber (10.9%), the remainder were found on less than 5% of the properties and usually on only one property, although also usually in large quantities (over 500 plants).

Table 4.5 indicates the way the plants grow on the property, as isolated plants or in small or large clumps on their own or grouped with other plants. The information is illustrated in Figure 4.3 for the key species.

The way the plants grow could have an effect on their commercial wild harvest potential. While the wild orange is the most prolific species noted in the survey, Table 4.5 and Figure 4.3 show that the majority of plants grow as single isolated plants, potentially increasing the cost of harvesting.

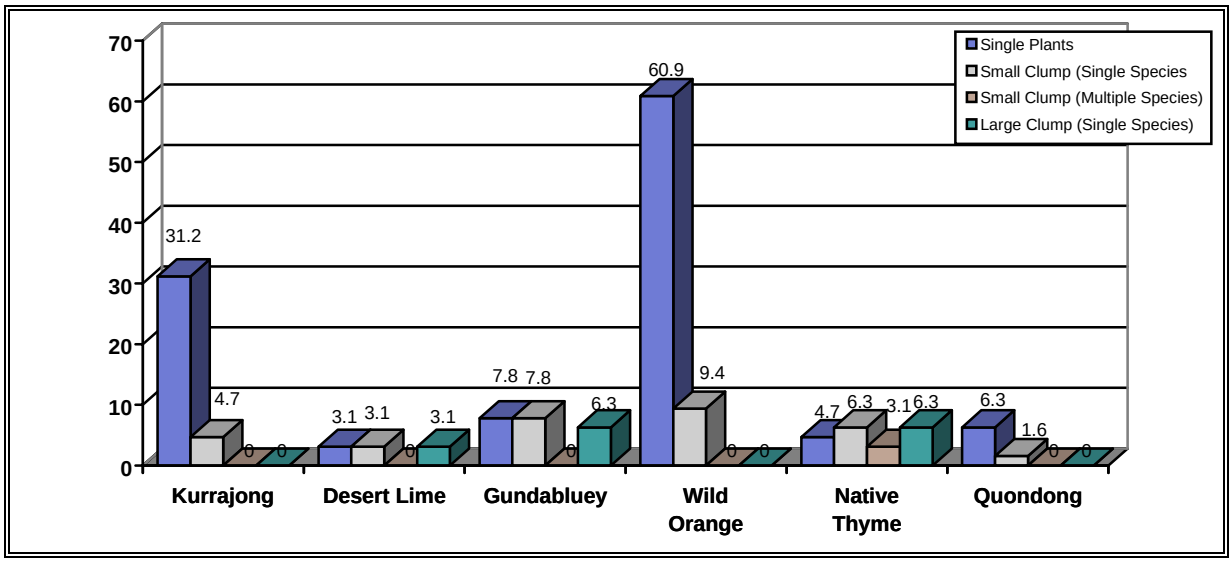


Figure 4.3. Percentage of Properties by Key Species by the Way the Plants Grow

While the desert lime, gundabluey and native thyme occur as isolated plants, they also grow in small and large clumps of single species, increasing the potential yield, providing scope to pick part of the crop commercially and leaving some to reduce the chance of non-sustainable production.

Of the *'other species'*, non-key species plants, while the incidence is low, around 50% of the species grow in large clumps of single species, which could increase the potential for cost-effective harvesting.

Table 4.6 indicates the type of country the various species grow on.

None of the species grow only in Brigalow country although all the key species are found growing on the other types of country. Some species grow in Brigalow and other types of country on the same property and are included in the *'other'* category in Table 4.6.

One of the comments on the question of the type of country the species grow in was that the thyme is taking over the Mitchell grass country.

Table 4.5: Plant species by the way the plants grow, expressed as frequency and percentage of responses

PLANT	SINGLE SPECIES		SINGLE SPECIES *SMALL CLUMPS*		MULTIPLE SPECIES *SMALL CLUMPS*		LARGE CLUMPS *SINGLE SPECIES*		LARGE CLUMPS *MULTIPLE SPECIES*		OTHER		NO RESPONSE		TOTAL	
	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%	freq.	%
KEY SPECIES																
kurrajong	20	31.2	3	4.7	0	0	0	0	0	0	0	0	41	64.1	64	100.0
desert lime	2	3.1	2	3.1	0	0	2	3.1	0	0	0	0	59	92.2	64	100.0
gundabluey	5	7.8	5	7.8	0	0	4	6.3	0	0	0	0	50	78.1	64	100.0
wild orange	39	60.9	6	9.4	0	0	0	0	0	0	0	0	19	29.7	64	100.0
native thyme	3	4.7	4	6.3	2	3.1	4	6.3	0	0	0	0	49	76.6	64	100.0
quandong	4	6.3	1	1.6	0	0	0	0	0	0	0	0	59	92.2	64	100.0
OTHER SPECIES																
sandalwood	1	1.6	2	3.1	0	0	0	0	0	0	0	0	61	95.3	64	100.0
emu apple	5	7.8	8	12.5	2	3.1	0	0	0	0	0	0	49	76.6	64	100.0
bush banana	2	3.1	0	0	0	0	0	0	0	0	0	0	62	96.9	64	100.0
cucumber	4	6.3	1	1.6	1	1.6	1	1.6	0	0	0	0	57	89.1	64	100.0
nipan	4	6.3	1	1.6	1	1.6	0	0	0	0	0	0	58	90.6	64	100.0
yams	1	1.6	1	1.6	0	0	0	0	0	0	0	0	61	95.3	64	100.0
water lilies	0	0	0	0	0	0	2	3.1	0	0	1	1.6	62	96.9	64	100.0
porcupine	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0

seeds																
black currant	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0
spinifex seed	0	0	1	1.6	0	0	0	0	0	0	0	0	63	98.4	64	100.0
wild gooseberry	0	0	1	1.6	0	0	0	0	0	0	0	0	63	98.4	64	100.0
leichardt	0	0	0	0	0	0	0	0	0	0	0	0	64	100.0	64	100.0
fig	0	0	0	0	0	0	0	0	0	0	0	0	64	100.0	64	100.0
nardoo	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0
mulga apples	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0
bloodwood	1	1.6	0	0	0	0	0	0	0	0	0	0	63	98.4	64	100.0
yapunyah	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0
wild mint	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0
mimosa pods	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0
conkerberry	0	0	0	0	0	0	1	1.6	0	0	0	0	63	98.4	64	100.0

Table 4.6: Plant Type by Type of Country on the property, expressed as frequency and percentage of responses

	mitchell		**gidyea**		**mulga**		**desert**		**brigalow**		**channel**		**other** [(1)]		**no response**		**total**	
	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**	freq.	**%**
KEY SPECIES																		
kurrajong	3	4.7	3	4.7	3	4.7	3	4.7	0	0	2	3.1	8	12.5	42	65.6	64	100.0
desert lime	0	0	0	0	0	0	1	1.6	0	0	4	6.3	0	0	59	92.2	64	100.0
gundabluey	4	6.3	3	4.7	1	1.6	0	0	0	0	3	4.7	2	3.1	51	79.7	64	100.0
wild orange	12	18.7	3	4.7	5	7.8	4	6.3	0	0	12	18.7	8	12.1	20	31.2	64	100.0
native thyme	6	9.4	4	6.3	0	0	1	1.6	0	0	2	3.1	2	3.1	49	76.6	64	100.0
quandong	1	1.6	0	0	2	3.1	2	3.1	0	0	0	0	0	0	59	92.2	64	100.0
OTHER SPECIES																		
sandalwood	1	1.6	0	0	0	0	0	0	0	0	1	1.6	1	1.6	61	95.3	64	100.0
emu apple	3	4.7	0	0	3	4.7	2	3.1	0	0	0	0	6	9.4	50	78.1	64	100.0
bush banana	0	0	0	0	0	0	1	1.6	0	0	0	0	0	0	63	98.4	64	100.0
cucumber	4	6.3	0	0	0	0	1	1.6	0	0	1	1.6	1	1.6	57	89.1	64	100.0

nipan	1	1.6	1	1.6	1	1.6	0	0	0	0	0	0	4	6.3	57	89.1	64	100.0
yams	1	1.6	0	0	0	0	1	1.6	0	0	0	0	1	1.6	61	95.3	64	100.0
water lilies	0	0	0	0	0	0	0	0	0	0	0	0	2	3.1	62	96.9	64	100.0
porcupine seeds	0	0	0	0	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
black currant	0	0	0	0	0	0	1	1.6	0	0	0	0	0	0	63	98.4	64	100.0
spinifex seed	0	0	0	0	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
wild gooseberry	0	0	0	0	0	0	1	1.6	0	0	0	0	0	0	63	98.4	64	100.0
leichardt	0	0	0	0	0	0	0	0	0	0	1	1.6	0	0	63	98.4	64	100.0
fig	0	0	0	0	0	0	0	0	0	0	1	1.6	0	0	63	98.4	64	100.0
nardoo	0	0	0	0	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
mulga apples	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	98.4	64	100.0
bloodwood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	98.4	64	100.0
yapunyah	0	0	0	0	1	1.6	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
wild mint	0	0	0	0	1	1.6	0	0	0	0	0	0	0	0	64	98.4	64	100.0

mimosa pods	1	1.6	0	0	0	0	0	0	0	0	0	0	0	0	63	98.4	64	100.0
conkerberry	0	0	0	0	0	0	0	0	0	0	0	0	1	1.6	63	98.4	64	100.0
(1) Mainly combinations of the other categories																		

4.3.2 Extent of Plants by Type of Country and Patterns of Growth

Table 4.7 indicates the number of respondents indicating the extent of plants on their property by type of country.

The table reinforces the relative abundance of bushfood species in Mitchell grass, Gidyea and Channel country and the limited extent in Brigalow, Desert and Mulga. However, even in these lesser incidence country, there is still significant incidence, with properties with over 500 plants particularly of kurrajong in all types and gundabluey in most types. Wild oranges are also fairly evenly spread, except in Desert and Brigalow country.

