DESERT KNOWLEDGE CRC

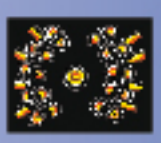
Bush Resources: Opportunities for Aboriginal Enterprise in Central Australia

Jock Morse

Report 2

October 2005

A joint project between the Desert Knowledge Cooperative Research Centre and the Central Land Council



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and the
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Contributing author information

Jock Morse is an Alice Springs–based geographer who works as a consultant on projects relating to land management and natural resource use. His initial purpose in coming to the region was to work as a bush resources project officer for the Central Land Council in 1997. This report is based in large part on that work. He is now part-owner of a small local company, Outback Bushfoods, which he formed with a business partner in 2001 as a means of carrying forward some of the developments that arose from the CLC project. His qualifications include an honours degree in science from ANU. Before coming to live in Alice Springs he worked for 10 years with CSIRO in the Division of Forestry and Forest Products in Canberra.

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Abbreviations/Acronyms

ACIAR	Australian Centre for International Agricultural Research
ALRTIG	Australian Low Rainfall Tree Improvement Group
ANBIC	Australian Native Bushfood Industry Council
ANU	Australian National University
ANZFA	Australian and New Zealand Food Administration
APY	Anangu Pitjantjatjara Yankunytjatjara
APYLM	Anangu Pitjantjatjara Yankunytjatjara Land Management
AQIA	Australian Quandong Industry Association
ARBIA	Australian Rainforest Bushfood Industry Association
ARRI	Aboriginal Rural Resources Initiative
ARTG	Australian Register of Therapeutic Goods
ASIC	Australian Securities and Investment Commission
ATK	Aboriginal traditional knowledge
ATSC	Australian Tree Seed Centre (CSIRO)
ATSIC	Aboriginal and Torres Strait Islander Commission (recently abolished)
BPIWG	Bush Products Initiative Working Group
BRS	Bureau of Resource Sciences, Bureau of Rural Sciences
CDEP	Community Development Employment Projects
CIFF	Coles Indigenous Food Fund
CLC	Central Land Council
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DK	Desert Knowledge
DK-CRC	Desert Knowledge Cooperative Research Centre
ECCMHS	Expert Committee on Complementary Medicines in the Health System
FAO	Food and Agriculture Organisation
GI	Glycaemic Index
HACCP	Hazard and Critical Control Point
IAF	Indigenous Australian Foods
IIED	International Institute for Environment and Development
ILC	Indigenous Land Corporation
IP	Intellectual Property
JECFA	Joint FAO/WHO Expert Committee on Food Additives
JVAP	Joint Venture Agroforestry Program
kJ	kilojoules
NHT	Natural Heritage Trust
NPY	Ngaanyatjarra Pitjantjatjara Yankunytjatjara
NPYWC	Ngaanyatjarra Pitjantjatjara Yankunytjatjara Women's Council
OTC	Over the Counter (medicines)
R&D	Research and Development
RIRDC	Rural Industries Research and Development Corporation
SWOT	Strengths, Weaknesses, Opportunities, Threats
TAFE	(College of) Technical and Further Education
TGA	Therapeutic Goods Administration
WHO	World Health Organization

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Preface

This report has its origins in work undertaken by the author as a project officer for the Central Land Council beginning in mid-1997. The main aim of that project was to research and report on the potential development of, and the involvement of Aboriginal people in, enterprises based on bush resources in central Australia. The project focused mainly on bushfoods, but aimed to include any potentially tradeable resources.

The CLC project was initiated by Bruce Rose, Paul Mitchell and other key players in the CLC Land Management Section and Rural Enterprise Unit, who applied for and received funding from ATSIC and the ARRI in 1996. During the course of the project, ARRI was disbanded, and all of the relevant personnel within CLC moved on to other organisations.

One of the aims of the CLC project was to undertake some trial market development and to trade with a small number of supplier groups (i.e. Aboriginal groups or individuals who were undertaking, or wished to undertake, the commercial wild harvest of bushfoods). This was intended to be a minor aspect of the project but it became apparent at a very early stage that it was the aspect which most interested Aboriginal people in the region, and had the most potential to yield the actual development of commercial trade in bush resources. It was also clear from the trial that the broader market showed a significant interest in central Australian bushfoods and that realistic commercial opportunities did in fact exist. The trial trade in bushfoods was extended as far as possible within the constraints of the project but this was inadequate in terms of both the interest shown by Aboriginal people and market potential. In an attempt to maintain the momentum built by the trial, the fostering of this activity eventually became the main focus of the project.

While this realignment of focus was taking place, all other aspects of the project, apart from the final report, were completed. These included documenting existing and potential commercial markets for bush resources, investigating a sample of existing suppliers, informing existing and potential suppliers about the project and about potential trade in bush resources, identifying the potential benefits for Aboriginal people from trade in bush resources, describing and analysing issues likely to impact on the development of bush resource enterprises, and assessing the commercial potential of a range of bush resources. This document is effectively a final report for the project and includes a wealth of insights the author gained through five years of active commercial trading in bushfoods undertaken after the project was completed. The commercial activity was a direct result of the project.

The overwhelming response of Aboriginal people to the trial trade in bushfoods during the project put the author in a difficult position. The project was not funded to do more than test the water and there was no budget for any significant trading and yet this was the one thing that Aboriginal participants wanted to happen. Efforts were made over more than a year during the project to procure funds from government programs, Aboriginal service agencies and commercial sources to support this aspect of the project. None were successful. Following discussions with various Aboriginal service agencies, including CLC, and with all other avenues apparently exhausted, the author and other interested parties decided that they would take it upon themselves to develop a more comprehensive commercial response to the obvious grassroots demand from Aboriginal collectors and the apparent market interest. A year or so after the project was completed (apart from the final report), Outback Bushfoods was established

by the author and Peter Yates, who had worked for several years as land management coordinator for Anangu Pitjantjatjara in northern SA, and was also concerned about the lack of conduits for the strong interest Aboriginal people had in bushfood trade.

In important ways, the commercial activities undertaken during and following the project may have subverted some of its original objectives. CLC's goals were admirable – it wanted to identify the most feasible and promising bush resource enterprises, research these enterprises to identify a range of practical details, and assist enterprise development and implementation. These are still worthwhile aims and can now be taken forward using this report. However, during the project it became clear that what was really needed was an immediate effort to get enterprises under way. The most important limiting factors in this effort were things that the CLC (or other agencies) could not provide – significant working capital for use by a commercial entity to buy, process, store and sell produce, and an ability to bypass 'communities' and deal directly with individual Aboriginal people who are interested in collecting and being part of developing enterprises.

With this background in mind, readers should not think that this is a purely objective report. The author has particular views and ethical values and is involved commercially in the bushfood industry. But neither should it be thought that the stance of the author detracts from the analysis conducted or the conclusions drawn.

In most cases the author's values, though not explicitly stated, will be obvious. Lest it not be so, the basics are these: The author fully supports and encourages the involvement of Aboriginal participants in bush resource-based enterprises at all and every level, from hobbyists or casual employees to owners and directors, and sees such developments as being essential to the long-term viability of Aboriginal communities in remote central Australia. The author supports wild harvest above cultivation and, while conceding that cultivation is probably inevitable, has reservations about the capacity of a mainstream horticultural approach to develop systems that will a) be suited to Aboriginal sensibilities, traditions and aspirations, and b) be able to operate in such a way that, if not enhanced, wild harvest is not damaged. The author has come to believe that the enterprise model most likely to succeed in the long term is one based on commercial principles, which deals with Aboriginal people as individuals and emphatically does not focus on the 'community'. It is clear that Aboriginal people involved in wild harvest prefer to deal directly and individually with those who buy their produce, require immediate payment for that produce at the time of delivery, and respond enthusiastically to the opportunity to control how, when and how much they work, and to being paid on the basis of the amount they collect. Provided markets are available for the material traded, enterprises based on these principles are, in the view of the author, likely to succeed.

With modest bushfood trade underway and several other bush resource enterprises making progress, recent experience has identified a range of research questions which could be addressed. These are identified in the report, and it is pleasing to see that the newly established Desert Knowledge CRC has tagged the research needs of bush resource development as an important research agenda.

Executive Summary

Introduction

This report describes and discusses the results of a two-and-a-half-year bush resource development project which the author undertook for Central Land Council (CLC) from mid-1997 to late 1999, plus five years of independent involvement in a bushfood enterprise working with Aboriginal collectors across the region. The Desert Knowledge Cooperative Research Centre (DK-CRC), through its Natural Resource Management Theme, has supported the writing-up phase of the project.

A major impetus for the project was the recognition within CLC and other Aboriginal service agencies that the developing bushfood industry, despite being overwhelmingly reliant on Aboriginal traditional knowledge of native food species, was generating few direct benefits for Aboriginal people and limited opportunities for their involvement in the industry in any meaningful way. Some important developments notwithstanding, this situation largely still prevails today.

There are few, if any, avenues for Aboriginal people to claim benefits from the use of their knowledge. The only benefits available arise from their direct commercial involvement in bushfood trade. This situation exists because information that Aboriginal people have provided on resource use has been placed in the public domain, where it is freely available to all.

Opportunities exist in central Australia for Aboriginal people to become involved in commercial enterprises based on bush resources – especially bushfoods. Aboriginal people have large tracts of land, access to bush resources, significant knowledge and skills and a large, mostly underemployed workforce. On the other hand, they are often hampered by lack of capital, resources, equipment and management know-how, and face significant disadvantages in comparison to mainstream producers in better watered parts of the country closer to markets in terms of:

- Greater distances to markets and customers
- Virtually no access to influential connections and networks in the business world
- Severely limited ability to secure loans and credit for new businesses
- Lack of start-up capital – the personal wealth of Aboriginal people is rarely high and the collective wealth of Aboriginal settlements is limited
- Limited access to the wide range of services and facilities that are typically located only in cities
- Lack of awareness and knowledge of services and facilities, and limited ability to make use of them even when they are accessible
- Limited availability of educated and well-trained workers and, more importantly, managers
- Most importantly, severely limited ability and opportunity to access information and expertise, which are possibly the most valuable resources of all for building new businesses, especially those based on new products.

Assistance may be available through research funding organisations such as RIRDC but may not always be helpful – the knowledge generated can help Aboriginal participants, but it is also available to those mainstream producers who are in a much better position to capitalise on new information.

A range of bush resource types were investigated and assessed in terms of their potential to form the basis of enterprise developments in the region. The kinds of resources considered included bushfoods, bush medicines, essential oils, timber and wood products, seed for horticulture, crafts and wildflowers. All of these have the potential to support viable enterprises, and there are good opportunities for Aboriginal people to be involved in each. With the possible exception of bush medicines, all of the resource types could be developed for existing markets. While some consideration was made of animals, the vast majority of bush resource species are plants.

The report recognises that at present, because of the more advanced stage of the industry in Australia, bushfoods represent the major enterprise opportunities in the short term. In the long term, other resource types may prove to be more valuable to Aboriginal participants in the region.

Potential benefits of bush resource enterprise for Aboriginal people in central Australia

The bushfood industry and, by analogy, other bush resource industries have the potential to offer important benefits to Aboriginal people – especially those living in remote areas with few opportunities. While economic benefits are important, they are rarely as important as the many social and cultural benefits that could flow from enterprises developed in appropriate ways. The benefits that can flow from wild harvest activities far outweigh any likely gains to be had from the horticultural development of bushfoods or other bush resources. The likely benefits available to Aboriginal participants are of three main kinds – social and cultural, economic, and health and nutrition.

Social and cultural benefits include:

- Opportunities for women
- Building and maintaining social ties and community cohesion
- Opportunities for learning, using, renewing and passing on traditional knowledge
- Valuing traditional knowledge and skills
- Building self-esteem.

Economic benefits and opportunities include:

- Opportunities to earn personal income
- Potential to involve significant numbers of people and settlements.
- A range of short-term and long-term prospects
- Potential for increased employment and training
- Reduction of welfare dependency
- A significant contribution to local portfolios and the long-term viability of settlements.
- Integration of subsistence and commercial resource uses.

Health and nutrition benefits include:

- Increased consumption of bushfoods and game animals
- Significant increases in exercise, especially for middle-aged and older women
- Greatly improved emotional wellbeing.

Existing bush resource–based industries

A review of existing industries showed that while Australia does have well-developed mainstream industries based on all of the kinds of resources considered, only bushfoods have been developed to any extent as a clearly demarcated section within a mainstream industry. The bushfood industry, characterised by a few large companies and a very large number of micro-businesses, is currently believed to be worth around $15 million in retail value in Australia, and is growing steadily. The bushfood industry appears to be undergoing important changes, such as taking on a new identity characterised as 'native food services', developing products that will allow expansion beyond the usual niche of high-price, low-volume gourmet products into a more mainstream market orientation and, increasingly, focusing on a reduced number of species and on condiments and spices rather than whole-food products. Of the dozen or so currently identified main species with future potential, only three – quandong, wattleseed and bush tomato – are currently supplied from inland regions. The currently limited role of other inland species is primarily due to lack of availability, and limited awareness among consumers and food service operators as to their uses and potential.

Two important recent developments are having an impact on Aboriginal people's involvement in the bushfood industry and their ability to benefit from it. These are Coles Supermarkets' creation of its Indigenous Food Fund, designed to provide funding for existing and potential Aboriginal enterprises wishing to produce bushfood products for sale in Coles, and the supply company Indigenous Australian Foods, which has been set up to receive and distribute licence payments paid by food companies that use Aboriginal people's services and display a logo on their products indicating that the company supports Aboriginal people's involvement in, and receipt of benefits from, the bushfood industry.

The review of existing industries included a look at the current situation that exists with each of the resource types in central Australia, and Aboriginal people's involvement in enterprises. This found that there is significant activity, and involvement of Aboriginal people, in relation to bushfoods, crafts – including some timberwork, or *punu* – and the collection and supply of the seed of local species for horticulture.

Bush resources in central Australia

The largest section of the report comprises an analysis of bush resources in the region and an assessment of their potential for commercial development. This section considered the seven resource types identified: bushfoods, bush medicines, essential oils, timber and wood products, crafts, seeds for horticulture, and wildflowers.