Table 4.7: Extent of Plants by Type of Country on the Property

Plants by Country		**0**	**1-50**	**50-100**	**100-500**	**100 +**
MITCHELL	kurrajong	23	9	1	2	2
	desert lime	29	2			
	gundabluey	18	6	--	2	4
	wild orange	9	23	7	3	2
	native thyme	18	1	1	2	9
	quandong	25	1	--	1	2
GIDYEA	kurrajong	15	8	1	3	4
	desert lime	22	2	--	1	1
	gundabluey	15	4	--	1	4
	wild orange	3	22	5	4	2
	native thyme	13	1	1	1	9
	quandong	19	1	--	1	2
MULGA	kurrajong	6	1	2	1	2
	desert lime	7	1	--	1	--
	gundabluey	3	2	--	1	3
	wild orange	7	--	3	1	2
	native thyme	6	--	1	--	1
	quandong	5	1	--	1	1
DESERT	kurrajong	1	3	1	1	2
	desert lime	5	--	--	--	--
	gundabluey	3	1	--	--	2
	wild orange	3	2	3	1	--
	native thyme	4	--	--	--	2

	quandong	4	--	--	1	1
BRIGALOW	kurrajong	--	4	--	--	2
	desert lime	5	--	--	--	1
	gundabluey	4	1	--	--	--
	wild orange	2	4	1	--	--
	native thyme	4	--	--	--	1
	quandong	5	--	--	--	--
CHANNEL	kurrajong	13	5	1	2	2
	desert lime	19	1	--	1	--
	gundabluey	12	4	--	2	3
	wild orange	4	16	5	2	2
	native thyme	11	--	1	1	8
	quandong	16	1	--	1	1
OTHER	kurrajong	8	4	1	1	2
	desert lime	14				
	gundabluey	10	2	--	1	2
	wild orange	3	7	5	1	2
	native thyme	7	--	--	1	5
	quandong	10	1	--	1	1

Table 4.8 indicates the way the key plant species grow by type of country. The large clumps largely of gundabluey and native thyme are largely growing on Mitchell grass, Gidyea and Channel country. Two respondents also indicated large clumps of desert limes, one in gidyea and one in brigalow country.

Table 4.8: Growth Patterns of Key Plant Species by Type of Country

Plants by Country		*Type of Growth Pattern*			
		SINGLE	SMALL CLUMP *SINGLE*	SMALL CLUMP *MULTIPLE*	LARGE CLUMP *SINGLE*
MITCHELL	kurrajong	11	3		
	desert lime	1	1		
	gundabluey	5	4		2
	wild orange	30	2		5
	native thyme	3	4	1	

	quandong	3	1		
GIDYEA	kurrajong	14	2		
	desert lime	2	2		1
	gundabluey	3	3		2
	wild orange	28	4		
	native thyme	2	4		5
	quandong	4	1		
MULGA	kurrajong	4	2		
	desert lime	1	1		
	gundabluey	2	3		1
	wild orange	10	3		
	native thyme	1	1		
	quandong	2	1		
DESERT	kurrajong	7			
	desert lime	1			
	gundabluey		1		1
	wild orange	4			
	native thyme	1	2		
	quandong	3			
BRIGALOW	kurrajong	6			
	desert lime				1
	gundabluey	1			
	wild orange	4			
	native thyme				1
	quandong				
CHANNEL	kurrajong	8	2		
	desert lime	1	1		
	gundabluey	3	4		2
	wild orange	21	4		
	native thyme	1	3	1	4

	quandong	2	1		
OTHER	kurrajong	8			
	desert lime				
	gundabluey	2	1		1
	wild orange	10	2		
	native thyme	2	2		2
	quandong	3			

Table 4.9 indicates the way the plants grow by the number of plants.

In the bulk of the single isolated plant incidence the property has less than fifty plants in total. There are also some examples of large numbers of desert limes, gundabluey and native thyme growing in large clumps which, as noted earlier, could provide the potential for wild harvesting.

Table 4.9: Growth Pattern of Plants by the Number of Plants

Plants by Country		**1 - 50**	**50-100**	**100-500**	**500 +**	**TOTAL**
SINGLE ISOLATED	kurrajong	10	2	3	5	20
	desert lime	1				1
	gundabluey	5				5
	wild orange	26	8	3	1	38
	native thyme	1			1	2
	quandong	1		1	1	3
Sub-Total		*44*	*10*	*7*	*8*	*69*
SMALL CLUMPED Single	kurrajong	1		1	1	3
	desert lime	1		1		2
	gundabluey	1		2	2	5
	wild orange	1		1	1	3
	native thyme		1		3	4
	quandong				1	1
Sub-Total		*4*	*1*	*5*	*8*	*18*

SMALL	kurrajong					
CLUMP	desert lime					
Multiple	gundabluey					
	wild orange					
	native thyme		1	1		2
	quandong			1		
Sub-Total		*0*	*1*		*0*	*2*
LARGE	kurrajong					
CLUMP	desert lime				1	1
Single	gundabluey				3	3
	wild orange					
	native thyme			1	5	6
	quandong					
Sub-Total		*0*	*0*	*1*	*9*	*10*
TOTAL		**48**	**12**	**14**	**25**	**99**

4.3.3 Flowering and fruiting patterns

Table 4.10 notes the response to when the various species are in flower, fruit or seeding. The key issue here seems to be the limited knowledge of the precise flowering and fruiting characteristics. This is probably expected given that the plants have not been seen as an economic alternative to date and are most likely to have been viewed as a weed.

The limited responses on when species flower and fruit suggests some variation in flowering, which could be used to extend the productive period from the region. Similarly, the number of responses that suggest that flowering and fruiting occur after rain may suggest some potential for more consistent cropping in a plantation or augmented wild harvest situation. Additional research is required to expand the information from the survey before this can be confirmed.

Table 4.11 looks at the respondent views on age to maturity of the species. Again, the limited knowledge stands out, reflecting the limited interest in the trees as fruit trees and probably the fact that most of them have been around and fruiting for some time, so the precise time new trees start fruiting is not recorded.

The table provides some evidence that there is more certainty about the species that mature more quickly such as native thyme, cucumber and bloodwood.

Table 4.10: Time Plants Flower and Fruit

PLANT TYPE	Never Seen Flower	Never Seen Fruit	Flowers After Rain	Fruits After Rain	Flowers Same time each year		Fruits Same Time each year		Other	No Response	TOTAL
					Time	No.	Time	No,			
KEY SPECIES											
kurrajong	2	1	3	0	Jan/Feb June/Aug	1 1	0	0	3	53	64
desert lime	0	1	0	0	0	0	0	0	1	62	64
gundabluey	1	0	0	2	0	0	0	0	6	55	64
wild orange	1	0	5	4	June/Aug Spring	2 1	Aug	1	12	38	64
native thyme	0	0	8	2	Summer	1	0	0	2	51	64
quandong	0	0	0	1	0	0	Winter	1	1	61	64
OTHER SPECIES											
sandalwood	0	0	0	1	0	0	0	1	0	63	64
emu apple	0	0	0	2	Jun/Aug	1	Winter	1	3	57	64
bush banana	0	0	0	1	0	0	0	0	0	63	64
cucumber	0	0	1	2	0	0	0	0	1	60	64
nipan	0	0	0	2	0	0	0	0	3	59	64

yams	0	0	0	1	0	0	0	0	2	61	64
water lilies	0	0	1	0	0	0	0	0	1	62	64
porcupine seeds	0	0	0	0	0	0	0	0	1	63	64
black currant	0	0	0	0	0	0	0	0	1	63	64
spinifex seed	0	0	0	0	0	0	0	0	1	63	64
wild gooseberry	0	0	0	0	0	0	0	0	1	63	64
leichardt	0	0	0	0	0	0	0	0	0	64	64
fig	0	0	0	0	0	0	0	0	0	64	64
nardoo	0	0	1	0	Jun/Aug	1	0	0	0	63	64
mulga apples	0	0	0	0	Apr/May	1	0	0	0	63	64
bloodwood	0	0	0	0	Anytime	1	0	0	0	63	64
yapunyah	0	0	0	0	0	0	0	0	0	63	64
wild mint	0	0	0	0	0	0	0	0	0	64	64
mimosa pods	0	0	0	0	0	0	0	0	1	63	64
conkerberry	0	0	0	0	0	0	0	0	1	63	64

Table 4.11. Perceived Years to Maturity of Species (Time Period of First Fruiting)											
PLANT TYPE	**Year 1**	**1 - 3 yrs**	**3 - 5 yrs**	**5 - 7 yrs**	**7 - 10 yrs**	**10 - 20 yrs**	**more than 20 yrs**	**Don't Know**	**Other**	**No Response**	**TOTAL**
KEY SPECIES											
kurrajong	0	1	0	0	0	2	0	13	1	47	64
desert lime	0	0	0	0	0	0	0	3	0	61	64
gundabluey	0	1	2	0	0	0	0	8	0	53	64
wild orange	0	0	2	0	0	1	2	25	0	34	64
native thyme	5	1	0	0	0	0	0	8	0	50	64
quandong	0	0	0	0	0	1	0	3	0	60	64
OTHER SPECIES											
sandalwood	0	0	0	0	0	0	0	1	0	63	64
emu apple	0	0	0	0	0	0	0	7	0	57	64
bush banana	0	0	0	0	0	0	0	1	0	63	64
cucumber	3	0	0	0	0	0	0	2	0	59	64
nipan	0	0	0	0	0	0	0	4	0	60	64
yams	0	0	0	0	0	0	0	3	0	61	64
water lilies	0	0	0	0	0	0	0	2	0	62	64
porcupine seeds	0	0	0	0	0	0	0	1	0	63	64
black currant	0	0	0	0	0	0	0	0	0	64	64

spinifex seed	0	0	0	0	0	0	0	1	0	63	64
wild gooseberry	0	0	0	0	0	0	0	1	0	63	64
leichardt	0	0	0	0	0	0	0	0	0	64	64
fig	0	0	0	0	0	0	0	0	0	64	64
nardoo	0	0	0	0	0	0	0	1	0	63	64
mulga apples	0	0	0	0	0	0	0	1	0	63	64
bloodwood	1	1	0	0	0	0	0	1	0	61	64
yapunyah	0	0	0	0	0	0	0	1	0	63	64
wild mint	0	0	0	0	0	0	0	1	0	63	64
mimosa pods	0	0	0	0	0	0	0	1	0	63	64
conkerberry	0	1	0	0	0	0	0	0	0	63	64

4.4 Detailed Survey Analysis

This section looks at the characteristics of the key bushfood species in relation to the survey.

4.4.1 Respondents with more than 100 plants of the Key Regional Species

Table 4.12 indicates the location of respondents, indicating more than one hundred plants of each of the key species on their property.

Table 4.12: Location of Bushfood Species

TYPE	LOCATION OF RESPONDENTS	% RESPONSES
kurrajong	Flinders	7.1
	Aramac	4.8
	Jericho	2.4
	Tambo	4.8
	Murweh	2.4
desert lime	Tambo	2.8
	Quilpie	2.8
gundabluey	Cloncurry	5.9
	Richmond	2.9
	Longreach	2.9
	Aramac	2.9
	Quilpie	2.9
	Murweh	2.9
	Bulloo	2.9
wild orange	Richmond	1.9
	Flinders	1.9
	Aramac	1.9
	Blackall	1.9
	Quilpie	5.7
native thyme	Cloncurry	11.1
	Richmond	2.8

	Flinders	2.8
	Longreach	2.8
	Aramac	2.8
	Blackall	8.3
quandong	Aramac	3.1
	Quilpie	3.1

All respondents noted that kurrajong grew singly or in small clumps. These respondents covered nine of the 20 locations. With the exception of Cloncurry, the locations were all in the central area from Flinders to Murweh. Only five locations indicated significant numbers of plants as shown in Table 4.12.

There was limited response to the incidence of the desert lime, with only five respondents from Aramac, Quilpie and Tambo indicating incidence. Again, only respondents in Quilpie and Tambo indicated quantities in excess of one hundred plants.

While the number of respondents related to the incidence of gundabluey was higher, only three respondents in two locations, Cloncurry and Richmond, indicated that they had large clumps of the wattle.

Wild orange is more prolific and widely spread, with respondents in fifteen shires (75%) indicating some incidence, although as indicated earlier, only as single plants or in small clusters. Only seven respondents in the five shires in Table 4.12 indicated having more than one hundred plants on their property.

Native thyme, while less widespread, was indicated as being found in large clumps in Cloncurry, Richmond and Blackall.

Quandong was indicated growing in Cloncurry, Winton, Aramac and Quilpie, although only in large numbers in Aramac and Quilpie.

There were no respondents from the six Shires of Mt Isa, Boulia, Diamantina, McKinlay, Paroo and Isisford. No respondents in Winton or Barcaldine had fifty or more plants of any species. The other twelve shires included respondents who indicated having fifty or more plants of at least one species.

Figure 4.4 indicates the number of respondents in each shire with more than fifty plants of one or more of the key species.

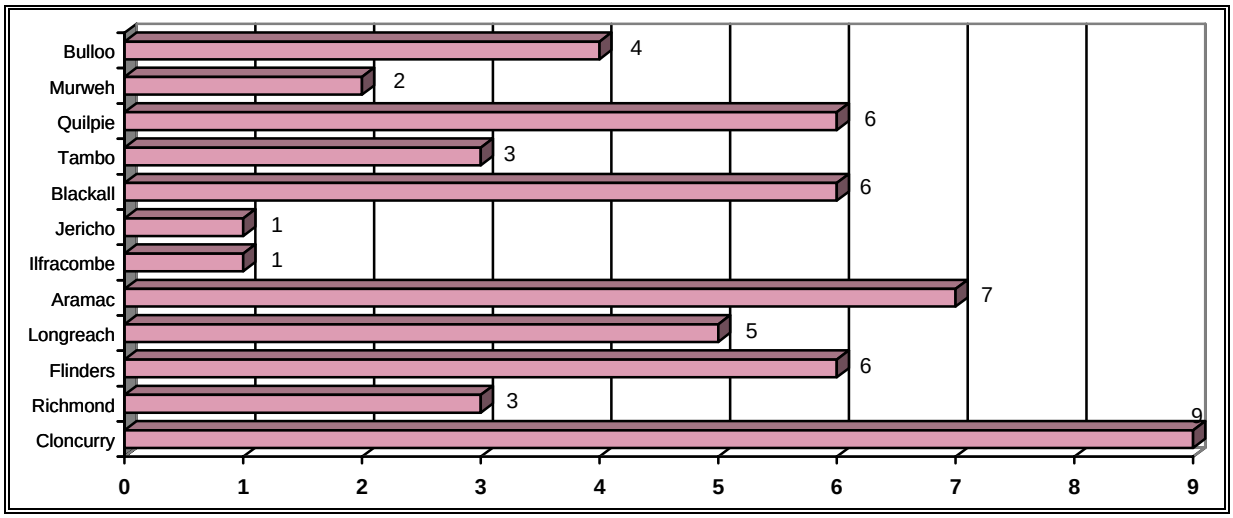


Figure 4.4. Respondents with 50 or more plants of key species

4.4.2 Interest In Wild Harvest and Plantation Establishment

Thirty-five respondents (55%) were interested in harvesting for income, with 32 (50%) interested in considering the development of a plantation. Of the thirty-five respondents who were interested in harvesting, 31 indicated where their property was. These respondents were located in 14 shires.

Two (8%) respondents indicated that they harvested for bush food and 59 (92%) said they did not. One of the respondents indicated that they supply produce to Longreach Bush Tucker and the other did not provide a formal response.

Nine respondents indicated that they were aware of the uses of bush food and the market for it (15% of respondents). Fifty (85%) were not aware. Of the nine respondents who were aware, seven listed markets, including jams and similar products, food services, supermarkets and restaurants.

These results are interesting in the light of a survey of the needs of graziers in central western Queensland conducted in 1988, where no interest was shown for alternative enterprises (Roberts and Crouch 1990). Some issues were raised that relate to this study, most notably concerns relating to the degradation of land and pasture, unreliable rainfall, drought, conservation extremists, lack of information, uneven income and water management and quality. Uneven income and degradation of land and pasture may be addressed through establishing a successful bush food industry, whilst unreliable rainfall, drought, conservation extremists, lack of information, and water management and quality may all be problems that need to be addressed to successfully establish the industry.

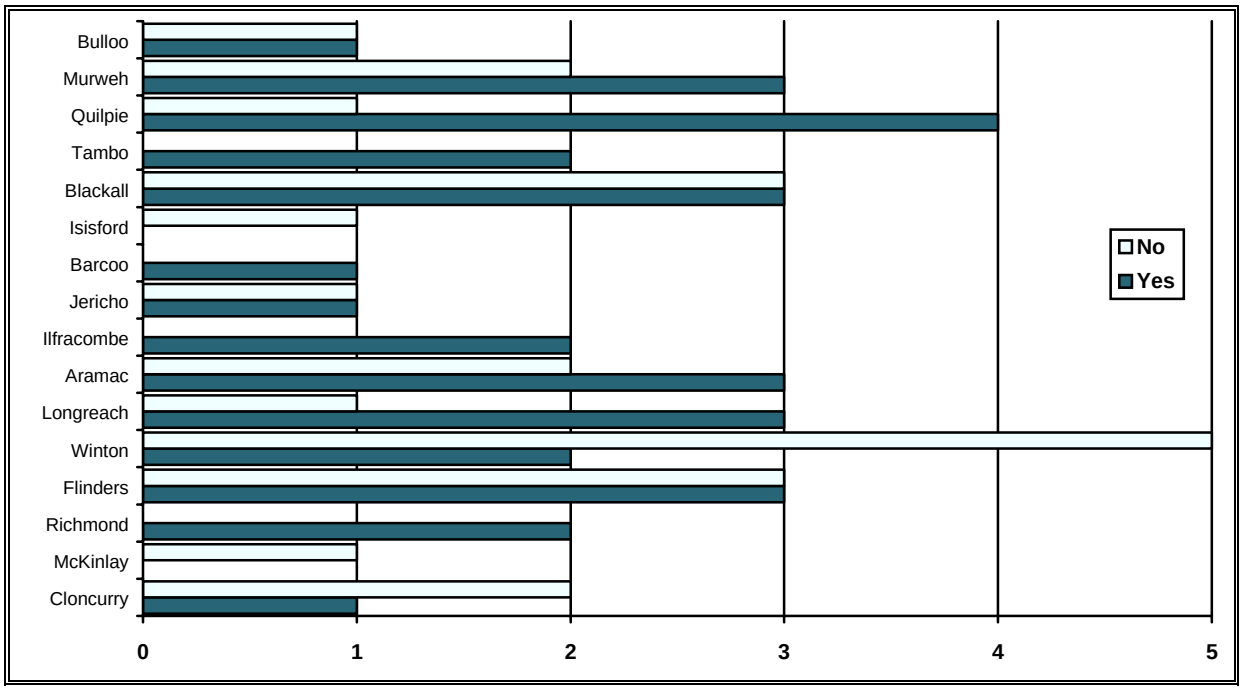


Figure 4.5: Respondents interested in harvesting

In the main, interest in developing a plantation was similar, although there were respondents who were interested in developing a plantation who were not interested in bush harvesting (Figure 4.6).

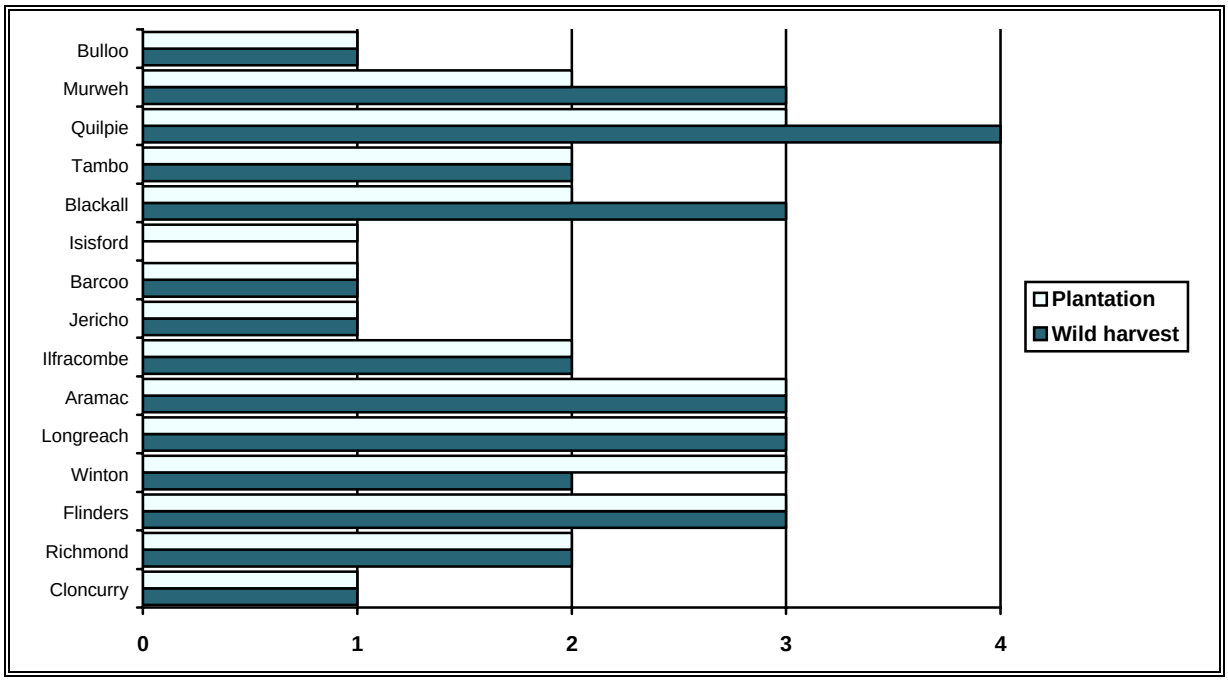


Figure 4.6: Respondents interested in developing a plantation

The interest in harvesting for income and in establishing a plantation is spread across all sizes of property. Tables 4.13 and 4.14 indicate the interest in harvesting for income and the interest in developing a plantation against the number of plants on the property.