Bushfoods

A simple process based on qualitative assessment was used to select bushfood plant species with potential for commercial development. This process resulted in the identification of about 70 species with some commercial potential. About half the species can be wild harvested commercially and the rest will need to be cultivated. The species were sorted into four ranks based on the strength of their potential.

Several animal groups with some commercial potential were also recognised – kangaroos, goannas, bustards, witchetty grubs and honey ants. Considerable research will be required to realise the potential of any animal species.

Bush medicines

Bush medicines were recognised as having tremendous long-term potential for Aboriginal groups in central Australia. An initial crude assessment, which basically only eliminated species with clearly limited potential utility, led to a list of about 75 potentially useful species. A considerable hurdle to development is posed by the legislative requirements of the *Therapeutic Goods Act 1989* (as amended). No central Australian medicinal species are currently used commercially and it is clear that considerable research and development will be required in order to realise the potential of the species listed.

Essential oils

A similar situation to that of medicines prevails with essential oils – more than a dozen aromatic species with potential to be utilised as essential oils are known, but the nature, extent and value of that potential will require considerable research for it to be realised. Many species with potential to be utilised as essential oils are also well-known traditional medicines whose medicinal use is closely related to their aromatic properties. The only established essential oil species known to occur in the region is sandalwood – *Santalum spicatum*.

Timber and wood products

Four kinds of sources were considered as having useful potential in terms of timber and wood products. These are:

- Abundant naturally occurring local species: desert oak, river red gum and mulga.
- Less abundant species with special wood characteristics that could be used in limited amounts, such as hakeas, grevilleas, Callitris species and others.
- Sandalwood, already discussed under essential oils.
- Plantation-grown trees – most likely eucalypts such as red gums and lemon-scented gum – would be most suitable, but research and species trials are required.

Wood used for making traditional craft objects – *punu* – was not considered in this category.

Seed for horticulture

Two existing businesses in the region currently deal in seed – Rod Horner in Alice Springs and Frank Baarda at Yuendumu Mining Company in Yuendumu. These two work together to a large extent, and have a long history of working with Aboriginal people in the region. Opportunities for growth in this field are considered to be limited.

Crafts and craft materials

Two established organisations in the region, both with strong involvement of Aboriginal people, deal in crafts made by Aboriginal people. These are Maruku Arts, based in Mutitjulu settlement, and Tjanpi Aboriginal Baskets, operated by NPY (Ngaanyatjarra Pitjantjatjara Yankunytjatjara) Women's Council in Alice Springs. Maruku works with Pitjantjatjara artists who make traditional wood carvings and tools such as woomeras, spears and coolamons, which are sold through tourist outlets both in central Australia and elsewhere (including overseas). Tjanpi works with Aboriginal women in settlements

throughout southern NT, northern SA and eastern WA who make baskets, bead strings and other craft products using traditional materials and motifs as well as modern materials. The baskets are very popular items in tourist outlets. There is potential for further development of businesses such as Maruku and programs like Tjanpi.

Wildflowers

Again there are no commercially available flowers of central Australian species. A recent study identified a number of species with potential, but more research into production, presentation and marketing is required.

Issues affecting bush resource–based enterprises in central Australia

The project analysed a range of issues likely to be important for new and existing bush resource–based enterprises in central Australia and which relate especially to the involvement of Aboriginal people and their capacity to benefit from those enterprises.

Issues of national significance as well as those relevant on a local scale were examined in this section. Because only bushfoods have been developed to the point where a coherent national industry exists, much of the analysis is based on bushfood issues.

From a national viewpoint, most issues relate to the fledgling stage of development of bush resource industries. This situation is reflected in a number of industry characteristics which may affect the success of central Australian enterprises. Of primary concern at the national scale is the bushfood industry's failure to satisfactorily deal with the fundamental role of traditional Aboriginal knowledge and with opportunities for Aboriginal participants.

Many local and regional issues are, and will continue to be, vitally important in the development of central Australian enterprises and Aboriginal people's involvement in them. The issues examined were of five main kinds: cultural and social issues, environmental issues, supply issues, marketing issues, and economic and commercial issues.

Cultural and social issues:

Resource and property rights, intellectual property

Ownership and control of resources and knowledge is very different in Aboriginal society compared to prevailing non-Aboriginal western systems. The western-based cultural and legal system through which Aboriginal people are forced to deal with the dominant, non-Aboriginal society allows few opportunities for the assertion of Indigenous resource and property rights and only recognises Aboriginal intellectual property in natural resources to a very limited extent. This situation makes it impossible for Aboriginal people to control or gain any special benefits from the use of traditional knowledge. Among the most significant differences between the two systems is the non-recognition of collective ownership and the lack of rights afforded traditional custodians of information now in the public domain in the western system.

Environmental issues for bush resource harvesting:

Aboriginal land management and bush resource harvesting

As Aboriginal people have moved from a nomadic life in which their survival depended on their knowledge of their country and the activity they undertook to 'look after' it, to one in which they live in permanent settlements and gain most of their sustenance from the community store, significant changes have occurred in the land. In particular, people do less burning, food harvesting, and spreading of seeds, which has led to changes in vegetation structure, species assemblages and fire patterns. Bushfood harvesting may have some influence in changing this situation and reviving 'caring for country' activities.

Ecological sustainability

Despite received wisdom to the contrary, it is likely that wild harvest is solidly ecologically sustainable for a range of reasons. These include:

- Species currently wild harvested commercially in the region are widespread, abundant and occur in a wide range of habitats.
- Only the fruits or seeds of plants are harvested and the plants are left.
- Harvesting pressure is relative to the crops produced.
- Collectors never harvest more than a portion of the crop in an area.
- The best harvest results occur where many plants hold heavy crops.
- Seed produced in heavy cropping events is of higher quality than in light crops.
- Factors other than harvest pressure are more likely to affect the viability of bushfood species populations in the wild.

A more important issue in terms of sustainability is the question of the social and cultural sustainability of remote settlements. Wild harvest of bush resources can be a valuable element in improving these aspects.

Supply issues for bush resources

Extent and availability of resources

While some species currently wild harvested (wattleseed and bush tomatoes) are abundant and occur over a wide region, others may need to be cultivated in order to be reliably available in sufficient quantities to allow commercial development.

Access to natural stands of bush resources

Aboriginal interests own about half of the land area in central Australia and so are in a good position to access natural stands of bushfood and other bush resources species. Access to material on pastoral land is somewhat more problematic due to government regulations. This area will need to be carefully considered on a government level if wild harvest is to gain official recognition and benefit from available services, including conservation and monitoring.

The importance of collector confidence

Wild harvest critically depends on the willingness of collectors to collect material to an agreed standard. This willingness in turn depends on confidence among collectors that they will be paid for their efforts at the time of delivery, an undertaking by buyers that creates significant

pressure on working capital during a short peak period each year. Collectors' confidence is fragile and is generally a function of personal relationships between collectors and buyers.

Continuity and reliability of supply

Bushfood crops are seasonal and subject to year-to-year variation and failure. Bush tomatoes in particular are unreliable producers. Overcoming the vicissitudes of wild production requires an ability to acquire a crop when it is available, and to store it effectively without significant deterioration for up to several years at a time.

Quality control

Seasonal variation, harvesting process, storage conditions and other factors all affect product quality from season to season, and systems need to be developed to deal with these factors adequately so that material of a consistent high quality can be provided.

Transport, storage, infrastructure and distribution

The physical movement and storage of materials must be dealt with by enterprises hoping to build reputations for supplying high quality material.

Wild harvest versus cultivation

While wild harvest can generate the many significant benefits outlined above, some important bushfoods and other bush resources are currently not available through wild harvest and are unlikely to be so in the near future. Cultivation will be needed if these species are to become commercially available, but if badly managed, cultivation has the significant potential of destroying the commercial viability of wild harvest. It is imperative that cultivation be developed in such a way that it does not jeopardise wild harvest. It would be preferable to have few species available and no cultivation than many species available and no wild harvest.

Marketing issues for bush resources

With the possible exception of bush medicines, bush resources in central Australia should suit existing markets. Currently only the bushfood industry is sufficiently advanced to have established its own putative niches within the range of broader food markets. Even within the bushfood industry, no marketing experience exists for most species in the region that have identifiable commercial potential. Issues that need to be considered in relation to marketing bush resources include quantity, quality and reliability of supply, identification or branding (a major current development in the bushfood industry is the adoption of a new image characterised by 'native foods'), the role of Aboriginal knowledge and people, and consumer awareness of the products.

Most non-food resources, again apart from medicines, are likely to fit into existing markets. Some resource types may benefit from identification as Aboriginal materials, whereas for others it will be irrelevant and identification with desert regions or 'the outback' will be more appropriate.

Building on strengths and unique attributes

For central Australian species, identification with central Australia, the outback, desert regions, Aboriginal culture, or other appropriate identifiers is likely to be a significant factor in building consumer awareness, customer loyalty and market profile in both the short and long term.

Economic and commercial issues

A range of commercial issues including consideration of appropriate commercial strategies, critical success factors, location factors, government requirements, legal issues and opportunities for discounting and cross-subsidisation were considered.

Enterprise development strategy

A final, short section enunciates and briefly describes some elements which might be considered in developing Aboriginal bush resource enterprises in the region. These include common sense considerations such as starting small, using the most accessible and easily developed resource types, attending to infrastructure and capital needs and undertaking a comprehensive planning exercise, paying particular attention to the involvement of appropriate Aboriginal people. Although Maruku Arts and Tjanpi Aboriginal Baskets are not entirely independent commercial enterprises, they are cited as good examples of appropriate structures which work well at involving Aboriginal participants and returning benefits to them.

Recommended research and action

Benefits to Aboriginal people participating in bush resource enterprises

All aspects of the potential benefits identified in Part 2 require investigation. Research should be undertaken by working closely with Aboriginal partners using action research and participatory approaches. This research should also address the questions of cultural and social sustainability for remote Aboriginal settlements whose members participate in bush resource harvesting. It is recommended that this work receive the highest priority of all research outlined here.

Wild harvest

Ecological sustainability will be an important issue in any effort to develop and extend commercial wildlife harvesting ventures, and will require a significant research effort for establishing baseline populations, identifying relevant ecological parameters and for monitoring impacts into the future.

Research into the possibilities for improving the wild harvest productivity of selected species by applying treatments such as watering, weed control, fertilising and infill planting to natural stands is recommended.

Animals

The development of enterprises based on the harvesting of animal species must await the completion of considerable basic research on ecology, population dynamics, life cycles, pathogens and a host of other issues, about which virtually nothing is currently known.

As an alternative to wild harvest and all its concomitant sustainability issues, research effort into the use of animals (either for food, non-food animal products, or live trade) could focus on captive breeding of selected species. Bustards would be suitable candidates, given the extensive research on captive breeding of related species overseas.

Bushfoods

A number of specific aspects of bushfood development deserve research attention. These include:

- The value of wattleseed and other foods as functional foods forming part of healthy diets. Specific aspects include the value of the glycaemic index for these foods and the role of bushfoods in a strategic approach to the treatment of diabetes, heart disease, kidney disease and other syndromes which disproportionately affect Aboriginal people.
- Post-harvest transport, storage and packaging, particularly for foods collected as fresh fruit – conkerberry, bush passionfruit, quandong, bush plum, bush banana – and post-harvest pathology, particularly of bush tomatoes.
- Productivity and characterisation of edible gums – particularly those produced by *Acacia pruinocarpa* and *A. ligulata*.

Bush medicines

Research on medicines should build on current knowledge and aim towards two objectives – firstly, identifying four or five 'best bets' in terms of effectiveness, availability and existing documentation and, secondly, investigating and undertaking the processes required to gain Therapeutic Goods Administration approval for at least one of those medicines.

Oils

The main thrust for oils research should be a broad effort to characterise and document species with known volatile oil content. This should be followed by more detailed studies of intraspecific variation, cultivation, productivity and processing requirements, and uses of a few key species.

Timber and wood products

The key research question for using timber of naturally occurring species is about productivity. Harvest plans require detailed and accurate information about growth rates, distribution, regeneration ecology and other factors impacting on sustainability. Similar research, including conducting properly designed trials, is required for the growth of plantation timber using effluent or other water sources.

Wildflowers

The main questions in relation to wildflowers are about cultivation and variation, with a long-term view to breeding. Seed set and germination research is critical for *Ptilotus* species in particular. Research programs should aim to sample gene pools of each species from across their known ranges and use this material in research projects.

Horticulture

It is probably fair to say that, given sufficient appropriate research, it will be possible to cultivate virtually any bush resource plant species. Some of the best commercial prospects for central Australia will require horticultural development in order for their potential to be fulfilled, and it is vital that the necessary research is undertaken as a matter of priority. Aspects of this work which are particularly recommended include:

- Multi-disciplinary research to develop horticultural production models that complement wild harvest and that are fully compatible with the sensibilities and aspirations of Aboriginal participants, so that horticultural development can contribute positively to overall bush resource enterprise development.

- An initial, minimum effort to assemble comprehensive germplasm collections of at least the nine, non-*Acacia*, bushfood species ranked 1 in Table 4.
- Research into natural intraspecific variation in key characteristics of food quality and basic cultivation response, growth rates and productivity, which should precede extensive horticultural trials.
- Horticultural trials that include material sources from throughout each species' natural range (in both a geographic and habitat sense).
- A horticultural research program that includes a range of medicine, essential oil and wildflower species as outlined above.

New development projects

In developing new projects to promote and/or facilitate the development of bush resource–based enterprises in central Australia, and improve the position of Aboriginal people and groups in those enterprises, CLC and other appropriate agencies should be mindful of the potential benefits available, as outlined in Part 2, and also of the issues likely to impact on enterprise development and the participation of Aboriginal people, as outlined in Part 5 of this report.

1. Introduction

Setting

Serious attention to the involvement of Aboriginal participants in commercial enterprises based on bush resources – especially bushfoods – has been a long time coming. The bushfood industry has been growing steadily in mainstream Australia from small beginnings about 30 years ago to an industry purportedly worth more than ten million dollars today (Cherikoff 1996, Econsult 1996a, Graham and Hart 1997, RIRDC 1998, 2002). Throughout that time Aboriginal people's involvement has been limited almost exclusively to the collection of raw materials from natural populations in the wild.

The industry is based on Aboriginal traditional knowledge …

Aboriginal traditional knowledge (ATK) underpins the entire industry and is the basis for virtually all product development that has occurred. The industry depends on ATK to such an extent that it is doubtful that any industry would exist at all in its absence. In the light of this situation it is reasonable for Aboriginal people to expect to benefit from developments in the bushfood industry to a greater extent than has happened to date. Benefits to Aboriginal people from participation in the bushfood industry currently consist almost entirely of being paid piece rates (e.g. X dollars per kilogram or per flour drum etc.) for collecting raw materials for supply to dealers and processors.

… but there are limited ways for Aboriginal people to benefit

There are apparently few, if any, legal avenues for Aboriginal people's claims for sharing in benefits arising from the use of ATK in the bushfood area (Janke 1997). This is because so much ethnobiological information, gathered by anthropologists and other researchers, has been placed in the public domain, where it is unprotected, and also because there is no Australian intellectual property law which relates to ATK (see Part 4 for a discussion on intellectual property rights). The road to recognition of intellectual property rights seems long and tortuous – a recent government inquiry into the commercial use of wildlife concluded, among many other things, that 'the importance of intellectual property rights of Aboriginal people in relation to the use of wildlife has not received sufficient recognition and … the Federal Government [should] give greater attention to this issue' (Commonwealth of Australia 1998, p. 395).

… so participation is vital

In the absence of any legal basis for claiming benefits such as royalties or licence fees, Aboriginal people are left with the options of either participating directly in the industry or developing agreements with companies wishing to use ATK commercially as their only means of securing a share of the benefits arising from developments in the industry. Each of these approaches entails both potential advantages and pitfalls for Aboriginal participants. In either case, it is to Aboriginal people's advantage not only to participate fully in the industry and negotiate their part robustly, but also to help to promote and develop the industry so that they earn a larger share of a larger pie.

… if they're not to be left behind

The impetus for the commercial involvement of Aboriginal participants is boosted by recent developments which increase the likelihood that, unless they are actively involved in the industry, the interests of Aboriginal people will be sidelined and left behind. In particular, the federal government's recognition of bushfoods as an emerging primary industry that should be brought into the ambit of

mainstream agriculture means that research funding is on offer to help 'access, disseminate and build on existing knowledge and species' and to 'preserve, explore and commercially protect the genetic resource base of bushfoods' (RIRDC 1998, p. 11). The RIRDC report does not say explicitly that it is referring to ATK when it talks about accessing, disseminating and building on existing knowledge, nor that the preservation, exploration and commercial protection of the genetic resource base of bushfoods is for anyone's benefit other than industry participants. There is also a push to bring bushfood production into the ambit of mainstream horticulture and agriculture, implying a shift away from wild harvesting and hence reduced opportunities for most Aboriginal people living in central Australia to earn an income from collecting.

Adding to this impetus is the growing industry emphasis on products derived from east coast bushfood species such as Davidson's plum, lemon myrtle and mountain pepper. Of the 14 most commonly used bushfoods in 1997, only four (bush tomato, wattleseed (including several different species), quandong and desert lime) are inland species (Graham and Hart 1997, 1998), of which only bush tomatoes and wattleseed are supplied in significant quantities by Aboriginal people from central Australia.

Research funding policy may be some help …

Against these apparently adverse trends there is also some recognition, albeit tenuous, of the proprietary interest of Aboriginal people in bushfoods. The federal government's RIRDC R&D Plan for the Bushfood Industry for the period 1998–2002 (RIRDC 1998, referred to above) included recognition of 'Aboriginal culture, food practices and involvement' in its vision statement, and a strong 'research ethics' statement in relation to ATK and benefits going to Aboriginal collaborators:

It is a prerequisite for all research carried out under this R&D Plan that the knowledge of Aboriginal people and their association with the land and the plants on which the bushfood industry is built must be recognised and respected. It is a further requirement that where information is provided to researchers by community elders and other Aboriginals, such information must be identified and codified. Where direct, identifiable, financial rewards result from the application of such knowledge, the community providing such knowledge must receive a proportion of such rewards. (RIRDC 1998, p. 12)

… but then again maybe not

A more recent revised R&D Plan (now referring to the 'Native Food Industry') for the period 2001–2006 provides a significantly weakened statement of research ethics, replacing the final sentence with the following:

… codified. The ethical consideration should be that opportunities for Aboriginal and Torres Strait Island communities or individual families, arising from native food development, should be fostered and promoted as a necessary step in the commercialisation of native species. (RIRDC 2002, p. 5)

And while the revised RIRDC plan includes a new objective (Objective 5 – human resource enhancement) which includes 'Support the involvement of Indigenous people in the industry and its development' as one of four strategies, other changes between the first and second plans reinforce the government vision of a mainstream agricultural basis for the industry:

- The addition of a reference to sustainable agriculture to the vision statement of the second plan.
- A shift in emphasis from regional differentiation to generic branding and globalisation in the market development strategy (Objective 1).
- A more explicit emphasis on agribusiness approaches to product development and improvement (Objective 2).

There is clear slippage between the requirement to provide a share of rewards in the first plan and the recommendation of fostering and promoting opportunities in the second. Statements such as 'recognition and respect for Aboriginal knowledge', 'identification and codification of information provided' and 'support [for] the involvement of Indigenous people in the industry and its development' fall a long way short of providing real, on-ground benefits for Aboriginal people.

The endorsements themselves as well as the changes made between the first and second plans indicate that RIRDC sees the involvement of Aboriginal people in the industry focusing on mainstream horticultural or agricultural enterprises. Benefits for Aboriginal people are unlikely to accrue in the absence of their direct participation in the industry but the experiences of Aboriginal participants in horticultural ventures in central Australia to date do not encourage a belief that this is the most appropriate way forward. In simple language, despite much intelligent discussion of the issue (e.g. Posey and Dutfield 1996, Christie 1996, Wells 1996, Williams 1998), powerful appeals to ethics in dealings between Indigenous peoples and the wider society (e.g. Cunningham 1993, Dodson 1996, Posey 1996) and warnings of the consequences of failing to do so (e.g. Blakeney 1996, Fourmile 1996), it is clear that as far as the official research view is concerned, Aboriginal people are basically on their own or must rely on sympathetic partnerships if they wish to gain a share of benefits from the growing native food industry.

Aboriginal land ownership is in their favour …

Another significant trend is the substantial increase in recent decades in Aboriginal ownership of land in central Australia. Today, Aboriginal people own about half of the land comprising the Central Land Council region (roughly the southern half of the Northern Territory) and there are prospects for this to increase further in the future through the purchase of properties and successful Native Title claims. A similar portion of the northern half of the Territory is also Aboriginal owned and there are large areas of Aboriginal-owned land in neighbouring regions of South Australia and Western Australia. On the face of it, this situation indicates significant opportunities for Aboriginal people to use their land for a variety of purposes including generating economic returns.

… but they still have to decide how to use it

Much has been written about Aboriginal land management (e.g. Davies et al. 1998, Ross et al. 1994, Sultan 1996, Walsh 2000, Young 1988a, 1988b, Young et al. 1991, Young and Ross 1994), and the aspirations of managers (Rose 1995, Tilmouth 1994a, Davies and Young 1995), yet there still seems to be a long way to go before Aboriginal landowners fully realise the potential for independence available in their land. The extent to which economic returns could come from cattle grazing – currently the most important land use for much of the region – is not clear, since making a living from cattle in central Australia appears to be becoming increasingly difficult even for traditional single-family enterprises (Altman and Taylor 1987, Young 1995). The cost structures of pastoralism in central Australia have increased and margins have tightened over the years so that today larger management units and high levels of professionalism and innovation are required in order to maintain

economic viability. Single pastoral leases, even big ones in prime country, are unlikely to be able to provide sufficient returns to support settlements of up to a hundred or more people (Young 1988a). Also, most Aboriginal-owned land is considered to be on the marginal end of the viability spectrum as far as pastoralism is concerned. These factors indicate that Aboriginal land managers will need to look seriously at the options open to them in terms of land management, and probably develop alternative approaches to land management and land uses from which they can earn incomes (Stafford Smith et al. 1994). Enterprises such as those based on bush resources, that are culturally appropriate, economically viable and ecologically sustainable, are likely to be particularly well suited to many such situations. This is especially true in light of the fact that many of the bush resource species with the best prospects are common on Aboriginal land, their abundance often being high where pastoral viability is low.

While the extent and use of Aboriginal land may have important implications for the involvement of Aboriginal people in bush resource industries, a consideration of the broader issues relating to the management of Aboriginal owned and operated pastoral leases is beyond the scope of this study, and readers are referred to the modest literature in the area (e.g. Davies et al. 1998, Davies and Young 1995, Rose 1995, Young 1988a, 1994, Walsh 2000, Young et al. 1991).

A recently completed study conducted in Arnhem Land comes to similar conclusions to those of this current report, albeit focusing on a different suite of species, and presenting a stronger emphasis on the role of governments and the objectives of biodiversity conservation (Whitehead 2003, Whitehead et al. 2002).

The project and this report

The project is a response to growing interest in bushfoods…

The Central Land Council's Bush Resources Development Project, results of which are reported here, was developed and undertaken in response to significant growth in the bushfood industry and the perceived lack of opportunities to further the interests of Aboriginal people, or for benefits to return to holders of traditional knowledge. The project has its origins in discussions within the CLC in the early to mid 1990s that were followed up with successful funding applications to the Bureau of Resource Science's (BRS, originally Bureau of Rural Resources, now Bureau of Rural Sciences) Aboriginal Rural Resources Initiative (ARRI, now defunct) and the Aboriginal and Torres Strait Islander Commission (ATSIC, recently abolished). This modest funding provided a project officer and some resources for a 12-month study that was stretched to two years and carried out between May 1997 and September 1999.

… and looks at ways that Aboriginal people can benefit from being involved

The project aimed to identify central Australian bush resources suitable for commercial development, to analyse issues relating to Aboriginal people's involvement in enterprises based on them, and to develop and describe a strategy for creating and growing Aboriginal-owned and -controlled enterprises in central Australia based on those bush resources.

The report provides a synthesis of the project findings in the form of a systematic overview of bush resources found in the region, along with an initial assessment of the prospects of their suitability for use in new Aboriginal enterprises, and outlines a strategic approach to developing the involvement of Aboriginal people in bush resource–based industries in the region.

Bush resources

So what are these 'bush resources' we're talking about?

A bush resource is anything in the landscape that grows, or just exists, that has or might have some current value or potential commercial value, or can or might be used in the production of something with commercial value. In general, the project has been concerned more with plants than animal resources, although the latter are considered briefly.

While the trade, or potential for trade, in live native wild animals is important in other regions and has been proposed as one element in a broader wildlife conservation policy for the NT, it is highly unlikely that there are any species which occur in sufficiently stable or large populations to warrant their exploitation for the live native wildlife trade. Nevertheless, it may be appropriate in some circumstances, provided adequate population monitoring is carried out, to exploit for live trade those species identified as being suited to harvesting for food in the region.

The resource value in plants will rarely involve the whole plant, but will usually focus on things the plant produces which can be processed to make products that are edible or are useful in some other way. So plant resources typically include materials such as seeds, fruit, timber, foliage, roots and tubers, bark and so on. In contrast, animal resources will usually involve the whole animal, rather than some material it produces.

The kinds of bush resources occurring in central Australia are considered in detail in Part 4. Most of the resources considered are traditionally known and used by Aboriginal people in the region. In fact their potential value on external markets often rests on the uses to which they are traditionally put and the knowledge that underpins those uses. This is not always the case and in some situations – for example, high-value timber production from desert oak or mulga – the potential value of the resource is independent of traditional knowledge.

… and is it only about things which can be traded with the outside world?

While the project has concentrated on prospects for products which have an existing or potential commercial market value, the subsistence and internal trade uses of plant resources are often equally or more significant to Aboriginal people in central Australia (Latz and Griffin 1978, Cane 1986, Davies et al. 1998, O'Connell et al. 1983, Devitt 1988, Walsh 1990). For example, native truffles (*Choiromyces aboriginum*, *Mycoclelandia bulundari*) have excellent market potential and could be sold for high prices, but are virtually never available due to being rare, hard to find and highly sought after by local people for immediate consumption. A more common, highly sought-after resource, 'pituri' (*Nicotiana* spp.), is commonly traded between individuals and settlements throughout the region, but is not available on external markets. In some cases subsistence and internally traded resources are likely to have measurable economic value because they substitute for products that would otherwise have to be purchased elsewhere. This is particularly true of animal resources such as kangaroos and goannas

which in some cases may provide a significant proportion of people's protein requirements (Wilson et al. 1992, Davies et al. 1997). As well as these internal market values, bushfoods can also provide significant nutritional benefits at a local level.

Research is the key to future developments …

The criticisms of research policy outlined above notwithstanding, research into bush resources and products of all kinds is needed to underpin any enterprise developments based on them. There is much we don't know that we need to know before we can make realistic and sensible commercial decisions. Luckily, Australia has a commendable record in funding and undertaking research into the sorts of things with which this report is concerned. And, despite the criticism, the Rural Industries Research Development Corporation stands out in the progression of knowledge in areas of interest. A quick scan of the bibliography attached to this report will reveal the significance of RIRDC's carefully focused research programs.

… but Aboriginal groups may be less able to benefit from research

For Aboriginal groups wishing to establish enterprises based on bush resources, such public research can be a two-edged sword. Research that helps remote Aboriginal groups to build well-founded businesses can also help other, non-Aboriginal enterprises – which will often be in a much better position to take advantage of the information – to do the same or better. In most cases, Aboriginal groups are likely to be disadvantaged in several ways; for example:

- Great distances to markets and customers
- Almost no access to influential connections in the business world
- Severely limited ability to secure loans and credit for new businesses
- Lack of start-up capital – personal wealth of Aboriginal people is rarely high and the collective wealth of Aboriginal settlements is usually also quite limited
- Limited access to the wide range of services and facilities that are typically located only in cities
- Lack of awareness and knowledge of services and facilities, and limited ability to make use of them even when they are accessible
- Limited availability of western-educated and -trained workers and, more importantly, managers
- Most importantly, severely limited ability and opportunity to access information and expertise, which are possibly the most valuable resources of all in terms of building new businesses, especially those based on new products.