Table 4.13: Interest in Harvesting for Income							
Interest by Type of Plant		*Number of Plants*					
		No Plants	**1 - 50**	**50 - 100**	**100 - 500**	**500 +**	**TOTAL**
YES	kurrajong	14	8	1	3	3	29
	desert lime	19	2	--	1	1	23
	gundabluey	12	3	--	2	2	19
	wild orange	7	14	6	3	2	32
	native thyme	11	1	2	1	6	21
	quandong	18	--	--	--	1	19
TOTAL YES		**81**	**28**	**9**	**10**	**15**	**143**
NO	kurrajong	8	3	1	1	3	16
	desert lime	15	--	--	--	--	15
	gundabluey	11	3	--	--	3	17
	wild orange	4	13	4	1	1	23
	native thyme	13	--	--	1	3	17
	quandong	12	1	--	1	1	15
TOTAL NO		**63**	**20**	**5**	**4**	**11**	**103**

Table 4.14: Interest in Developing a Plantation							
Interest by Type of Plant		*Number of Plants*					
		No Plants	**1 - 50**	**50 - 100**	**100 - 500**	**500 +**	**TOTAL**
YES	kurrajong	12	7	1	2	4	26
	desert lime	17	2	--	1	1	21
	gundabluey	11	3	--	2	1	17
	wild orange	6	15	5	3	1	30
	native thyme	10	1	2	1	5	19
	quandong	16	1	--	--	--	17
TOTAL YES		**72**	**29**	**8**	**9**	**12**	**130**
NO	kurrajong	9	4	1	2	2	18
	desert lime	16	--	--	--	--	16
	gundabluey	11	3	--	--	4	18

	wild orange	5	10	5	1	2	23
	native thyme	13	--	--	1	4	18
	quandong	13	--	--	1	2	16
TOTAL NO		**67**	**17**	**6**	**5**	**14**	**109**

These two tables indicate some interesting issues. The two respondents with significant quantities of desert limes were interested in both harvesting and developing a plantation. From the answers to other questions, it is likely that these two are already harvesting limes and are aware of the market and the income potential.

The presence of large quantities of plants on a property does not necessarily lead to an interest in harvesting. In some cases this may be because of the way the plants grow. For example, four respondents with more than five hundred kurrajong trees on their properties were interested in developing a plantation, while only three were interested in harvesting for an income. The largely isolated growing nature of the kurrajong in the wild could make it more attractive in a cultivated situation.

While not conclusive, the tables suggest that there is slightly more interest in harvesting over developing a plantation for respondents who already have significant numbers of plants. This is probably as expected but the extent of interest in developing a plantation by respondents with large numbers of plants is also interesting.

Tables 4.15 and 4.16 indicate the respondent's interest related to the way the plants grow.

Table 4.15: Interest in Harvesting for Income

Interest by Type of Plant		*Growth Pattern of Plants*				
		SINGLE	**SMALL CLUMP**	**SMALL CLUMP**	**LARGE CLUMP**	**TOTAL**
		Isolated	*Single Species*	*Multiple Species*	*Single Species*	
YES	kurrajong	12	3	--	--	15
	desert lime	2	2	--	1	5
	gundabluey	2	4	--	1	7
	wild orange	20	3	--	--	23
	native thyme	2	3	2	2	9
	quandong	1	1	--	--	2
TOTAL YES		**39**	**16**	**2**	**4**	**61**
NO	kurrajong	8	--	--	--	8
	desert lime		--	--	--	--
	gundabluey	3	1	--	1	5
	wild orange	17	1	--	--	18
	native thyme	1	1	--	3	5
	quandong	3	--	--	--	3
TOTAL NO		**32**	**3**	**--**	**4**	**39**

Table 4.16: Interest in Developing a Plantation

Interest by Type of Plant		*Growth Pattern of Plants*				
		SINGLE	**SMALL CLUMP**	**SMALL CLUMP**	**LARGE CLUMP**	**TOTAL**
		Isolated	*Single Species*	*Multiple Species*	*Single Species*	
YES	kurrajong	12	2	--	--	14
	desert lime	2	2	--	1	5
	gundabluey	2	3	--	1	6
	wild orange	20	2	--	--	22
	native thyme	1	3	2	2	8
	quandong	2	--	--	--	2
TOTAL YES		**39**	**12**	**2**	**4**	**57**
NO	kurrajong	8	1	--	--	9

	desert lime	--	--	--	--	--
	gundabluey	3	2	--	1	6
	wild orange	15	2	--	--	17
	native thyme	2	1	--	3	6
	quandong	2	1	--	--	3
TOTAL NO		**30**	**7**	**--**	**4**	**41**

Again, the tables indicate some interesting issues. For example, the respondent with quandong trees in small clumps is interested in harvesting for income but not in developing a plantation. On the other hand, one respondent with single isolated quandong trees not interested in harvesting, is interested in developing a plantation.

The information in the last four tables reinforces the base information that a significant number of property owners are interested in either wild harvesting for an income and/or developing a plantation if they can be shown the benefits to them. On balance there is slightly more interest in harvesting, which requires less costs to implement and probably less time and effort, but still strong interest in developing plantations where appropriate.

4.5 Summary of survey results

There are a significant number of properties with the key bushfood plants growing on them, although often in relatively small numbers and growing as single plants or in small clumps. There is some incidence of properties with larger numbers of plants and with growth in large clumps for desert lime, gundabluey and native thyme. The extent of incidence of most of the plants regionally and by type of country suggests that most properties could participate in the industry if they want to.

There is significant interest from graziers in being involved in the industry, both as wild harvesters and in developing plantations. However, at this stage there seems to be little knowledge about the industry, either about the species and their characteristics or the market. This combination of interest and limited awareness suggests that some education and dissemination of information is required to assist the industry to develop in the region.

4.6 Wild harvest potential

For wild harvest to be a viable option, there needs to be sufficient yield of the raw products to supply the expanding bush food market. This supply would also need to be consistent in terms of quantity and quality, and not affected by pending or existing legislation which could limit access to removal of plant material from the wild. The process would also need to be economically feasible for the harvesters, which may include factors such as yields in a given area, distance to travel to single or clumps of trees, access to the plants and the resources required to harvest and process the raw product. Harvest from the wild needs to be based soundly on ecological principles to ensure that damage to the environment does not result, and to protect the source of the produce to ensure continuity of supply for future generations.

4.6.1 Estimated wild harvest production in relation to demand

The potential yields of gundabluey, desert lime, native thyme, kurrajong, wild orange and quandongs have been estimated based on survey results of plant abundance and distribution and on estimated yields of plants growing in the wild (Table 4.17). Abundance was determined on a shire basis using the percentage of survey respondents with greater than 100 trees. Each respondent was assumed to be representative of their shire, and the number of properties in the shire was multiplied by the percentage of respondents with trees. The average number of plants was assumed to be 1000 for those respondents with greater than 100 plants. The accuracy of the wild harvest production estimate is dependent on both plant yield and density. More research is needed to better quantify both of these. The density of plants could be more accurately determined by visiting properties with the KRS, and counting plant numbers within a given area (eg Maikhuri *et al* 1994). Yield could be better quantified through monitoring the yields of known plants in the wild (or wild augmented) over a series of consecutive seasons to provide an average yield within different rainfall patterns.

Table 4.17. Estimated wild harvest production of the Key Regional Species.

Key Regional Species	product	abundance	estimated yield*		current demand
			kg/plant	total (kg)	total (kg)
gundabluey	seed	31 000	1	31 000	7 500
desert lime	fresh fruit	4 900	1.5	7 350	3 000
bush tomato	dried fruit	0	0.3	0	6 200
native thyme	dried/fresh leaf	40 600	0.1	4 060	270
kurrajong	seed	32 700	1.5	49 050	>200
wild orange	fresh fruit	17 000	1.5	25 500	>0
quandong	dried fruit	6 000	0.7	4 200	>1 200

*estimated at approximately 2/3 the plantation production (Table 4.20)

Based on the calculated estimates, western Queensland could supply the total current demand of all of the Key Regional Products, with exception of the preferred form of bush tomato which does not grow in western Queensland. Western Queensland could not, however, meet the projected demands for wattleseed, desert lime fruit or quandong fruit in the year 2000 (Table 3.5). Estimated supply of native thyme leaf, kurrajong seed and wild orange fruit would be adequate.

This estimation does not take into consideration potential problems associated with the high variability of rainfall in western Queensland, nor the high incidence of drought. Monitoring yield over a number of seasons would help to address this problem.

4.6.2 Possible impact of legislation on wild harvest

Legislation may impact on the potential of wild harvest in western Queensland, particularly in the areas of natural resource management and conservation. Recent legislation under the jurisdiction of the Department of Environment has restricted the harvest of any plant portion from a large number of endangered and threatened plants (Lavarak 1995 and Anon 1995). Where a plant is listed as endangered, no harvest is possible, where threatened, full development plans are required before harvesting can proceed. There are no plants with bush food potential in western Queensland currently listed. It is likely that increased wild harvest activity will draw attention to western Queensland and that development plans will be required at some stage. Provided that sensible, rather than overly restrictive, development

plans are required this should be seen as a positive move, enabling the industry to demonstrate its ecological credentials.

Current federal legislation is restrictive in allowing the export of plant material, but not in the export of seed or propagative material. This may pose serious threats to the industry if it is not possible to export produce, but propagative material is allowed overseas for the establishment of offshore plantations.

Any raw material harvested from leasehold land is currently subject to a fee payable to the Forest Service within Queensland DPI.

4.6.3 Can wild harvest production satisfy industry needs?

Desert lime and native thyme have been selected as case study crops for this section. Both show potential within the bush food market, and are becoming more readily accepted and utilised by processors within the industry. Desert lime produces a small fruit, whilst the leaf of native thyme is being used as a herb. At present all Queensland supply of these crops comes from wild harvest, with some wild augmentation of desert limes.