While there are no easy answers to overcoming these disadvantages, Aboriginal groups and individuals do have some advantages in their favour, and ultimately their success will depend on their ability to take advantage of those aspects of their chosen enterprises that may generate a slight advantage for them over their competition. Part 5 of the report discusses these and other issues likely to affect business success and provides a SWOT analysis summarising the position of Aboriginal enterprises and the challenges facing them.

2. Potential benefits of bush resource enterprises for Aboriginal people in central Australia

Introduction – the general idea

The potential benefits available to Aboriginal people from participating actively in bush resource enterprises are many and varied, and are likely to accrue in three main areas of people's lives – society and culture; local, regional and personal economies; and health and nutrition. These three areas are intimately linked – cultural or social benefits are also likely to impact positively on health and wellbeing, as are economic benefits; improvements in health and wellbeing are likely to boost people's abilities to participate in cultural activities and to generate economic benefits and so on.

The benefits available will vary, depending on the type of enterprise undertaken – for example, the benefits available from bushfood harvest are likely to be more extensive than those from some other kinds of enterprise. Also, benefits are likely to accrue in relation to the level of participation – people will benefit in proportion to the effort they put in. As well, benefits are likely to be greatest where people are in full control of the way in which they participate, and are making decisions and taking action in response to market forces rather than participating in externally controlled and funded 'projects'.

While outsiders looking at the prospects of enterprises are most likely to be interested in the economic benefits, experience to date shows that Aboriginal people, who are of course also interested in the economic returns, actually stand to gain a lot more than just cash in their pockets. Economic returns in effect provide a catalyst which allows Aboriginal collectors to access these other collateral benefits.

The fact that Aboriginal people participate in bushfood harvesting on an individual basis probably means that bush resource–based enterprises are likely to generate benefits primarily for individuals and families, rather than 'communities'. The bushfood enterprise experience shows that 'communities' are actually quite artificial entities in relation to enterprise activity, except in so far as they influence where people live and thus the resources available to them.

The benefits outlined here have been identified from experience in bushfood enterprise activity but are likely to be similar to the kinds of benefits available from other kinds of activities, especially those involving outdoor work: the use of traditional skills and knowledge, spending time on country, the involvement of women, earning money in proportion to work done, and so on.

The benefits have been identified during this project and the enterprise activities that developed out of it, as well as being reported by other workers, by participants in bush resource enterprises, and by other relevant informants who have had contact with various Aboriginal bush resource enterprises, or who have witnessed Aboriginal bush resource collection and/or trade activities. While the benefits are real in that they have been noted by reliable observers, they are yet to be fully and formally documented, and no organised research has been undertaken.

Social and cultural benefits – empowering individuals and communities

Bush resources offer important opportunities for women …

Aboriginal women, especially middle-aged and older women, are disadvantaged in most settlements, having the most responsibility for looking after families and raising children, and the least access to resources such as family income, employment opportunities and vehicles. Because the harvesting of plant resources is overwhelmingly (though not exclusively) women's business, women are the ones who stand to benefit most from opportunities to undertake these activities.

… help build and maintain social ties and community cohesion

The processes of finding, collecting and processing bushfoods provide valuable opportunities for friends and family members to spend time together, fulfilling a range of important social activities that help to build relationships, air grievances, resolve conflicts, establish common goals, help resolve each other's difficulties, make plans and so on. The women seek opportunities to spend time together in their country collecting bushfoods and often value the benefits of this kind of activity as being as high as, or higher than, the monetary rewards to be gained from selling their produce.

… and provide opportunities for learning, using, renewing and passing on traditional knowledge in a non-contrived setting

Many people can and do get out into their country on a more or less regular basis; however, the impetus and focus of purpose provided by the opportunity to earn money undertaking highly seasonal activities that fundamentally rely on traditional skills and knowledge has a very strong motivating effect on people. They apply extra effort to arranging transport; collecting equipment, food and water; scouting crops; organising family members and friends; and so on, so that the work can get done. The tremendous value of non-contrived opportunities for people, again especially women, to spend time and effort honing and applying traditional knowledge and skills – and passing on their skills and knowledge to younger people in situations that come close to simulating traditional settings – should never be underestimated. The benefits gained from reinforcing traditional knowledge and skills include the important benefits of strengthening people's identification with and knowledge of their country, and the panoply of stories and lore that bring it to life, reinforcing their authority to speak for it and strengthening lines of inheritance.

The harvesting of wattleseed is of particular significance because of the impact European contact has had on this activity. Within a short time after white settlement, wattleseed was replaced as a primary staple food by store-bought white flour. Several theories have been proposed to explain the rapidity and totality of this transition, the most likely of which is the huge disparity in work required to prepare wattleseed in comparison to store-bought flour. Most of the work in making wattleseed available as food is in the cleaning, grinding and cooking process rather than the initial collecting, which is relatively easy and rewarding. But without a use for wattleseed, people dropped the collection part of the process when they gave up preparation and processing. Since people today are not required to undertake the tedious grinding and cooking process (which is done using machinery), and most of the important cultural benefits derive from the collection activity, harvesting wattleseed represents an excellent opportunity to revive an important cultural activity. The situation is less dramatic for bush tomatoes, since they are traditionally eaten raw or with little processing and their harvest and consumption, while significantly reduced, was never dropped.

Also, valuing traditional knowledge and skills has important flow-on effects …

Part of the reason that Aboriginal people so enthusiastically take up opportunities to collect bushfoods for money is that the demand for bushfoods shows them that some of the things they value most in the world are also (finally) beginning to be valued by other people. Since their lands and lives were taken over by outsiders, most Aboriginal groups have found this kind of external positive feedback to be thin on the ground and very hard to come by; until recently, these outsiders have implacably demonstrated that Aboriginal culture and all it entails is worthless in their eyes. In the words of Bruce (Tracker) Tilmouth, former Director of the Central Land Council: 'Aboriginal people were stripped cruelly and systematically of their cultural heritage by successive governments and religious orders bent on the destruction of Aboriginal culture and religion. We were told not to use our language, we were told that our law was not "civilised", we were told that we did not teach our children properly and we were told not to practice our religion.' He goes on to say: 'These purposive acts of the governing authorities of Australia can only be described as cultural genocide – a term I do not use lightly' (ATSIC 1992, p. 92). While Mr Tilmouth was speaking in relation to the removal of cultural objects, the words apply as much to all other aspects of Aboriginal culture, which for more than 200 years have been denied, discounted and ridiculed. The putative and tenuous reconciliation being offered via the valuing of Aboriginal cultural expression – through paintings, dance and ecological knowledge – is an extremely important development for both Aboriginal people and the wider society.

… such as building self-esteem and confidence

For people living in remote Aboriginal settlements in central Australia, any paid work they do can seem contrived and artificial and unrelated to the rest of their lives and local activity. In contrast, bushfood collection, for which they are paid not for the time they spend but for the material they collect, helps people to build strong feelings of self-worth. This feeling is reinforced by the opportunity to use skills and knowledge that have strong meaning in their lives, and to carry out this work in such a way that they have complete control over where they go, what they do and how they do it, the pace they work at and the period of time over which they work.

Economic benefits and opportunities – a vital contribution

Aboriginal people in remote settlements have few opportunities to earn personal income …

Unemployment levels in remote settlements are extremely high and Aboriginal people in the region have few opportunities to earn personal incomes that are not based purely on the amount of time they do 'work for the dole' style artificial jobs (i.e. CDEP [Community Development Employment Projects]) or on their social security status. Older people, especially women, are particularly disadvantaged in this regard. The main avenue for earning cash income for older women is painting, an activity that is typically enjoyable and satisfying and allows a person to decide their own hours and so on, but which, except for the few well-known and highly regarded artists, is very poorly paid in comparison to bushfood collecting when assessed on the basis of an hourly rate. But creating paintings based on cultural themes and stories is analogous to collecting bushfoods in that it is culturally appropriate, based on individual effort, and output is entirely under the control of the painter. Benefits derived from personal income involve more than just the income itself – they are related to the social and cultural benefits described above. The value of personal income is enhanced by the cultural relevance of the work, the ability to make decisions about all aspects of the work done and the direct relationship between the effort applied and the income earned.

… and bush resource activity can involve many people and settlements throughout the region

Currently in central Australia only wattleseed and bush tomatoes are harvested commercially from wild stands. This is because only these species are available in sufficient quantities to make wild harvest worthwhile. While acacias generally set seed reliably in early to mid summer each year, bush tomatoes are quite erratic, only producing good crops once every few years following good rain over a period of at least several months. Demand for these species is growing steadily and sales over the last few years have been in the order of three to six tonnes per year of wattleseed and two to five tonnes of bush tomatoes. With prices around $10 per kilogram for clean wattleseed and up to $12 per kilogram for bush tomatoes, this level of trade injects somewhere in the order of up to $120,000, and probably averaging around $70,000, into local economies across the region by way of payments to individuals each year. Outback Bushfoods' records show that more than 370 people from 35 settlements and homelands have supplied seed or bush tomatoes to the company over the last three years, and it can be assumed that at least another hundred or so supply to other dealers in the region. If the average yearly outlay is paid to 120 people, this amounts to $1,000 per person per year, representing a significant short-term seasonal lift in income for those people. The significance of this income is enhanced by the fact that a fair proportion of it is paid during the Christmas–New Year period when no other sources of cash are available. While this is clearly not enough to provide more than a short-term boost, it is expected to grow significantly over the next few years, and more people from more settlements are expected to become involved. Overall, bushfoods represent a modest but significant additional income to local economies.

… generating significant short-term and long-term prospects

In the immediate term – the 2005 and 2006 seasons – demand for wattleseed is expected to be around eight tonnes per year and rising. Bush tomato demand will grow but because of the erratic fruiting characteristics of the species, collections cannot be predicted. It is expected that, provided funds can be procured in time, as much produce as possible will be purchased when it becomes available. In the longer term, demand is expected to grow steadily, and as it does, collection areas are likely to be expanded to more settlements within a broader catchment area.

… in areas such as employment and training

The bushfood collection system currently operates in an informal way, with collections being organised by the collectors themselves. On a completely informal basis, the collectors also organise the training necessary for new collectors to be able to participate. This system appears to work well, and many younger people have joined the collectors' ranks in the few years that the author has been involved in the business. It is doubtful that suitable training could be organised effectively in any other way, and probably any attempt to do so would lead to undesirable impacts on various parts of the system. Since key qualities of the current system include its informality, independence, and lack of outside influences, it is hard to see that any kind of externally offered training could be effective.

… and reduction of welfare dependence

While the incomes most collectors currently earn from bushfood harvesting are modest and have no effect on welfare payments, they can still have a significant impact on available cash and perceived levels of wealth within settlements. Income from bushfood collections is extra money, and as such allows a high level of discretion in its expenditure. This means that income from bushfood collecting may be spent on

items which people would otherwise not be able to obtain. In time it is expected that as demand grows, individual incomes from bushfood collecting may be sufficient to replace welfare income for parts of the year.

In the longer term, bush resource enterprises can help build local portfolios and contribute to settlement sustainability …

The development of a sound economic base has repeatedly been identified as a vital goal for the long-term viability and sustainability of remote settlements in central Australia. While a range of options have been at least looked at, and some remain as possibilities, in reality there are few really solid economic options for these communities. Aboriginal people reside in remote areas not for the economic opportunities they offer but in order to be on, or close to, their land and to participate in the vital social and cultural milieu that gives their lives context and meaning. Meanwhile, the continued viability of settlements depends heavily on a continuous flow of resources from elsewhere. Commercial bushfood harvesting is beginning to show itself to be a robust and reliable, if modest so far, component of the regional economic mix taking us into the future. It has the advantages of being a highly favoured activity for people in the region – being based on traditional knowledge and practice – and of utilising local resources to earn export income, requiring little infrastructure or capital outlay, and being renewable and likely to grow significantly in the foreseeable future. Along with the solid foundations of art and, in some localities, mining, and the somewhat problematic area of tourism, bushfood production from wild harvest and horticultural plots has the potential to make a significant contribution to building a sustainable future for local economies and social groupings.

… particularly by encouraging local resource use and consumption

One of the more interesting developments to come out of Aboriginal people's growing involvement in bushfood harvesting has been the increased local consumption of bushfoods by collectors, their families and other community members. This phenomenon has yet to be documented, but appears to be provoking a range of downstream effects. These effects include the positive health impacts outlined below, and a modest but recognisable economic effect. People's involvement in bushfood collection, and the subsequent increased availability of bushfoods, appears to be a catalyst for further interest in bushfood collection and consumption, thus enhancing other benefits. Also, consumption of bushfoods in any significant amount appears to lead to a reduced consumption of some store-bought produce (especially luxury goods such as sweets and chips and other non-essential goods consumed by children), and may have important economic impacts through internal market substitution. These phenomena would be worth investigating.

Health, wellbeing and nutrition benefits – possibly the most important benefits of all

Significant health benefits derive from the increased consumption of bushfoods plus continued consumption of game animals …

As discussed further in Part 4, wattleseed, bush tomatoes and other bushfoods (especially animal foods) have important beneficial nutritional attributes such as low fat levels, high proportions of which are polyunsaturated, a low glycaemic index for most plant foods despite high fat-to-protein ratios, high protein and complex carbohydrate content, and significant levels of vitamins and minerals. In view of the alarming trends in Aboriginal health in central Australia – very high and growing levels of diabetes, kidney disease, coronary heart disease, obesity and high blood pressure – the dietary aspects of the local

consumption of bushfoods is an important consideration in developing enterprise models. As pointed out above, the growth of economic opportunities from bushfood harvesting appears to have led to an increased consumption of bushfoods, possibly partly displacing some less healthy foods. Harvesting for local use is likely to continue to be of significant benefit to Aboriginal settlements and should be an important focus of enterprise development based on the wild harvesting of both plants and animals.

…along with increased exercise

One fundamental truism of bushfood harvesting is that it involves significant amounts of work. People have to walk from plant to plant, often covering distances of many kilometres in a day's collecting. They must work to remove the seeds or fruit from the plant, carry the collection with them as they go, bend and stretch to complete all the necessary tasks, and expend considerable energy in the process of cleaning the material. These are significant activities for people who in general are becoming seriously sedentary.

…and health benefits include improvements in emotional wellbeing

While the emotional benefits of wild harvesting may be difficult to elucidate, and the evidence is so far entirely anecdotal, they nevertheless appear to be genuine and significant. Various people who have spent time with collectors over the last few years, including the author, other dealers, non-Aboriginal community employees and residents, and at least one health professional, have consistently noticed an improvement in general wellbeing among collectors. Reasons for such developments are a matter of conjecture at this stage and require systematic investigation. In the author's opinion, emotional benefits derive from many aspects of the process of finding crops, arranging and carrying out collections, spending time on country in coherent groups of similarly motivated friends and family, and as collateral effects of many of the other benefits outlined above. Several people with whom the author has discussed the issue mention two particular aspects of the collection process that may generate emotional benefits. These are the very important social opportunity offered to women and their children as they sit around together undertaking the quite time-consuming tasks of cleaning seeds and fruits – this is a time of storytelling, gossip, discussion of individual situations and hopes for the future, resolution of grievances and so on that is very important in building the interpersonal links and commitments so vital for community health. The second aspect is the likelihood that many people, especially women, gain direct emotional benefits from being away from the high stresses to which they are subjected every day in their settlements.

3. Review of existing bush resource–based industries

Introduction

The development of bush resource–based enterprises by Aboriginal groups in central Australia is unlikely to be successful if it does not take into account the broader context in which they will operate. Any new or developing enterprise can expect to be influenced, willingly or not, by what has gone before and what exists around it. The situation for a new business attempting to create a market for an entirely new product will be quite different from that of a business working with products about which prospective customers are at least minimally aware. In a very important sense, industry activity prior to the start up of a new enterprise primes the market for that new enterprise.

Consideration of the milieu within which an enterprise will operate is important, especially at national and regional levels, as a means of gaining a perspective on the industry and enabling realistic assessments of a business's prospects and competitive status. While it is unlikely that any proposed central Australian enterprise will affect or be affected by happenings on the international stage in any particular industry – at least in the short to medium term – it will nevertheless be prudent to maintain a watching brief on the international situation. This section attempts to provide an overview of the state of bush resource industries in general, and the bushfood industry in particular, at both national and regional levels, with some discussion of the international scene.

Overview of national industries involving bush resources – what's going on out there?

The Australian bushfood industry – a sleeping giant?

Several studies and reviews that have been completed in the last few years have attempted to build a coherent nationwide picture of the current state of the bushfood industry (Econsult 1996a, Beal 1996, Phelps 1997, Graham and Hart 1997, 1998, Atech 1999, Cherikoff 2000, Robins 2001). These reports provide the only currently available description of industry characteristics and estimates of size, growth, patterns of activity, current and projected value, and future prospects.

Despite some reasonable work having been undertaken by these authors, the picture they paint of industry value and projected growth is notably imprecise and variable and is ultimately based on a very limited foundation. This imprecision, variability and lack of a solid foundation seriously undermines any confidence we can have in the estimates presented. Basically most subsequent publications on the topic use the figures generated by Econsult (1996a) in their survey of the bushfood industry. Some authors (Robins 2001 – commercial value of industry 'up to $20 million'; Cherikoff 2000 – 'industry variously valued at $10 to $16 m per annum') provide no source for their estimates. The Econsult (1996a) report estimated the then current retail value of the industry to be $14 million, with prospects of growth to $100 million by 2000. The precision and reliability of the Econsult figure are limited by the primary data on which it was based – relatively few industry players were consulted and of those who were contacted, relatively few returned questionnaires, and many of those who did provided only rough estimates of numbers. The upshot of all this is that at present we really don't know what the industry is worth overall, but suspect that retail value is

somewhere in the range of $10–20 million annually, a figure which is at most 20% of the value projected (in 1996) to be achieved by the year 2000 (Econsult 1996a). Figures for the value of individual products are only available for quandongs, which, in the 1999 season, the Australian Quandong Industry Association put at $1,365,000 for primary-sourced quandong product (www.users.centralonline.com.au/aqia/). Clearly, more work is needed in order to accurately describe the value and growth prospects for the industry and its various products.

Nationally, the industry is based on just a few flagship species …

Another key area on which many attempts have been made to provide a clear picture is the topic of 'best bets' for the industry – the top species in terms of current trade and future prospects at various times. Table 1, below, provides lists obtained from six separate assessments, and includes 19 species, of which 11 can be regarded as coastal or sub-coastal species; six are confined to inland areas. No two of the six proposed lists of top-priority species are in total agreement. Only two species are included by all authors and one other is included by five of the six. All three of the species agreed upon by five or more of the authorities (bush tomato, wattleseed and quandong) are prominent inland species ranked at level 1 in this report. Against this, however, only two other species identified in this report as having commercial potential for central Australia appear on the list (kurrajong, ranked 2, and wild orange (*Capparis* spp.), with species ranked 2 and 3).

Table 1. Identified top-priority species for the bushfood industry

Common name	Scientific name	Authority					
		1	2	3	4	5	6
native thyme	*Ocimum tenuiflorum*						
kurrajong	*Brachychiton* spp.						
wild orange	*Capparis* spp.						
bush tomato	*Solanum centrale*						
wattleseed	*Acacia* spp.						
quandong	*Santalum acuminatum*						
wild limes	*Citrus* spp. *						
lemon aspen	*Acronychia acidula*						
lemon myrtle	*Backhousia citriodora*						
mountain pepper	*Tasmannia lanceolata*						
muntries	*Kunzea pomifera*						
riberry	*Syzygium leuhmannii*						
Davidson plum	*Davidsonia pruriens*						
Warrigal greens	*Tetragona tetragonioides*						
Illawarra plum	*Podocarpus elatus*						
kakadu plum	*Terminalia ferdinandiana*						
rosella	*Hibiscus* spp.						
native herbs	*Prostanthera rotundifolia*						
aniseed myrtle	*Backhousia anisata*						
Number of species		11	15	10	9	7	5

Authorities: 1: Econsult (1996a); 2: Graham and Hart (1997); 3: RIRDC (1998); 4: RIRDC (2001); 5: Phelps (1997); 6: this report.
* Citrus includes two inland species formerly classified in other genera – *Eremocitrus* and *Microcitrus*.

Note that the table only includes priority species listed in this report if they also appear on other lists. The trends illustrated may indicate that development of central Australian species is destined to occur outside of the main thrust of bushfood development nationally.

… but the most appropriate place for bushfoods in the market – niche or mainstream – is by no means settled

Several industry reviews examined the placement of bushfoods in the market and the ways in which they are used. It is clear from this work (especially Econsult 1996a, Graham and Hart 1997, and Cherikoff 2000) that the primary market sector at present for most bushfoods is in the food service and restaurant sectors, with a significant and growing presence as manufactured products, and only very recently as small packets of raw materials on supermarket shelves. Throughout their modern history of use, products containing bushfoods have been marketed as gourmet, relatively high-priced novelty items. Only recently has an effort begun to be made to bring bushfood products to the attention of mainstream consumers, by including them as ingredients in less exotic products with prices in line with similar non-bushfood products, and moving them out of specialist areas in supermarkets and onto shelves with other similar products (e.g. bush tomato relish off the gourmet shelves and onto shelves with other relishes). The trend away from a high-priced, low-sales-volume marketing approach to one of medium-price, high-volume is a strategic direction that is likely to benefit producers in the long run by enabling much greater volumes of sales.

Bushfood's troublesome special features – high prices, ingredients without a cuisine and industry youth …

Due to their relatively high wholesale prices and strong flavours, bushfoods are generally seen, at least by producers and manufacturers if not consumers, as separate individual and specific ingredients to be used sparingly to enhance more mundane products. Bushfoods (with the possible exception of animal products) are not perceived as complete foods and even less as forming a coherent cuisine. Thus, bushfood dishes offered in restaurants are generally familiar recipes originating in various national and regional cuisines and adapted using bushfood ingredients. There appears to be no reason why this trend will not continue, and be elaborated upon in the future.

As several reviewers note, the industry is still young and growing and considerable development of its structure can be expected before a coherent and stable pattern emerges. At present, although no figures are available on the size of individual businesses, the industry can be characterised as consisting of a few main players and large numbers of small to micro businesses and hobbyist participants. The few large businesses (including the 'big four': Robins Australian Foods, Cherikoff Pty Ltd, Red Ochre and Australian Native Produce Industries) account for most of the national and export trade. Smaller businesses, including collectors, growers, processors, dealers, restaurants and so on, often supply materials to the larger players. A few smaller businesses are beginning to venture into processing and manufacturing on their own behalf. Undercapitalisation has been identified as a chronic problem in the industry, especially for smaller businesses.

… and even more troubling – bushfood's embarrassing dark secret

While most reviews of the bushfood industry mention (usually obliquely) the role of Aboriginal knowledge, and express the idea that Aboriginal interests should be acknowledged somehow, none of the studies considers, in any serious way, the special place of Aboriginal traditional knowledge or the placement of Aboriginal settlements in terms of enterprise development or prospects for growth. Even less does any analysis carried out to date acknowledge or describe the less than level playing fields that Aboriginal groups face when attempting to participate in what are fast becoming mainstream economic activities. This theme is taken up in Part 5, which deals with a range of issues facing enterprise development in central Australia.

Other evidence for the state of bushfood production and trade at the national level reveals the groundswell of micro businesses and hobbyists

In addition to the few published accounts of the industry, other available sources can be consulted to add detail to the picture portrayed. Of these other sources, none is more vivid than the internet, which yields thousands of strikes in searches using the terms 'bushfoods' (or 'bush foods') or 'Australian native food'. While many sites are represented more than once on such lists, the picture generated by this simple and effective exercise is one of hundreds of independent small and micro businesses, often specialising in one or a few particular species or products, and/or in a specific location, region or ecological zone (such as southern Queensland or rainforest). The image of an industry featuring a few medium to large companies and a great number of very small businesses operating all around the country is unavoidable. It is also abundantly clear that all but a tiny fraction of this groundswell of enterprise is taking place in the better-watered coastal and sub-coastal parts of the country, mainly between Cairns in north Queensland and Adelaide in South Australia. The proportion of enterprises that operate in dryer inland areas is so small as to almost disappear. Of course, such search methods are biased against businesses that don't have a website, and thus underestimate the actual number of enterprises in existence. It is probably fair to assume that most of those missed in such surveys are very small businesses and probably operate with a very local focus.

The fact that few businesses operate under formal corporate structures is illustrated by the fact that the Australian Securities and Investment Commission (ASIC) lists only 32 currently valid entities with registered names that include the words 'bushfood' or 'bush food', and a further 14 that include the words 'native foods'. Of these 46 entities, only four are registered Australian companies (www.asic.gov.au). Of course, other companies are known to exist (for example, none of the majors have the target words in their names), and there is no way, without expending large amounts of time and energy (and probably money) on the exercise, that a comprehensive and accurate list of all Australian businesses dealing in bushfoods can be assembled, and the brief survey here is thus only by way of illustration.

Nevertheless, the trend outlined is backed up by the fact that the main (only?) active web-based discussion group on the topic of bushfoods currently has 184 members (http://groups.yahoo.com/group/bushfoods/). If discussion over the last three years (monitored by the author, who is a member) is anything to go by, the vast majority of members are hobbyists or at most operate small home-based businesses, often involving small quantities of local materials, home processing, and small acreage plantations of a range of bushfood species. The trend is further illustrated by the range and character of material published in the only industry publication – *Bushfoods Magazine*. This magazine, which has been going for about three years, came out in 18 paper editions before being converted by its publisher, Queensland-based Sammy Ringer, to a web-only format (www.hotkey.net.au/~bushfood). Articles and correspondence published in the magazine portray a strong grassroots movement based on a growing interest among individuals in the exploration, development, cultivation and use of Australian native food plants, mainly by hobbyists and small-business people.

Opportunities for Aboriginal interests – CIFF and IAF – are now beginning to emerge

In the past three years, important developments have occurred that have the potential to significantly boost Aboriginal people's involvement in the bushfood industry and the benefits they receive from it. Largely on the initiative of Juleigh Robins of Robins Australian Foods, a series of steps have been

taken to set up a robust supply chain for bushfoods that includes operators at each of the critical points: producers/collectors, processors/manufacturers, distributors, and retail and food service outlets. Robins' major partner in this venture is Coles Supermarkets.

The objectives of the Coles–Robins Foods supply chain are twofold: to develop the fledgling bushfood industry and to maximise Aboriginal people's involvement in it. The strategy to further these objectives has two main arms. Firstly, bushfood product manufacturers (Robins, Australian Native Produce Industries and Taylors Foods) and Coles have agreed to allocate a small amount from each unit of product sold to be returned to participating Aboriginal groups. Under this scheme, Coles donates 25 cents from each sale and the manufacturers 12 cents (37 cents in total) to a special-purpose fund (entitled the 'Coles Indigenous Food Fund' – CIFF), which, on the basis of competitive applications, distributes the money as grants to Indigenous groups who are, or have the potential to become, contributors to the supply chain. This has been a significant amount of money and to date a number of groups have benefited from grants. Secondly, in parallel to the fund development, Coles has undertaken to run a three-year promotional campaign for bushfood products. The campaign, called 'Taste of Australia', has now been running in 120 or more Coles supermarkets for more than two and a half years and includes a wide range of manufactured products.

More recently, further developments have involved Robins and partners (not Coles this time) taking steps to establish a more prominent role for Indigenous interests in the bushfood industry and to help strengthen the supply of raw produce from Aboriginal sources. In this initiative a new company, majority owned and controlled by Aboriginal interests, has been set up to provide a formal link in the bushfood supply chain between collectors/producers and Robins Foods. The not-for-profit company – Indigenous Australian Foods (IAF) – becomes the 'procurement entity' in the supply chain, channelling bushfoods from Aboriginal groups to Robins Foods. It also has the role of owning a logo that certifies that the products to which it is attached have been purchased from an Aboriginal organisation and that sales benefit Aboriginal people. These sales benefit Aboriginal organisations by earning a royalty (basically a licence fee for using the logo) for IAF. Currently, Robins pays a fee of 10% of profit from the sale of labelled products to IAF. Like the CIFF, IAF distributes the fees collected to participating groups as grants for activities that further their ability to supply bushfoods to the chain. The distributions are expected to be modest for the first few years (estimated at approximately $20,000 per year to start with [Juleigh Robins, pers. comm., 2003]).