There is little published information available on these plants. Desert lime has been researched overseas as a source of genetic material for commercial citrus (Rahman and Nito 1994). In Australia, desert lime has principally been considered a woody weed which should be controlled (Csurhes 1993). Native thyme has mostly been considered for medicinal and organic chemical uses in Asia (Ganguly 1994)

The demand for both desert limes and native thyme has been increasing since the first Queensland harvests over the 1993/94 summer (Table 4.18). Supply has been erratic with the 1995/96 season the worst due to drought and heavy frosts. Consistency of supply needs to be guaranteed, at least from season to season. Additionally, many people within the industry require consistency of supply throughout the year (eg restaurants). It is possible that demand for desert lime fruit will decline in the 1996/97 summer in response to the poor supply in 1995/96. One processing company was hoping to enter the market place with a line of products based on limes, and another existing processor had planned on extending their production of lime based products. The financial effects on these companies is likely to be strong, and the flow on effects are yet to be seen.

Table 4.18. Fluctuations in Queensland price, demand and supply of desert lime and native thyme (from Phelps and Phelps 1996).

	Desert Lime				Native Thyme			
	'93/94	'94/95	'95/96	2 yr proj[1]	'93/94	'94/95	'95/96	2 yr proj[1]
Price* ($/kg)	7.50	6.50	6.50	6.50	80.00	55.00	55.00	55.00
Supply (kg)	266	1180	250	1000 to 15000	75	2	25	50 to 500
Demand (kg)	266	1500	3000	3000 to 25000	12	11	37	100 to 300

* farm gate price

[1] 2 year projected estimates for the 1997/98 season based on current domestic market trends, feasibility study results and wild harvest levels.

The demand for native thyme from processors was initially low, primarily as a result of overpricing at the wholesale entry point. The pricing has been altered, further promotion undertaken and the demand is now steadily increasing. However, if the industry relies on wild harvest of thyme leaf, it is expected that similar problems will occur as with limes. There are already signs of problems for next year, with drought conditions within inland Queensland currently restricting the harvestable area of thyme. A number of restaurants have expressed interest in obtaining fresh thyme leaf, which can not be supplied on a regular basis from wild harvest production.

It is likely that more problems of supply will be encountered for each species within the next 2 years, especially if demand increases as expected (Table 4.18). Legislation may also restrict the wild harvest of plant material within Queensland (Lavarack 1995), although at present there are no known bush food plants under threat (Anon 1995). Quality assurance programs would also be easier to implement and conduct with plantation production systems.

It would seem that wild harvest production will not fulfil existing and potential demand. This suggests that at least some plantation production of both desert lime and native thyme is required, although wild augmentation may suffice for the next 2 to 5 years. Both species are suited to simple water harvesting, as they grow in clumps rather than as scattered plants (Tables 4.5 and 4.16). In this case, low banks could be constructed to allow the ponding of rainfall runoff. This would increase the effectiveness of the rain that does fall, and also provide the ability to efficiently flood irrigate from other water sources (eg farm dams and bores). Ponding has already been used effectively for desert limes on one property in western Queensland. Research is required to determine innovative plantation establishment, production and harvesting techniques, as well as to look at wild augmentation production systems.

4.6.4 Estimated wild harvest farm gate returns

Econsult (1996b) have detailed the potential returns for bush food plantations but no figures are currently available for the economics of wild harvest. Costs of production for wild harvest have been estimated in this section for: fuel and vehicle costs; labour costs; and sundry additional costs (such as additional stationary and telephone). Labour costs are the most difficult to estimate, with the time taken to harvest and sort raw produce estimated in Table 4.19. The current structure of the bush food industry in western Queensland has been assumed to apply (see section 2.4.2), which means that no packaging or transport costs would be incurred. It has been assumed that to harvest 2000kg of limes, 500km would be travelled in a private vehicle; to harvest 50kg of native thyme, 100km would be travelled in a private vehicle; and to harvest 100kg of kurrajong seed, 100km would be travelled in a private vehicle. Private vehicle costs are assumed to be the equivalent of 50c/km. Sundry additional costs are assumed to be negligible on larger quantities, but subject to economies of scale, eg increased administrative costs to sell 2000kg of limes would be $10-50 for telephone calls, facsimile transmissions and postage but may be also be $10-50 to sell 50kg of thyme. These costs have been charged at $50/2000kg of limes; $50/40kg of thyme; and $50/100kg of kurrajong seed.

It has been assumed that no additional land or infrastructure costs have been necessary for wild harvest production to be undertaken, although if large volumes are harvested additional storage sheds and cold room space may be needed.

Only the three plants currently harvested in western Queensland have been considered, ie desert lime, native thyme and kurrajong.

Table 4.19. Estimated costs for wild harvested desert lime, native thyme and kurrajong.

Key Regional Species	product	estimated harvest time (min/kg)	estimated sorting time (min/kg)	estimated labour costs[a] ($/kg)	other operating costs[b] ($/kg)	total operating costs ($/kg)	net return ($/kg)
desert lime	fresh fruit	5	10	3.00	0.15	3.15	3.35
native thyme	dried leaf	60	90	30.00	2.00	32.00	23.00
kurrajong	seed	10	30	9.00	1.00	10.00	5.00

[a] assuming labour at $12/hr, [b] based on estimates from Econsult (1996b).

It is evident from these figures that desert lime, native thyme and kurrajong are all providing a good return from wild harvest production. The higher return from native thyme may reflect the current level of supply, or perhaps the perceived difficulty in harvesting and sorting the product. Considering many of the companies interviewed in the marketing section indicated high price of raw product was a problem, the margins on native thyme may need to be reduced if demand is to increase.

The estimated times for harvest and sorting each of the products should be reasonably accurate, coming from local industry experience. The returns will be most sensitive to the time taken to harvest and sort each of the products.

4.6.5 Ecological sustainability of wild harvest production

For a wild harvest industry to be feasible, it needs to focus on the long term effects of removing seeds, fruits and leaf from the wild. The two major issues are the preservation of the natural ecosystem and the continued ability to harvest from the plants - if plants are over-harvested then both the natural processes and their ability to bear may be affected.

Conservative harvesting of the edible produce coupled with minimal disturbance to the surrounding areas should ensure a sustainable system. For instance with fruit, if only the best fruit is removed from a tree, or if different areas are harvested on a rotational basis, both the integrity of the system and the plants' ability to bear fruit should be maintained.

DPI Forestry service advises that harvesting no more than one third of the leaf from a plant in the wild should guarantee its continued survival and not interfere with natural growth. To develop a truly ecologically sustainable wild harvest industry in western Queensland, however, more research is needed to study the impact of different levels of wild harvest on the ecosystem. Monitoring of harvested and non harvested areas may enhance the understanding of the ecology of the system and preserve the ecological balance. Existing records and observations made by land managers would also provide invaluable information eg the comments from the survey of graziers that native thyme in increasing in density and area may indicate a need for harvest to help control the spread of the plant.

In some areas the natural ecosystem and ecological processes have already been greatly disturbed, eg the cleared Brigalow country where desert lime has resuckered into unnaturally high densities, and conservative harvesting to preserve the natural balance is not of a high importance.

4.7 Plantation establishment potential

4.7.1 Estimated plantation production in relation to demand

Estimated plantation production data for the KRS are provided in Table 4.20. With the high levels of production expected, only small areas of each plant would be required to fill the current and predicted levels of demand (Table 4.21). It does need to be considered that the KRS would take from 2 to 10 years to reach maturity, and that plantings established now would most likely be supplying the greater demands predicted.

Table 4.20. Estimated production figures* for the Key Regional Species under plantation conditions.

Key Regional Species	product	density	estimated yield		time to maturity	farm gate value	gross return
		plants/ha	kg/plant	kg/ha	years	$/kg	$/ha
gundabluey	seed	625	1.5	937.5	4	5.00	4 687.50
desert lime	fresh fruit	625	2	1250	5	6.50	8 125.00
bush tomato	dried fruit	3300	0.5	1650	2	8.00[a]	13 200.00
native thyme	dried leaf	5000	0.2	1000	2	55.00	55 000.00
kurrajong	seed	275	2.0	550	5	15.00	8 250.00
wild orange	fresh fruit	625	2	1250	10	5.50	6 875.00
quandong	dried fruit	833	1	833	5	20.00[a]	16 660.00

*information based on local estimates, Australian Native Produce Industries Pty Ltd (1995), Econsult (1996a), Econsult (1996a) and DPI Notes (Appendix VII),

[a] Econsult (1996b) prices divided by 1.5 to better estimate western Queensland prices.

Farm gate value in Table 4.20 has been estimated from a number of sources, the most relevant being the DPI Notes presented in Appendix VII. This source does not quote prices for bush tomato or quandong. Farm gate prices can also be found in Australian Native Produce Industries Pty Ltd (1995) and Econsult (1996b). The prices quoted for raw produce in these

sources are generally higher than in the DPI Note series. The expected prices for bush tomato and quandong in western Queensland have been adjusted accordingly.

Table 4.21. Areas of the Key Regional Species required to fill current and predicted levels of demand.

Key Regional Species	area for current demand (ha)	area for predicted demand (ha)
gundabluey	8.0	73.3
desert lime	2.4	22
bush tomato	3.8	34.4
native thyme	0.3	2.5
kurrajong	0.4	3.3
wild orange	>0	>0
quandong	1.4	13.2

Propagative stock of most of the KRS is available now, with a number of nurseries in all states (8 in Victoria, 8 in NSW, 3 in Queensland, 2 in SA, 3 in WA, 2 in NT and 1 in Tasmania; Robins 1996) supplying seedlings. The CSIRO has recently called for expressions of interest in the commercial propagation of superior lines of desert lime (*Eremocitrus glauca*). Superior lines of CSIRO developed quandong are already available commercially.

Estimated current plantings

The current level of plantings for any of the KRS throughout Australia is difficult to determine, but industry rumour indicates that bush tomato plantings may exceed 20 000 plants (the equivalent of 6.1ha), quandong plantings approximate 50 000 trees (the equivalent of 24ha), and wild lime plantings (both desert lime and the coastal limes) consist of 200 to 500 trees (the equivalent of 0.8ha). It is thought that the wild lime plantings are predominantly desert lime, so desert lime planting may exceed 0.4ha. Levels of gundabluey, wild orange, kurrajong and native thyme plantings are unknown, although native thyme is being grown in at least two locations in Australia.

The indications are that bush tomato and quandong oversupply will occur in the short term, with bush tomato demand fully satisfied by wild harvest at present. Bush tomato plantings would not be sufficient for the predicted demand in 2000, but quandong plantings will still exceed predicted demand in 2000.