IAF currently has about a dozen members, and this is expected to eventually reach eighteen. NPY Women's Council and a group of collectors associated with Janet Chisholm of Napperby Station represent central Australian collectors in the company and occupy two positions on the board.

Other bush resource–based industries in Australia

Elsewhere in the country, most industries based on the kinds of materials identified here as bush resources actually use cultivated, rather than bush harvested, raw materials. Exceptions to this general trend include:

- Timber products – plantations are gradually beginning to augment forestry based on natural forests but it is unlikely that industrial forestry will ever abandon production based on managed natural forests.
- Sandalwood harvest – which again is still based on bush harvesting but is in transition to plantations and will eventually be entirely plantation based.

- Kangaroo harvest – currently undertaken as part of an integrated management scheme involving harvesting as part of strategic culling programs in three states (Queensland, NSW and SA).

Not much is happening with traditional medicines

While a few traditional medicine species are included on the Australian Register of Therapeutic Goods (ATRG), few widely available products using Aboriginal traditional medicines are known.

The example offered by the use of *Duboisia hopwoodii* (commonly known as 'pituri bush') for commercial alkaloid production provides a useful illustration of what is likely to be required for the long-term commercial viability of bush medicines and, by extension, the limited opportunities likely to be available to Aboriginal participants in this kind of development. The species is grown by mainstream farmers in the Kingaroy area of Queensland, on contract to Boehringer Ingelheim, a large German pharmaceutical company, and Alkaloids of Australia Pty Ltd. The plants are the world's richest source of scopolamine (also known as hyoscine), which is used to produce a range of pharmaceutical ingredients. The trade is based entirely on cultivated hybrid clones developed, with very large capital inputs and government-supported research and development efforts, specifically for their alkaloid content and quality, reliable growth characteristics and reduced susceptibility to root nematodes and stem borers (Tony Cunningham, pers. comm., 2004). This is emphatically a modern, mainstream, high-tech industry and has virtually nothing to do with the fact that Aboriginal people in south-western Queensland traditionally used the species as an ingredient in chewing tobacco, or other central Australian groups used it as a poison to catch game. The only realistic way in which Aboriginal people could benefit from such developments would be through owning shares in the pharmaceutical companies (or other parts of the production system).

Overall, the requirement that medicines must be registered on the Australian Register of Therapeutic Goods is likely to present a significant (but not insurmountable) barrier to the commercial development of traditional remedies.

But essential oils are moderately big business

Essential oils and fragrances support a large and growing industry both in Australia and internationally. The international industry is dominated by a few major crops (for example, citrus oils, mint oils, lemon fragrance oils and eucalyptus oil), the top 10 of which account for 80% of the total world market for essential oils. Production of all the main crops occurs mainly in one or more of about seven countries (Brazil, China, USA, Egypt, Mexico, Guatemala and Indonesia), and prices for these crops are generally quite low (all data from Victorian Department of Agriculture NRE Information Series – see: www.nre.vic.gov.au/). While Australia's share of international trade is small, it is still a significant industry: RIRDC estimates the current value of the Australian essential oil industry to be worth $6–7 million at the farm gate and $20–25 million wholesale/retail per year.

RIRDC's estimate does not include trade in sandalwood (*Santalum spicatum*), which is worth several million dollars on its own. Most sandalwood is exported as wood (mainly to China) for processing, either into oil, using steam distillation, or ground into powder for use in making joss and incense sticks. Some local processing – particularly steam distillation of oils – is now done in Australia (for example, the large operation at Mount Romance in Western Australia).

In addition to sandalwood, several other Australian species are prominent in the local industry, including some with close relatives in central Australia that also contain aromatic substances. The major Australian species used for oil are tea-tree (*Melaleuca alternifolia*), *Boronia megastigma*, *Eucalyptus kochii* and a few other eucalypts. Many other species are used commercially in smaller volumes. Oils made using Australia species include, among others: lemon myrtle oil (*Backhousia citriodora*), mainly from NSW and Queensland plantations, lemon-scented tea-tree oil (*Leptospermum patersonii*), mainly wild harvested in New South Wales and Queensland, various blended oils derived from different species and chemotypes of *Melaleuca*, (e.g. nerolina – *M. quinquenervia* Chemotype LN, niaouli – *M. quinquenervia* Chemotype C, rosalina – *M. ericifolia*), tickbush oil (*Kunzia ambigua*), blue cypress oil (*Callitris intratropica*) from Top End locations in the NT, and white cypress oil (*Callitris glaucophylla*).

The variety of oils produced commercially, and the growing market – between 1993 and 1998 world demand for essential oils grew 6.1%; for botanical extracts, 15.9%; plant-derived chemicals, 9.8%; and gums, gels and polymers, 7.4% (RIRDC background paper on essential oils – www.rirdc.gov.au/programs/eop.html) – would seem to indicate that real opportunities exist for small-scale commercial development of central Australian species. Before any essential oil enterprises are established, research is needed into species, chemotypic variation between individuals and populations within species, chemical constituents of oils, typical yields, variation in yield and quality in relation to growing conditions, horticultural requirements, extraction and post-harvest handling, economics and so on.

Timber and wood product business is dominated by industrial forestry with minor but significant specialist activity

Most economic activity in relation to timber is carried out at a highly industrialised level and is based on the very extensive publicly owned and managed forests in eastern Australia. Nothing of that kind is contemplated for central Australia. Since it is unlikely that timber or wood products will ever be produced in industrial-scale quantities in the region, the focus must be on low-volume, high-priced outputs. The industry sector most relevant to central Australia is the relatively minor trade in specialty timbers and objects made from them, especially furniture. It is not known how big this industry is in Australia, but it is believed to be comparable to other specialty industries based on handmade objects in that it is highly dispersed, individualistic and locally or regionally focused. Enterprises in this field are typically very small, home based, and employ only a few people each. By their very nature, one-off handmade objects, being labour intensive, expensive to produce and high priced, cannot be industrialised.

Trade in seeds for planting is moderate at the national level

A modest trade in the seeds of native plant species for horticulture, forestry, nursery production and other uses is carried on in Australia. Although reasonably up-to-date figures are only available for CSIRO's Australian Tree Seed Centre (ATSC), it is believed that most of the trade is in seed of various forest species, especially eucalypts and acacias, for use in establishing timber-producing plantations in other countries. Between 1991 and 2001 the ATSC dispatched more than 21 tonnes of tree seed from more than 1,000 species and tens of thousands of seed lots (http://www.ffp.csiro.au/tigr/). A catalogue of suppliers of Australian tree seed provided on the ATSC website lists 41 separate organisations, including four government agencies and 36 private companies. Many of these private companies also supply seed of native species other than trees. Two of the companies listed operate in the NT – one in Darwin (Top End Seeds), which supplies mainly Top End species, and Rod Horner, in Alice Springs,

who supplies seed of central Australian species. Apart from the dealers listed by CSIRO, other groups also trade in seed. These include Tangentyere Landcare and Environmental Health Unit and Greening Australia, Alice Springs, who collect small amounts of seed for propagation and use in environmental projects in the region, and Frank Baarda of Yuendumu Mining Company, who works with Rod Horner and buys seed from Aboriginal collectors.

Apart from companies specialising in the collection and supply of seed, a great many companies and other small businesses include trade in seed as one activity among others, such as nursery operations, landscaping, or environmental work of other kinds. A web search using the term 'native plant seed' yields thousands of hits, mostly of entities of this kind.

Community organisations also comprise an important component of the native plant seed industry. A national survey of native seed collection, storage and distribution undertaken by Florabank (www.florabank.org.au – a semi-government organisation formed as a partnership between Greening Australia, CSIRO Forestry and Forest Products, and the Australian National Botanic Gardens, Canberra, and funded by Bushcare) found that 70–80% of all native plant seed used in Australia was used for mine site rehabilitation. Revegetation projects undertaken by landholders, local authorities and so on accounted for another 10–20% of seed used. While commercial suppliers dominate the significant sales to mining companies, much of the seed for revegetation comes from community organisations, who generally collect local seed for local projects. Very little seed, representing a very wide range of species, is used to produce plants for the nursery trade (Mortlock 1998a, 1998b).

Craft enterprise is usually locally focused, but has a national body to promote its cause

Craft in Australia is big business, and is largely decentralised and locally focused. At its highest expression, craft is seen as a legitimate medium for pure artistic expression, and is practised by individuals and collectives working in their own or variously shared studios. Two main organisations provide a national forum for policy development and debate, for review of trends, for exhibitions and criticism, and for opportunities for artists to present their work. These organisations are Craft Australia – the national organisation for professional craft, whose 'particular focus is the creation of sustainable economic advantages for the sector by actively supporting existing markets for Australian craft and developing audiences both here and overseas. Through this, [they] work towards securing the identity of the crafts in Australia's culture and economy' (www.craftaus.com.au/) – and the Australia Council for the Arts, the federal government's arts funding and advisory body (www.ozco.gov.au). These organisations work closely together, and Craft Australia receives funding from the Australia Council.

The Australia Council has recently released a new 'Visual Arts and Craft Strategy', which will provide a 'major new four-year investment by the Australian, State and Territory governments of at least $39 million'. This strategy and funding will support regional craft organisations, exhibitions and catalogues, tour opportunities, grants to artists, professional support for Indigenous artists, publications and forums, market exposure and sales opportunities, and greater public engagement with visual arts and crafts (Arts Council press release, 9 December 2003). This is clearly a great boost to the sector and should lead to significant opportunities for Aboriginal arts and craft workers and collectives in central Australia.

The wildflower industry is a big part of the much bigger cut-flower trade

The wildflower industry worldwide is huge and very valuable, estimated to be worth around $A17 billion in 1994 (Mansfield and Kenna 1995). This compares with Karingal Consultants' (1994) figure of $A34 billion for 1990 (expected to rise to around $A40 billion by 2000), double the 1994 figure of Mansfield and Kenna – clearly there are difficulties with accurately compiling and/or interpreting statistics. Nevertheless, whatever the actual tally, the industry is very large and profitable. A more recent analysis of the domestic wildflower market (Horsman 2000) shows that sales of wildflowers in Australia have not kept pace with growth in production, indicating a level of resistance among domestic florists and their customers. Horsman (2000) estimates that wildflowers account for only about 5–10% of total domestic flower sales and ascribed the limited utilisation of wildflowers to a lack of awareness among consumers. Clearly there is room for improvement and growth in this area.

Competition in the overall flower market is fierce, mainly from overseas producers, and margins are sufficiently tight that production of mainstream species is probably not feasible in central Australia. Central Australian production must focus on unique species of high quality if it is to have any chance of success. It is also important to consider the place of central Australian production in the broader Australian context and possibly the export system. Karingal Consultants' detailed analysis provides a valuable guide to the issues affecting cut-flower enterprise development, and signals, indirectly, how central Australian producers might fit in. In particular, the core industry strategy articulated by Karingal Consultants states that the industry can:

... achieve growth in sales and profitability by concentrating on improving industry production performance, productivity in use of inputs, quality management, market penetration and price – essentially with existing and improved varieties of existing species of wildflowers – while maintaining that sufficient level of investment in new species and products that will be needed to safeguard the industry's medium and long term future (Karingal Consultants 1994, p. 13)

Clearly, under such a strategy, opportunities in the national and international market for central Australia mostly revolve around medium- to longer-term development of new species and varieties (such as those listed in Table 6). In the meantime there may be significant opportunities for modest sales of wildflowers in the local area – Alice Springs and other NT towns, and in Adelaide and regional SA.

What about closer to home? – the central Australian situation

Local bushfoods are nationally important, but only two kinds feature, and wild harvest predominates …

Central Australia is a major source of wattleseed and bush tomatoes – two of the most important bushfoods, in terms of volume and value, in Australia. Virtually all wattleseed and bush tomatoes currently supplied from central Australia are collected in the wild by Aboriginal people. Over the last three years, more than 500 Aboriginal people have collected wattleseed or bush tomatoes for sale, and many collectors have been able to make good money for short periods of time from these collections. Some bush tomatoes, and a range of other species, are now beginning to be supplied from small-scale community-based horticultural plots.

… and most trade is through five main operators

As well as a number of small groups (often only one or two individuals) who are attempting to build enterprises in their settlements, five main operators buy material from collectors and supply bushfood material from central Australia to the industry.

Frank Baarda, of Yuendumu Mining Company, buys material – mainly seeds and bush tomatoes – from residents of Yuendumu and other settlements – mainly Warlpiri and Anmatyerr people – in the region. Alice Springs–based seed collector and merchant Rod Horner deals mostly with Anmatyerr and Alyawarr people in the Utopia region, who collect wattleseed, bush tomatoes and seed of a range of other species for him. Rod Horner and Frank Baarda have recently joined forces to improve the viability of both businesses. In addition to bushfoods, these two operators also supply seed of central Australian species for horticultural uses (see below).

Since 1993 Janet Chisholm, who together with her husband is the proprietor of Napperby Station, north of Alice Springs, has been buying bushfoods – mainly wattleseed and bush tomatoes – from the Anmatyerr people of Laramba and the surrounding area through the station store. Over the last two years Reedy Creek Nursery (proprietors Mike and Gail Quarmby), located in far south-east SA, in collaboration with a number of Aboriginal settlements both in central Australia and in southern SA, and until recently, with Tangentyere Council CDEP in Alice Springs, has been developing small horticultural enterprises in Aboriginal residential areas, focusing on growing bushfood species. This enterprise, under the name ‘Outback Pride’, now supplies a range of packaged raw ingredients and manufactured products to the general public through Coles stores.

Outback Bushfoods, a partnership between the author and Peter Yates, former land management coordinator for Anangu Pitjantjatjara Yankunytjatjara at Umuwa SA, buys bushfoods – again mainly wattleseed and bush tomatoes – from Aboriginal collectors throughout the southern NT, northern SA and central ranges region of WA. Outback Bushfoods works in collaboration with NPY Women’s Council, which provides services to women in settlements throughout southern NT, northern SA and eastern WA.