4.7.2 Potential of the species reviewed through Queensland herbarium records

Of the species reviewed, most have a wide distribution throughout Queensland (Appendix III) and grow primarily on clay soils (Appendix IV). This suggests strong potential for use in plantations throughout western Queensland. The major exceptions are quandong (*Santalum acuminatum*), sandalwood (*Santalum lanceolatum*) and warrigal greens (*Tetragonia tetragonoides*) which grow mostly on sandy or loamy soils and bush tomato (*Solanum centrale*) which grows on sandy soils and has only been recorded in central Australia. Some of the wild oranges, notably *Capparis loranthifolia*, *Capparis spinosa* and *Capparis umbonata* are only found to the north or south of the Tropic of Capricorn.

Quandongs have not been recorded growing on clay soils and occur predominantly south of the tropic of Capricorn. They should be suitable for plantations in the Charleville area, or other areas which have sandier soils.

Warrigal greens and sandalwood have been found growing in clay soils and may be suitable to plantations in heavier soils. Warrigal greens may be better suited to plantations south of the Tropic of Capricorn, which would mimic their natural distribution.

The main type of bush tomato (*Solanum centrale*) may not be suitable as it is not found in Queensland, although *Solanum esuriale* may be able to substitute in western Queensland. More investigation is required to confirm this.

Of the wild oranges, *Capparis loranthifolia* may not be suitable for more northern plantations as it has a tendency to grow south of the Tropic of Capricorn. *Capparis spinosa* and *Capparis umbonata* grow predominantly to the north of the Tropic of Capricorn, and may be

best suited to plantations in the northern parts of western Queensland. *Capparis mitchellii* has a much wider distribution, however, and may be the more sensible choice of the wild oranges to trial.

This information suggests that trial plantations would be worth establishing to further investigate the major species for commercial potential. A more detailed cost benefit analysis should also be completed for individual species, as well as bioclimatic modelling to determine the most suitable areas for plantation establishment.

4.7.3 Potential of other species

Some species have been identified as having strong commercial potential through the market survey and from discussions with members of the bush food industry. They are not species which occur naturally in western Queensland, but may be worth pursuing for their suitability in plantations. These include lemon myrtle (*Backhousia citriodora*); native rosella (*Hibiscus heterophyllus*); native pepper (*Tasmannia lanceolata*); native peppermint (*Eucalyptus dives*); and muntries (*Kunzea pomifera*). There are some additional species which occur in western Queensland that may be worth pursuing further. These include emu apple (*Owenia acidula*), pigweed *(Portulaca oleracea*), bush banana *(Marsdenia australis*) and native pear (*Cynanchum floribundum*).

The levels of demand and current plantings have not been reviewed for these species, but warrant further investigation.

4.7.4 Potential plantation farm gate returns

Econsult (1996b) have detailed the potential returns for a variety of different sized bush food plantations in far western New South Wales. These figures will provide a guide to potential returns in western Queensland, but further research will be needed to quantify the returns for the specific mix of plants best suited to western Queensland.

Their report includes assumed levels of the following operating costs: water; fuel and power; rates; operating consumables; fertiliser; vehicle costs; stationery; postage and telephone; computer costs; accounting and administration costs; marketing costs; freight and cartage; packaging; and labour costs. It also includes establishment and infrastructure costs for: planning and design work; site preparation; irrigation systems, dams and tanks; plant and equipment; working sheds; storage sheds; cold room; plant stock; fertiliser; office space; loam and mulch; setup consumables; and working capital. Interest and discount rates have also been incorporated in to the projected figures. Income has been assumed to come from: sale of fresh produce; sale of dried produce; sale of semi-processed produce; and the sale of processed produce.

The plantation production system selected is based on low volume production, with plants interplanted in guilds of suitable mixes in a riverland community.

Within this framework, and based on species suitable for the arid zone of far western NSW, a 20ha plantation would provide an internal rate of return just under 9%. If established in 1997, the plantation would make an operating surplus in 2002 and employ a manager and 4 full time equivalent staff. A 20ha plantation could have an operating surplus of $42 500 in the year 2010.

Operating costs have been extrapolated from this scenario and adjusted in consultation with Mr David Cotterill of Econsult Pty Ltd to better suit western Queensland conditions. Operating costs excluding harvesting and sorting, but including amortised costs of plant and equipment, have been estimated at $2 500/ha. Harvesting costs have been estimated at $1 200/ha for gundabluey, $1 875/ha for desert lime, $2 500/ha for bush tomato, $20 000/ha for native thyme, $825/ha for kurrajong, $1 800/ha for wild orange and $1 200/ha for quandong. This data has been based on estimated wild harvest times, with the assumption that harvest and sorting times will be faster in a plantation than in the wild. The estimated operating costs have been applied to the KRS to provide an estimate of returns from the KRS (Table 4.22). The annualised costs of establishment have not been included as they will vary from those for far western NSW in areas such as land value and costs of irrigation supplies.

The industry structure for western Queensland has been assumed to remain the same as it is currently, and the same as for wild harvest returns presented in section 4.6.4.

Table 4.22. Estimated returns* for the Key Regional Species under plantation conditions.

Key Regional Species	product	estimated yield (kg/ha)	gross return ($/ha)	estimated operating costs ($/ha)	estimated return after operating costs($/ha)
			$/ha		
gundabluey	seed	937.5	4 687.50	3 700.00	987.50
desert lime	fresh fruit	1250	8 125.00	4 375.00	3 750.00
bush tomato	dried fruit	1650	13 200.00	5 000.00	8 200.00
native thyme	dried leaf	1000	55 000.00	22 500.00	32 500.00
kurrajong	seed	550	8 250.00	3 325.00	4 925.00
wild orange	fresh fruit	1250	6 875.00	4 300.00	2 575.00
quandong	dried fruit	833	16 660.00	3 700.00	12 960.00

*information based and Econsult (1996b).

If farm gate prices remain at their current levels, returns after operating costs for plantations will be exceptional for all plants except gundabluey. However, it is unlikely that prices would remain at their current levels once plantation production has begun. Quandong prices are likely to drop as the South Australian plantations come into production, as are bush tomato prices. It is likely that all bush food farm gate prices will decline as plantation production increases, particularly if demand is exceeded.

The most promising current returns are from native thyme, but the demand could be supplied from a fraction of a hectare at present. Given this, and the probable price drop for quandong and bush tomato, desert lime and kurrajong may be the most suitable species for plantations at present. Wild oranges have also yielded a positive return, but the current and future levels of demand are uncertain.

4.7.5 Ecological sustainability of plantation production

Ecological sustainability of a plantation based industry is quite different to a wild harvest based industry. For a wild harvest industry, natural conditions and processes need to be preserved as much as possible to ensure long term viability of harvest. Plantations are, by their very nature, not functioning in a natural way. In the extreme, plantations are monocultures which rely heavily on chemical application to supply nutrients and to reduce pests and diseases.

The preferred form for plantations in western Queensland would be to use guilds of companion plants native to the area and to use sound principles of integrated pest management. The guilds may be based on plants which will deter insect attack or which have similar water use requirements. Organic production techniques, or at least minimal chemical use, would be preferable from both an environmental and marketing perspective, with the possibility of utilising organic branding. This should not be seen to exclude the use of superior varieties of plants, which will be essential for western Queensland to compete in terms of providing a consistently high quality product to the mainstream bush food market. Preferably superior varieties would be selected for low water use and drought hardiness whilst able to produce a quality product.

It is envisaged that innovative plantation designs are required to overcome variable rainfall and, possibly, low availability of irrigation water. For example, wild augmentation of existing clumps of plants via pondage banks could be coupled with interplantings of other species or of improved varieties of the same species. Irrigation may only be applied during the establishment phase and at critical physiological times of the plant’s growth cycle eg budding and fruit set, with pondage banks constructed to enhance the benefit of natural rainfall events. Design could be enhanced by heeding the way in which the plants grow naturally.

It is assumed that by mimicking natural processes and using plants native to the area, the success rate of plantations will be enhanced and the long term future of the industry ensured. In the context of western Queensland, then, desert lime and native thyme may have a high chance of success, whilst bush tomato may not. This assumption has been made as the plants are already well adapted to the local pests and diseases, and are also adapted to the variable rainfall conditions experienced. The use of species native to the area would also avoid the possibility of introducing new weeds to the area.

There are still a number of unknowns surrounding the establishment of a plantation based industry. The suitability of different areas would be dependent on the quantity and quality of water, and the suitability of local soils. A better inventory of land and water suitable to plantations should be completed to determine the areas most suited to different types of plantations.

A further limitation to the successful establishment of plantations in western Queensland is the lack of commercial horticultural skills. This could be overcome through training, or through the importation of the necessary skills eg via contractors or consultants.

5. Preferred species analysis

This section discusses an approach developed to define the preferred species for western Queensland. The analysis approach is designed to be used to identify preferred species in any region of Australia. It can be used at any scale, from regional down to individual properties, and is based on a decision tree approach.

The analysis is based on determining the following:

- the species considered grows in the region;
- the competition from other regions based on their competitive advantage in growing the required bush food species;
- comparative ease of growth based on soil, climate and other factors;
- the ease of obtaining bush food from the species in terms of both wild harvest and cultivation;
- the market potential of the species.

The methodology is based on ranking defined factors across each of the areas above and weighting the factors to give an overall preferred species rank. Ranking is based on a five (5) point scale, with 1= low and 5 = high. A number of factors are considered important in determining the potential of a species for the bush food industry. These include the market potential of the product, the food potential of the product, the harvest and shipping potential of the products and the wild harvest and plantation potential of the product. This has been organised into a flow chart (Fig 5.1) showing the way these factors have been related to each other and system used to filter out species with only low potential.