Between them, these dealers have handled somewhere in the order of three to five tonnes of material, again almost all of it wattleseed and bush tomatoes, each year for the last few years. Other, part-time, operators trade a small amount of material to the industry, and a small but significant amount of material is traded for consumption in Aboriginal settlements.

Box 1: Bushfood collectors in the Alice Springs region

Enthusiastic Aboriginal bushfood collectors live in most of the communities in central Australia. Usually, collectors are women and range in age from their early twenties through to their seventies. They have in common a detailed knowledge not just of species and their use, but also of their ecology, distribution and reproductive status. These strong women have a very strong work ethic, extremely well-developed collecting skills, strong family values, a commitment to culture and an unflagging motivation to be out together in their country. In an important sense, the opportunity to earn money by selling bushfoods they collect provides a catalyst that encourages them to get out and do the things that they really want to do. The region is rich in wattleseed and bush tomatoes and, in the season, collectors can collect quantities which earn them significant seasonal incomes. The money typically is used to purchase items of value to their families – food, clothing, white goods, TVs, even vehicles sometimes. It is clear that income earned in this way is valued much more highly than that derived from welfare payments. Bushfood collecting generates a range of collateral benefits for the collectors that go well beyond the simple monetary exchange. Benefits accrue in the areas of health, family coherence, self-esteem, cultural continuity, the continuity of knowledge, community standing, financial independence and land management. There are probably others. The benefits derive from getting exercise, eating bushfoods, being away from communities and spending time together in groups of mixed aged that are loosely based on kinship, and passing on stories, knowledge, skills and law to younger women (and occasionally men), updating their knowledge of land, and carrying out activities such as foraging for other, non-commercial bushfood plants and animals (especially goannas) and, occasionally, burning country. The strong motivation women have for collecting is shown by the work they do to overcome the significant obstacles they encounter, such as limited transport options and the pull of other commitments, to go collecting and, without external assistance, collect, clean and deliver produce to buyers in town. In effect, collectors demonstrate their interest in, and commitment to, harvesting bushfoods by the considerable efforts they go to in order to participate.

Some animals are harvested for food, but not commercially

Apart from occasional and very minimal harvesting of witchetty grubs, and possibly honey ants, for the restaurant trade, no commercial harvesting – in the sense of selling material to outside buyers – of wild animal resources is currently undertaken in the region. However, the harvesting of wild animal resources is economically significant at the local community level, providing significant substitution for store-bought meats. This wild harvest is also nutritionally important, providing many people with a significant portion of their protein requirements. Native animal foods are also very low in fats, with those they do contain being mostly polyunsaturated.

Attempts to quantify local hunting indicate that post-colonisation settlement patterns have led to a concentration of hunting pressure around settlements and a significant alteration of impact patterns (Cane and Stanley 1985, Cane 1986). At the same time, vast areas of country are now much less frequently visited, and hunting pressure in these areas has fallen accordingly.

Trade in traditional medicines is virtually non-existent

A modest trade in local central Australian materials exists, and this is almost entirely Aboriginal organised and operated. For example, irrmanka irrmanka (*Eremophila alternifolia*) is used as the main active ingredient in therapeutic ointments made and sold in several settlements. Recently in central

Australia, John and Marilyn Cavenagh, under the trading name 'Yalka', have begun including small bundles of the dried leaf of traditional medicines (*Eremophila* spp.), wrapped with natural fibres, in sample bush-produce packs, which are aimed mainly at the tourist markets.

… and the same goes for essential oils, only more so …

No local involvement in essential oil production is known, and all oils and fragrances sold in the region are imported from elsewhere. At this stage no locally occurring species are known to be used for essential oil production.

… but there has been some activity around timber and wood products …

Development of the fine timber and craft potential of central Australian species to date has been of two main kinds: small-scale local ornamental carving and turning, and making small pieces of furniture, mainly done by hobbyists (for example, objects for sale in the Leaping Lizard craft shop in Alice Springs), and larger-scale semi-professional carving of traditional objects (termed *punu*) by Aboriginal people, mainly in the NT–SA border region, for the tourist trade. Most of the Aboriginal wood carving in the region is organised and commissioned by Maruku Arts, a successful company owned and run by the Aboriginal artists themselves and based at Mutitjulu settlement. In many ways Maruku Arts offers an excellent model for building Aboriginal enterprises based on bush resources, since it is owned and operated by the people who supply the material in which it trades, and it has employed experts in key areas such as business management, accounting, and promotion, marketing and sales. By employing outside managers, the company not only acquires appropriate skills but also avoids the possibility of the conflicting motivations that artists placed in management positions may face.

Timber enterprises of a more mainstream nature are virtually unknown. However, a modest effort undertaken by local wood workers in the late 1980s–early 1990s indicated that several species have excellent potential, with high quality wood suitable for a range of high value applications such as fine furniture. Peter Bartlett and his partner used desert oak timber that they procured by felling already dead trees (with the permission of the landowners). Logs were transported to Alice Springs on a truck and cut into flitches and boards for use in furniture making. When finished, the timber is highly attractive, with a deep, rich red glow, very high strength, stability (and weight) and rock-like hardness – ideal qualities for large pieces of feature furniture. Because of its very high silicon content, desert oak timber is extremely hard when green and is significantly more so when cured, presenting significant processing challenges. To handle this demanding material, the team used special tungsten chains and blades on their chainsaw and circular saw. Even these wear very quickly when processing this material. Such expensive items of special equipment and high wear and tear, as well as the limited throughput and time-consuming and labour-intensive nature of the operation, limited the economic viability of the business in this case and it was discontinued after a couple of years (Peter Bartlett, pers. comm., 1997).

Other models may work better for this kind of operation. For example, it is likely that economic viability could be improved significantly by increasing throughput, working materials up into higher-valued finished products, using more easily worked green timber, using a wide variety of timbers, developing a marketing strategy for timbers of central Australian origin, working with well-known artists and craftspeople around the country to make signature pieces that can be used to emphasise the qualities of the material, and so on.

… whereas seeds for horticulture have a long history of steady trade

Two small businesses in the region have traded in seeds of central Australian species for 20 years or more. These two businesses, mentioned previously – Yuendumu Mining Company, with Frank Baarda as principle, and Rod and Kusha Horner's partnership based in Alice Springs – control virtually all trade in seed in the region, and by joining forces are endeavouring to maximise opportunities and minimise costs, especially costs related to holding stock (Rod Horner, Frank Baarda, pers. comms, 2002). Neither of the existing businesses are large enough by themselves to support their operators totally and both operators gain income from other activities some or most of the time. The industry has been characterised by boom–bust cycles related to the national and international demand for seed, which in turn is related to a complex set of factors to do with mining economics, mineral prices, exploration history, species fashion, the legal requirements of various jurisdictions and so on. The industry has occasionally been reasonably lucrative, but has not grown appreciably over many years and appears unlikely to be capable of supporting new participants unless they can generate substantial business expansion.

In order for Aboriginal enterprises based on supplying seed to be viable, they will probably need to find ways of discounting costs and diversifying incomes – for example, by working in with existing businesses, having a diverse range of material available and promoting the business well in a variety of places likely to attract the attention of all existing and potential users of native central Australian germplasm, including the nursery industry. There may be opportunities for supplying propagation material other than seeds, such as cuttings, tip cuttings and in-vitro materials, provenance-based collections that offer comprehensive genetic samples of a species, and so on.

… there have been some interesting recent developments in Aboriginal crafts …

One vigorously growing area is that of basket making. Tjanpi Aboriginal Baskets, a grant-funded program of Ngaanyatjarra Pitjantjatjara Yankunytjatjara Women's Council (NPYWC), commissions baskets from women in NPYWC's area of operation, supplying some of the materials required, and buying, promoting and selling the finished baskets. More than a hundred women have been involved in basket making over time (Thisbe Purich, NPYWC, pers. comm., 2002). The baskets have gained a reputation for quality, style, colourfulness, variety and the innovative use of bush materials (for example, feathers and eucalypt capsules). Rising prices reflect the growing awareness and appreciation of these excellent handcrafts.

The production and sale of string beads that are made from a wide range of materials such as red beans (*Erythrina vespertilio*) and bloodwood capsules (*Corymbia* spp.) is another form of craft work that takes place in the region. Maruku Arts, described above, is a further example of a successful craft-based enterprise in the region.

Another enterprise based on crafts that has developed in recent years is the creation of toys out of scrap wire by several craft workers, mainly based at Titjikala settlement, south of Alice Springs. Like many such things, the idea is gradually spreading to other makers and settlements and becoming increasingly identified with Aboriginal craftspeople in the region. While this work does not use natural resources, it does make use of materials that are abundantly available at virtually all Aboriginal settlements in the region. At a modest stretch, these materials can be considered 'bush resources'.

The success of these enterprises indicates that further small, locally-based Aboriginal enterprises utilising various crafts may be possible. Possible types of materials and creations could include leatherwork, bush material and so on. The likely keys to success in this field are imagination and action on the part of individual craft workers.

… but wildflower enterprises are a thing of the future

As part of this project, a trial shipment of bush-harvested *Ptilotus helipteroides*, amounting to five boxes each of approximately 100 stems, was collected, prepared (lower leaves trimmed, dead material removed, stems trimmed for length and neatness, then cooled and packed carefully into boxes) and shipped to a dealer at the Adelaide flower markets (Caroline Graham of Australian Food and Flora), in order to test market interest in the species and the possibility of export sales to Japan. The species is unique to the region, very attractive in appearance and the material was of high quality compared to other naturally occurring plants of this species in the region. Ms Graham indicated prior to the shipment that it would be possible, with the right material, to export 15,000 stems a week to Japan (in 1998). Prices are variable and depend on quality but something in the order of 5 to 10 cents per stem was thought to be possible then. Feedback in relation to the shipment indicated that the *Ptilotus* stems fall into an awkward position in the market and may be difficult to sell. Despite their acknowledged striking appearance and durability, the flowers were thought to be too small to be competitive with feature flowers (such as waratahs and kangaroos paws), and too large and few per stem to be effective as 'fillers' compared with the likes of Geraldton wax. The flower stem length was also at, or below, the lower end of market requirements (minimum of 600 mm is required). While this result may seem a little disappointing, it is not the last word, and actually offers hope for the future. The amenability of this (and other) species to improvement (in terms of market requirements) through cultivation in the short term and plant breeding in the longer term is probable but untested. The basic ingredients of flower colour, shape, durability and uniqueness are good, at least for this and other mulla mullas, and probably for all of the species on Mansfield and Kenna's (1995) list, and the opportunity exists to take these ingredients to the next level and produce marketable varieties from the region. It is also likely that other markets exist, beside the top-end export ones, for which some or many central Australian species may be well suited. One area requiring research for mulla mullas is germination ecology, since members of the genus are notoriously recalcitrant sprouters, and also often very poor setters of seed.

4. Bush resources in central Australia

Introduction

An analysis of the kinds of bush resources available in central Australia forms the basis for understanding and assessing the potential use of bush resources in local and regional enterprises, and for developing strategies to realise that potential in favour of Aboriginal people in the region. We need to identify resources that have some commercial potential, and the kinds of uses they might be put to, as well as examples of products that could be developed from them. This section discusses bush resources themselves and ways in which their utility may be assessed. The basic approach has been to start with as many potential candidates as possible and to identify a manageable group of 'best bets' from these. The initial list of 'possibles' is made up mainly of plant species, complemented by a small number of animal species.

Aboriginal traditional use is our primary guide …

As a matter of necessity and survival, Aboriginal people have made use of natural plant and animal resources in central Australia for tens of thousands of years. While they found some plant species more useful than others, people developed uses for a large range of plants and animals and many other resources in their domain. In an important sense, Aboriginal traditional uses and knowledge represent a very long period of exploration and testing. Over thousands of years Aboriginal people in central Australia have found, experimented with and made appropriate use of everything in their environment that had any utility. Equally their experimentation enabled them to identify what was not useful. This immense body of knowledge, which includes information about where things could be found, the detailed ecology of plants and animals, their productivity in relation to the environment, harvest times, preparation requirements and the full range of skills needed for harvest and processing, represents what today we would term intellectual property. This body of knowledge is our main source of information in relation to the potential commercial use of bush resources.

… knowledge of which has been recorded in some detail

A fair amount of information on traditional knowledge of bush resources and their use is available to the public in published articles, books and reports. This sizeable literature describing Aboriginal knowledge and use of plants and animals in inland Australia, as well as more general material on flora and fauna of the region, was consulted in the process of identifying species for potential use. The individual works are not always referred to in the text and the reader should consult the bibliography for examples. Of particular relevance in central Australia is Peter Latz's seminal work, originally assembled in the late 1970s, summarising most existing ethnobotanical information relating to plants for the area. His excellent published work (Latz 1995) lists 277 species as 'important plants' used by central Australian Aboriginal people (p. 75), and notes a number of less important species that were used only occasionally, or for very general purposes, or are rare or have limited distributions.

Assessing commercial potential

Not all traditional resources are suitable for wider use …

A relatively small percentage of the very many species that were important resources for Aboriginal subsistence in central Australia lend themselves to development and use in the broader Australian, or indeed international, community. This study takes a more focused view of the term 'resources', and attempts to identify those species that have an apparent utility value that goes beyond traditional use and may translate into commercial potential.

… and not all resources considered in the study were used traditionally

This subset of traditional plant and animal resources is augmented by a few species which are either introduced into the region and so have no traditional value, or are not recorded as having been used in ways that might now be identified as having some commercial potential.

… and also, potential commercial utility is not always the same as traditional use

Commercial possibilities for central Australian bush resources are not limited to traditional uses. For many resources the study also considers non-traditional uses which respond to the demands and sensibilities of a modern society, and which may not have been appropriate in a traditional setting. In many cases, completely new products derived from traditional resources may provide a sound basis for the development of new enterprises that can bring economic and cultural benefits to Aboriginal people in the region.