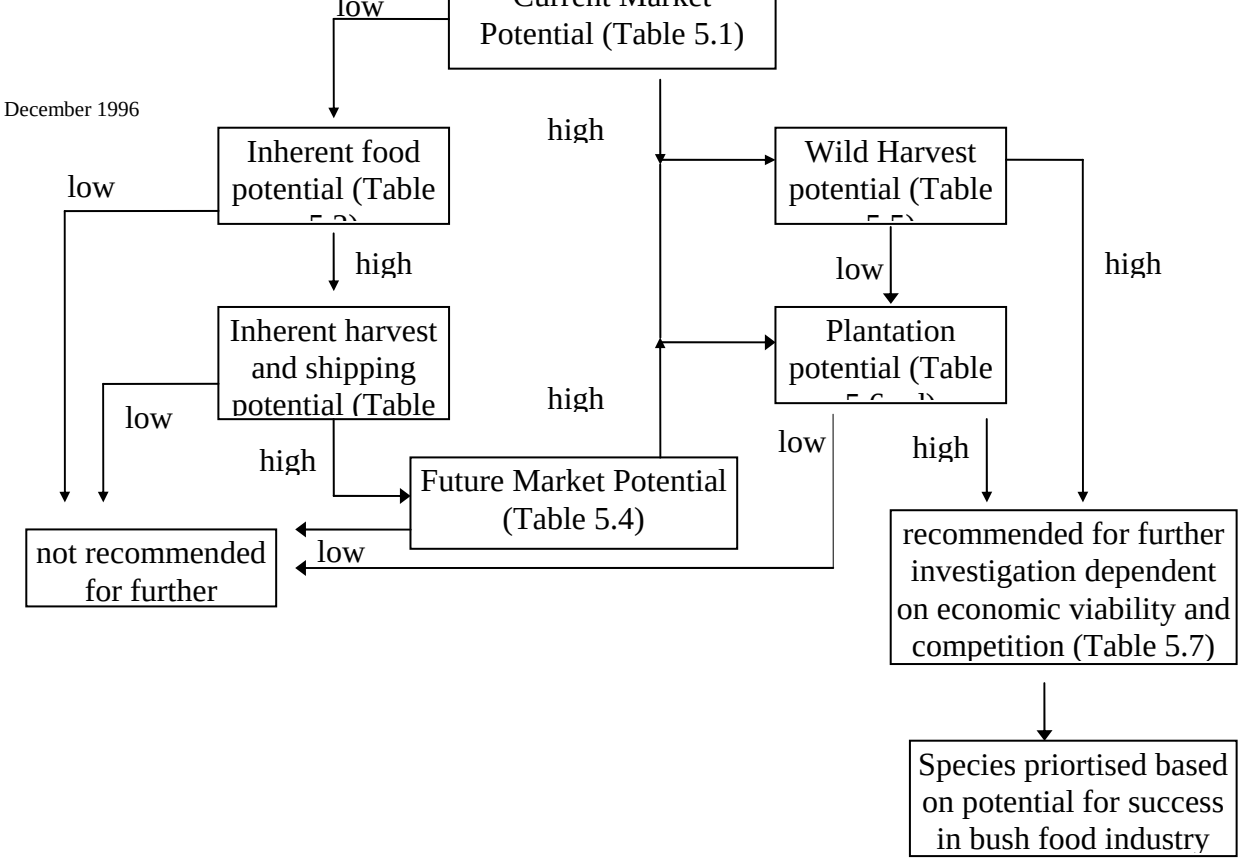


Figure 5.1. Flow chart summarising the decision tree approach to select potential regional species.

Where the current market potential is low (Table 5.1), inherent food (Table 5.2) and inherent harvest and shipping potential (Table 5.3) are seen as the two most important factors determining the future potential in the market place. It is assumed here that if the product has an interesting flavour with applicability in the bush food industry coupled with relatively simple harvesting and transport requirements then it has the potential to succeed commercially. Future Market Potential is assumed to be high if scores in both Table 5.2 and 5.3 are high, and that the plant has the potential to succeed commercially. Future Market Potential is summarised in Table 5.4. The method has been devised in this way to allow plants with the potential for success, but no current usage, to be considered for both wild harvest (Table 5.5) and plantation potential (Table 5.6).

Where a plant has high current or future market potential, but has only a low score for wild harvest potential (Table 5.4), it has been deemed important to consider its potential in a plantation. This will avoid the possibility of excluding any plants that perform poorly in the wild, but may perform well under plantation conditions.

It was considered important to prioritise the species that are worth investigating further (Table 5.7) to ensure that only the best species are investigated within the resources available at the time.

A plant would not be recommended for further investigation if it has low inherent food potential (Table 5.2), low inherent harvest and shipping potential (Table 5.3) or low plantation potential (Table 5.6d).

The Key Regional Species have been used in this section to provide an example of the application of the approach. Since the scoring system devised is relative, the scores for the KRS can be utilised for comparative purposes in future investigations. For example, if wild oranges score 2 in Table 5.2 (inherent food potential) and do not become well used because of taste, then any other product scoring 1 or 2 in the future is unlikely to succeed. An alternative approach to allow effective comparisons would be to score the 11 preferred species used in the industry (Box 2.1) and then use these scores for comparative purposes.

A number of other species were mentioned more than once in the survey of western Queensland graziers. These were: emu apple, bush cucumber, bush banana, plumwood, nipan, black currant and waterlilies. The preferred species analysis approach could also be applied to species to gauge their suitability for use in the bush food industry. The research required to determine the market, food and other potential of these species is outside the scope of this project.

5.1 Current market potential

Table 5.1 indicates an assessment of the current market potential of the KRS. This assessment is based on the relevant research carried out for this study and includes responses from leading bushfood processing companies in Qld, Vic, NSW and SA outlined in Section 4.

Table 5.1. Current Market Potential of the KRS.

Species	proportion of companies using (%)	current usage (kg)	potential usage in 2000 (kg)	rank (1-5)
gundabluey	90	7500	68700	5
desert lime	27	3000	27500	4
bush tomato	61	6200	56800	5
native thyme	17	270	2500	3
kurrajong	25	200kg	1800	3
wild orange	6	>0	uncertain, possibly small	1
quandong	58	>1200	>11000	5

Wild orange would need to be considered in the context of Table 5.2 as the next step in the decision tree. This is because of its low current market potential. The other species have a medium to high score and could move straight into consideration for wild harvest or plantation potential (Table 5.5 and 5.6a-d), but will be considered in each table for the sake of this exercise.

5.2 Inherent food potential

Table 5.2 provides an assessment of the food potential of the KRS. The rankings made for taste are arbitrary in this case, coming from experience rather than formal tests. Research involving taste tests of raw and processed products is essential to properly determine the market potential of new products. This procedure could include product development by bush food companies and hospitality consultants, and taste tests “by proxy” in a similar fashion to wine tasting (where the taste is compared to existing products in the market place). The initial taste tests should concentrate on aspects such as bitterness and astringency to determine what items are worth pursuing with more formalised tests.

The toxicity rating has been provided based on exiting literature but, as with taste, more formal research is recommended. This should involve the testing of new products for toxic compounds through accepted laboratory procedures. Toxicity testing may also be required as a routine component of any quality assurance schemes developed within the industry (Plantchem Pty Ltd 1996).

Table 5.2. Estimated Inherent food Potential of the KRS.

Species	Taste	Toxicity rating	Pre-storage processing	Pre-wholesale processing	Manufacturing processing	rank (1-5)
gundabluey	good	low	moderate	low	moderate	4
desert lime	good	low	moderate	moderate	low	4
bush tomato	good	moderate	low	low	low	4
native thyme	average to good	low	moderate	high	low	3
kurrajong	good	low	moderate	moderate	moderate	4
wild orange	average	low	low	high	high	2
quandong	good	low	moderate	moderate	low	4

In this case, the arbitrary rankings indicate that all plants but wild orange have a moderate to good chance of being accepted within the bush food industry based on their food potential. This is supported by the fact that all the products from the KRS except for wild orange fruit already have a strong market acceptance within the industry.

5.3 Inherent harvest and shipping potential

Both the harvesting and shipping potential of the KRS are considered in Table 5.3. These factors are considered important in terms of the potential returns at the farm gate, as well as the ease of delivering a high quality product to the market place. For instance nipans have been considered for use by industry in western Queensland, but they bruise easily and are difficult to transport. They are also difficult to harvest. Despite a high food potential, their use has been precluded due to these factors.

Prestorage processing is low for wild orange fruit, which requires no specialist treatment, however it requires pulping before it enters the wholesale market and before it is stored in the long term. It also requires a high level of processing as part of the manufacturing process, with seeds needing removal from the pulped product. By comparison, wattleseed requires no treatment prior to storage, only needing to be cleaned of contaminants (eg husk) prior to wholesale. It requires roasting and grinding into a flour during manufacturing.

Table 5.3. Inherent harvest and shipping potential of the KRS.

Species	Ease of picking	Ease of on-farm storage	Transportability	rank (1-5)
gundabluey	difficult	simple	simple	4
desert lime	moderate	difficult	difficult	2
bush tomato	difficult	simple	simple	4
native thyme	difficult	simple/difficult *	simple	3/4
kurrajong	difficult	simple	simple	4
wild orange	simple	difficult	difficult	3
quandong	moderate	simple/difficult *	difficult	2/3

* native thyme and quandong ease of storage varies according to the form of the product

Desert lime and wild orange require refrigerated storage and transport to the market place, making both more difficult than wattleseed or kurrajong seed which can be stored in any dry location and transported in normal containers. Quandong and native thyme require refrigerated or very fast transport to the market place if they are to be supplied fresh, but not if they are supplied in the dried form. It may also be worthwhile to consider the effect of the time of harvest on product quality eg harvesting perishables during summer may lead to lower quality due to extreme temperatures and rain damage.

Table 5.4. Future Market Potential of the KRS.

Species	food potential (A)	harvest and shipping potential (B)	Future market potential (A+B)
gundabluey	4	4	8
desert lime	4	2	6
bush tomato	4	4	8
native thyme	3	4	7
kurrajong	4	4	8

wild orange	2	3	5
quandong	4	3	7

Of all the KRS, only wild orange may be marginal in terms of its potential use in the bush food industry. This is because it has a low market usage at present and has not scored well in terms of food potential, leading to a lower overall Future market potential than other species currently used in the industry. Again, this is supported by the high volume of use of the KRS with the exception of wild orange fruit.

5.4 Inherent wild harvest potential

Once a species has been determined to be saleable at present or in the future, it seems judicious to explore its potential for harvest from the wild. Table 5.5 outlines a ranking procedure to account for the harvesting of a species from the wild, including factors such as yield, concentration of the plants in a given area and access to the plants. These all affect the ease of obtaining the product and relate to the potential farm gate returns and costs of the product. A further category could be used to explore the timing of harvest in relation to current enterprise activities (eg shearing or fly control).

The length of season relates to this aspect, providing an indication of how critical the timing of harvest is; eg desert lime has a short season when the fruit can be picked. This means that if desert lime is to be picked, all other property activities need to be re-organised around the lime harvest. By comparison, kurrajong seed remains in the pod for quite some time and there may be 4 to 6 weeks over which seed can be harvested, allowing for usual management activities to proceed as usual. Seasonality and production systems are relevant to most aspects of the ability to fit harvesting into the normal work requirements of the core pastoral activities, the ability to use family labour at picking time , the availability of contract labour and the ability to develop appropriate mechanical harvest systems.

Table 5.5. Inherent wild harvest potential of plants with edible portions found in western Qld.

Species	Yield/unit	concentration	accessibility	length of season	rank (1-5)
gundabluey	low	scattered	good	moderate	2
desert lime	moderate	clumps	good	short	4
bush tomato	low	scattered	good	moderate	2

native thyme	low	clumps	good	moderate	4
kurrajong	moderate	scattered	good	moderate	3
wild orange	high	scattered	good	moderate	3
quandong	moderate	scattered	good	moderate	3

The concentration of desert lime trees and native thyme plants into clumps suggests that wild augmentation through ponding may be an alternative production method.

One further attribute which could be considered in the wild harvest potential is the evenness of ripening of fruit, where fruit which ripens unevenly over a long period of time may be more difficult and more expensive to harvest because a number of small harvests would be required to pick the fruit.

5.5 Plantation potential

If a species bears marketable produce, it may be suitable for cropping within a plantation, even if it is not suitable for wild harvest. Tables 5.6a, 5.6b and 5.6c outline a ranking system for determining plantation potential, with Table 5.6d summarising the results.

The species ranking for plantation potential is based on the following:

- the extent of incidence (or geographic range) - a higher ranking is allocated to species with wider distribution in the region, assuming that plants already present are well suited to the area;
- the extent of incidence nationally - a high ranking is provided where the species is largely confined to the region, assuming that this will offer an advantage over other areas where the plant is not found;
- regular consistent production - species that produce a consistent production volume across a range of temperatures, rainfall and soil types. The information discussed earlier on national incidence of species, soil types and preferred climate ranges is used in ranking this attribute;
- the risk of failure of availability due to drought, frost, natural life cycles of the species and economic factors such as the comparative value of bush food compared with other property enterprises such as sheep and cattle. This factor could include an assessment of the opportunity cost of the new crops on animal husbandry options, if information is available. The possibility of alternative cropping or animal husbandry has to be included

in the assessment. The ranking is based on the discussion of crop failures, ease of harvesting, and relative farm gate prices provided earlier.

Table 5.6a. Estimation of how well the KRS will grow under plantation conditions.

species	regional incidence[1]	state incidence[2]	national incidence[2]	regular consistent production (dryland)	regular consistent production (irrigated)	risk of failure (dryland)	risk of failure (irrigated)	rank (1-5)
gundabluey	moderate	high	high	low	moderate	high	low	4
desert lime	moderate	high	low	low	high	high	moderate	4
bush tomato	low	low	low	low	moderate	high	low	1
native thyme	moderate	moderate	moderate	low	moderate	high	low	3
kurrajong	high	high	high	low	high	high	low	5
wild orange	high	high	moderate	low	high	high	low	4
quandong	low	low	high	low	high	high	moderate	2

[1] based on herbarium records and response from survey

[2] based on herbarium records

Table 5.6b. Plantation Potential of the KRS.

Species	Yield/unit	propagule availability	time to production	ease of establishment	rank (1-5)
gundabluey	moderate	high	moderate	good	4
desert lime	high	low (but improving)	moderate	good	4
bush tomato	moderate	low	moderate	good	3
native thyme	moderate	low	short	good	4

kurrajong	moderate	high	lengthy	good	4
wild orange	high	low	lengthy	moderate	3
quandong	moderate	high	moderate	difficult	3

The plantation establishment table (Table 5.6c) includes an assessment of the potential competition from other areas of Australia, based on the suitability of soils, temperatures, rainfall and water availability in the competitive and local regions. In this case, western NSW has been used as an example for comparison. Western NSW would be able to grow the same plants as western Queensland, and probably withe same success. Other potentially competitive areas should also be considered, eg the riverland of SA.

Table 5.6c. Suitability of area for plantation establishment.

species	regional soil type	regional temp.	regional rainfall	regional water supply	competitive soil type	competitive temp.	competitive rainfall	competitive water supply	rank (1-5)
gundabluey	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3
desert lime	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3
bush tomato	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3
native thyme	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3
kurrajong	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3
wild orange	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3
quandong	suitable	suitable	erratic	limited	suitable	suitable	erratic	limited	3

Table 5.6d. Summary of the plantation potential of the KRS in the region.

Species	plantation potential (a)	plantation potential (b)	plantation potential (c)	overall plantation ranking
gundabluey	4	4	3	11
desert lime	4	4	3	11
bush tomato	1	3	3	7
native thyme	3	4	3	10
kurrajong	5	4	3	12
wild orange	4	3	3	10
quandong	2	3	3	8

The overall ranking indicates that all of the KRS bear further investigation, and all but the bush tomato have a strong potential for plantation production.

Other factors which could be included in the analysis include:

- the ease of mechanical harvest;
- the ability to mix crops to spread cash flow (where a higher rank would be given where species can be grown with other species with either shorter or longer times before fruiting to ensure quicker access to cash flow and extended income);
- the relative farm gate value compared with other enterprises;
- the potential farm gate product values;
- the potential contribution to regional development;
- the conservation and species preservation potential through cultivation; and
- water and soil quality.

More research would be required to determine values for these aspects.

5.6 Recommendations for further investigation

Species should finally be prioritised by summarising the rankings from each section and, where possible, including an indication of returns per ha and a comparative supply analysis

with other regions. This will avoid the possibility of growing plants which will not return a positive value or of growing plants that will only contribute to problems of oversupply.

5.6.1 Economic potential and comparative competition analysis

Economic potential has been drawn from Table 4.22 and comparative competition from Table 5.6c and industry knowledge. It is considered that it is appropriate for these two factors to be the final filter applied before prioritisation, as the industry believes that market driven growth is essential to its long term success (Econsult 1996a).

If a plant is not going to be economic to grow, or the product will be surplus to demand, there is no need consider it for further investigation until these factors change (Table 5.7). Three possible results have been considered:

- not recommended for further investigation;
- unsure due to imperfect market knowledge; and
- definitely recommended for further investigation as there is strong confidence in the future of the product and the plant.

Table 5.7. Economic Potential and comparative present competition form other areas for the KRS.

Species	economic potential	comparative competition	recommend for investigation
gundabluey	positive - low	strong competition from SA wild harvest	UNSURE
desert lime	positive - medium	no competition at present	YES
bush tomato	positive - medium	strong competition from plantations and NT wild harvest	UNSURE
native thyme	positive - high	no competition at present	YES
kurrajong	positive - medium	some competition from SA	UNSURE
wild orange	positive - medium	some competition from NSW	UNSURE
quandong	positive - medium	strong competition from SA and NSW plantations	UNSURE

Desert lime and native thyme are definitely worth further consideration, as there is little competition from elsewhere and they return a positive economic potential. Wild orange may not be worth pursuing until more is known about the potential demand of the fruit. The other 3 are uncertain, with competition based on rumours rather than hard data. They may still be worth pursuing further.

5.6.2 Species prioritisation

The final species prioritisation then considers all of the factors, from market score through to the recommendation for further investigation based on economics of production and the strength of competition. Table 5.7 has been considered most important in ranking the species. If a plant has not been recommended for further investigation, then it should be automatically ranked last. If it is not clear if a plant should be recommended for further investigation, it has been ranked lower than those which are definitely worth further investigation. If there is more than one plant within each of these categories (“yes”, “unsure” or “no”) then they have been ranked within these categories according to their overall scores.

Table 5.8. Final ranking of the KRS to give the preferred species for further investigation.

Species	Marke	wild	plantatio	scor	recommend	RANK

	t score*	harvest potential	n potential	e	for investigation	
gundabluey	8	2	11	21	UNSURE	FOURTH OF SEVEN
desert lime	6	4	11	21	YES	EQUAL FIRST OF SEVEN
bush tomato	8	2	7	17	UNSURE	SEVENTH OF SEVEN
native thyme	7	4	10	21	YES	EQUAL FIRST OF SEVEN
kurrajong	8	3	12	23	UNSURE	THIRD OF SEVEN
wild orange	5	3	10	18	UNSURE	SIXTH OF SEVEN
quandong	7	3	8	18	UNSURE	FIFTH OF SEVEN

*Market score uses the score from either current or future market potential, in this case the highest score has been selected for use.

The final priority for investigation, then, is desert lime and native thyme, followed by kurrajong, quandong and bush tomato. Wild orange does not appear to be worth investigating further as a plantation crop at this point in time.

In determining which of the species should be investigated further, the question has not been asked how they should be investigated. Where limited resources exist for research and development, the question of best allocation of funds needs to be asked. If wild harvest and wild augmentation are likely to be able to supply a quality product consistently, then R&D expenditure should be directed towards these systems. If not, then R&D efforts should be directed towards plantation based systems. For the long term success of the industry, however, the generally accepted view is that plantation production systems are essential (Econsult 1996a).

6. CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates a strong potential for both wild harvest and plantation production of a number of bush food species. The potential area required to meet market demands (both current and projected) is limited, suggesting that there is the scope for 6-10 mixed cropping plantations at present, with more to be established as the bush food industry expands its needs for raw produce. The recommended species are desert lime and native thyme, followed by kurrajong, quandong and bush tomato. Wild orange and gundabluey may not be worth investigating further as a plantation crop at this point in time.

Some crops could be brought into production quickly through the use of wild augmentation eg supplementary watering of clumps of desert lime or native thyme.

The industry currently seems to favour organic production systems within mixed plantings, and the industry should be encouraged to develop within these criteria in western Queensland.

It is felt that there is a shortfall in the horticultural skills base in western Queensland which has a tradition of wool and beef production. In this respect other regions are better suited to horticultural production. This is an issue which needs to be addressed by both private and public sectors, with initial assistance needed from the public sector to stimulate the successful establishment of a bush food industry in western Qld. The best way to achieve this may be to establish demonstration plantations where the cost of establishment is funded by the property owner, but where training and assistance is provided by the government - with the proviso that these people then make their skills available to other new comers to the industry.

With respect to the objectives of the project:

- the economic viability of a plantation or wild harvest bush food industry in Australia's northern rangelands, focussing on western Queensland has proved to be favourable;
- the size of the bushfood industry in Australia was assessed to be $14 million retail;
- a number of rangeland bush food products have strong potential in the bush food industry;
- the availability of raw materials is currently good with respect to current levels of demand, although wild harvest production can not guarantee the same consistency of quality and yield that plantations could;
- the natural distribution and preferred soil types of a number of native plants with bush food potential were determined; and
- the most likely plants to succeed in a demonstration plantation are desert lime, native thyme and kurrajong. Quandong, gundabluey and wild orange would also grow, but their market potential is limited by other factors.

A coordinated approach involving the public and private sectors is required to quickly and strategically enhance the bush food industry in western Queensland.

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