So, traditional use is an important factor, but not the only one

While traditional use is an important factor, and the starting point in identifying potential commercial use, many central Australian species can be used in ways and for purposes that were not part of traditional life. As indicated above, these include such things as timber for furniture, cut flowers for decoration, essential oils (although suitable species were often used in raw form for medicinal purposes) and seeds for horticulture. Many other traditional resources, especially foods, can be used in new ways that go well beyond their traditional uses. Examples include the use of wattleseed in a broad range of food products, and new, composite products using bushfoods mixed with mainstream ingredients.

What was needed was a systematic process of selection and elimination, starting with as large a group of 'possibles' as possible

How can we decide which of the hundreds of traditional and other bush resource species are likely to be suitable for commercial development? For plant resources, this question was addressed using a stepped process to progressively filter out species that were unsuitable and identify the best bets for further development. Starting with all the species used traditionally, plus a number of others, the selection was refined at each step using relevant criteria. The process is illustrated below in Figure 1.

Using this process, most candidates selected were foods …

By far the largest group of traditional resources is plants used for food. Of the more than 270 species used traditionally by Aboriginal people in central Australia and described in Latz (1995), a little less than half (124) were used for food. Using the selection process described below, this group of 124

prospective candidates was reduced to about 68 species that have tangible commercial potential. These 68 'best bets' were then ranked into four priority levels based on their overall scores in the selection and assessment process. Selected species and their proposed ranking are detailed below in Table 3.

The first step in the selection of candidates for food was assessing their food quality …

Bushfoods were assessed for their food value using a 'food quality index', which involved scoring for taste, texture, appearance, consistency, nutrition and versatility. Since most of these characteristics are quite subjective and/or are poorly known for many species, the values arrived at are indicative (i.e. either 'high' or 'low') rather than quantitative. This step in the selection process tended to be fairly inclusive, giving a species the benefit of any doubt, so as not to unfairly eliminate species on the basis of incomplete information or inappropriately adverse subjective evaluation. Species assessed as having low food value were not considered further. Those assessed as having high food value were then assessed for availability.

In terms of nutrition, many of the food species included on the list exhibit characteristics which enhance their value from the point of view of a traditional subsistence diet, but which may be ambiguous or detract from their value in a modern diet. Many species have, by modern standards, a high fat content, often in the area of 10–20% (63% for quandong kernels). On the other hand, many species have high protein levels, often approaching levels common in animal products (around 25%), and are also high in carbohydrate and soluble fibre. A high protein (>15%) and low fat (<6%) content is rare, and for seed producers is only found in *Acacia victoriae* (18% protein, 3.2% fat), *A. murrayana* (20%, 5.2%), *A. torulosa* (17%, 2%), *Dysphania kalpari* (15%, 2.3%) and *Eragrostis eriopoda* (16%, 1.6%). The high protein/low fat combination may, however, also occur in other species for which data are not available.

Fruits are generally low in protein, fat and carbohydrate, mainly because they are high in water (most above 85%, the rest above 65%), but levels are modest even when fruits are dried (for example, fresh *Solanum centrale* fruit has figures of 62% water, 3.8% protein, 0.6% fat, 32% carbohydrate and 8% soluble fibre compared with the dried fruit, which has 12.5% water, 8.5% protein, 3.8% fat, 67% carbohydrate and 23.4% soluble fibre). All figures were obtained from Brand and Maggiore (1992).

… and the second step was to assess the availability of plant food resources

Availability is a crucial factor in commercial potential since a species would have very little commercial potential, even if it were the best food yet known, if it could not be procured. This rule is not absolute and some things – typically those that could sell for very high prices, such as native truffles – may have tangible commercial potential despite being available only sporadically or in very small quantities. The criteria used and how these might affect availability are outlined below in Table 2.

… which depends on whether they can be collected from the wild or must be cultivated

Availability was assessed in two steps, the first being to look at wild harvest. Species scoring well for wild harvest were automatically included in the lists of candidates suitable for further development. Of the final 67 promising species or species groups identified as having both good food value and availability, 34 scored a satisfactory or better result for wild harvest (Table 3, below). Of the species

for which wild harvest was considered viable (about half of the final list of species), more than two-thirds are currently actually being wild harvested, at least occasionally. Several, including at least five acacias, one bush tomato and kalpari (*Dysphania* spp.) are being harvested in significant quantities and have been harvested for many years. Clearly work will be required in order to realise the identified wild harvest potential of the species not currently being harvested or being harvested in only very small quantities.

Wild harvest is highly unlikely to be possible for several of the food species on the list with the most promising prospects, and their availability to the market will ultimately depend on our ability to produce them in cultivation.

In the second step of the availability assessment, species scoring less than satisfactory for wild harvest were assessed for horticultural potential on the reasoning that if they couldn't be harvested from the wild maybe they could be grown in plantations. Thirty-three species were identified as having satisfactory or better horticultural potential (Table 3, below). Of course, in the long run, species scoring well for wild harvest may also need to be cultivated if the demand for products made from them outstrips the sustainable productivity of natural stands. Some of the species identified as having wild harvest potential are likely to present significant challenges in terms of horticultural cultivation.

Figure 1. Flow chart of process used for identifying plant and animal resources with commercial potential

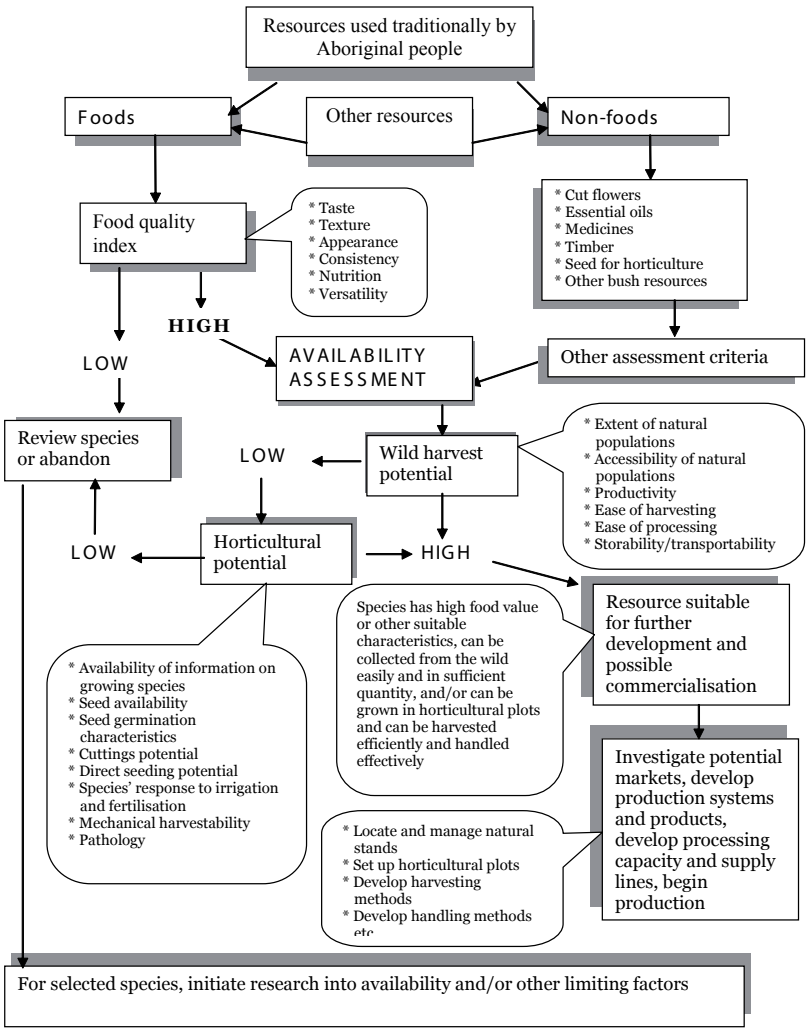

Table 2. Criteria for assessing availability of species with commercial potential

Assessment criterion	Details
1. Wild harvest potential	The extent to which material of sufficient quality, quantity and reliability to meet existing or forecasted market demand can be harvested effectively and efficiently from naturally occurring plants
Factors considered	
Extent of natural populations	Regional distribution and abundance of a species; typical size, density and structural characteristics of local stands or patches
Accessibility of natural populations	Habitats occupied; land tenure; distance of patches from roads; structural characteristics of vegetation in which species occurs
Productivity under natural conditions	Reliability of crops; typical size of crops; annual variability and extent to which they respond to climatic conditions; variation between individuals, patches and regions of occurrence
Potential impacts	Likelihood that harvesting activities may affect the survival of individuals, populations and species in areas harvested; what kinds and patterns of impact might be expected and conditions under which they could be exacerbated
Ease of harvesting	Plant parts used and location on plant; seasonality, ripening and dehiscence characteristics; strength of attachment to plant
Ease of processing	Necessity for post-harvest threshing, winnowing, sieving or other cleaning; difficulty of any post-harvest processing; availability of machinery for processing; extent of manual handling required
Storability/ transportability	Susceptibility to spoilage, suitability for pre-ripe collection; special handling requirements – especially packaging, cool chain, pre-storage treatment, pest control
2. Horticultural potential	The suitability of species to cultivation under horticultural conditions, and the productivity responses likely to result from cultivation – especially important for species not readily available in the wild
Factors considered	
Existing knowledge of species	Trial results; results for closely related species or genera; mainstream or casual experience in the region; known issues
Seed availability	Existence of seed collections; documentation accompanying seed collections; extent of provenance representation from across the species range; seed freshness and viability; cost of acquiring seed; variability of plants grown from seed
Seed germination characteristics	Seed coat characteristics; existing knowledge of germination inhibition factors (e.g. dormancy) for the species; pre-sowing treatment requirements; evenness of germination; vigour of seedlings
Potential for cuttings	Existing information on ability to grow plants from cuttings; availability of plant material; need for special equipment, and its availability; health and vigour of plants produced
Direct seeding potential	Ability of seeds to germinate and grow under field conditions, with or without irrigation; knowledge of suitable sowing methods (e.g. depth of planting, seed pre-treatment)
Response to irrigation and fertiliser	Effects of irrigation and fertilisation on growth and survival of plants and timing and productivity of crops or material to be harvested
Mechanical harvestability	Availability of machinery suited to a species or crop type; period of ripening; tendency of crops to remain on plants for a time after ripening; ability of material harvested to withstand process of harvesting
Pathology	Known pathogens of plants, fruits and seeds; treatment requirements of known pathogens; extent to which cultivation may exacerbate pathology

Table 3. Rankings, wild harvest and horticultural potential of food species

Species	Ranking	Wild harvest	Horticulture
Acacia aneura	1	✔	
A. colei	1	✔	
A. coriacea	1	✔	
A. murrayana	1	✔	
A. victoriae	1	✔	
Solanum centrale	1	✔	
Grevillea stenobotrya	1	✔	
Carissa lanceolata	1		✔
Capparis spinosa var. nummularia	1		✔
Cucumis melo ssp agrestis	1		✔
Cyperus bulbosus	1		✔
Marsdenia australis	1		✔
Santalum acuminatum	1		✔
S. lanceolatum	1		✔
A. adsurgens	2	✔	
A. dictyophleba / A. melleodora	2	✔	
A. jennerae	2	✔	
A. tetragonophylla	2	✔	
Eucalyptus coolibah ssp arida	2	✔	
E. gamophylla	2	✔	
E. pachyphylla	2	✔	
Brachychiton gregorii	2	✔	
Owenia reticulata	2	✔	
Capparis umbonata	2		✔
Eragrostis spp.	2		✔
Ipomoea polpha	2		✔
I. costata	2		✔
Panicum spp.	2		✔
Solanum chippendalei	2		✔
S. cleistogamum	2		✔
S. ellipticum	2		✔
S. esuriale	2		✔
Yakirra australiensis	3		✔
A. acradenia	3	✔	
A. kempeana	3	✔	
A. stipuligera	3	✔	
A. tenuissima	3	✔	
A. torulosa	3	✔	
Atalaya hemiglauca	3	✔	
Dysphania spp.	3	✔	
Capparis lasiantha	3		✔
C. loranthifolia	3		✔
C. mitchellii	3		✔
Citrullus spp.	3		✔
Ficus platypoda var. minor	3		✔
Fimbristylis spp.	3		✔
Vigna lanceolata	3		✔
A. estrophiolata	4	✔	
A. georginae	4	✔	
A. pruinocarpa	4	✔	
A. ammobia	4	✔	
A. ligulata	4	✔	
A. pachyacra	4	✔	
A. ramulosa	4	✔	
E. normantonensis	4	✔	
E. camaldulensis	4	✔	
Allocasuarina decaisneana	4	✔	
Ventilago viminalis	4	✔	
Enchylaena tomentosa	4		✔
Fungi (3 species)	4		✔
Grevillea juncifolia	4		✔
G. eriostachya	4		✔
Portulaca oleracea	4		✔
Solanum diversiflorum	4		✔
S. gilesii	4		✔
Tecticornia verrucosa	4		✔

Problems of incomplete information and subjectivity of judgement, which affected the assessment of the 'food quality index', were even worse for horticultural potential. Of all the steps in the assessment process, horticultural potential was probably the least precise, simply because very few target species have been tried systematically in cultivation, and scores against criteria were often arrived at indirectly or simply could not be adequately assessed. The set of factors described in Table 2 proved very much an idealised approach to horticultural assessment and in several cases, personal judgement of a single criterion decided between inclusion and exclusion of a species on the horticulture list.

A recent review of horticultural aspects of bushfood species, which focused mainly on east coast species, provides a summary of the limited existing horticultural knowledge of *Santalum acuminatum* as well as *Solanum centrale* and some central Australian *Acacia* species (Ahmed and Johnson 2000). Neither *Solanum centrale* nor any of the acacias are likely to be problematic in cultivation and these species are currently well served by wild harvest. *Santalum acuminatum* has been cultivated successfully for some years and much is known of its biology (see, for example, Grant and Buttrose 1978, Loveys et al. 2002, Radomiljac 1998, Tennakoon et al. 1997). Despite the lack of solid published information on other species, it is probably fair to say that, given sufficient suitable research, it will be possible to cultivate virtually all the promising candidates.

Some of the best commercial prospects for central Australia will require horticultural development in order for their potential to be fulfilled, and it is vital that the necessary research is undertaken as a matter of priority. Experience accumulated over the last few years by Tangentyere CDEP and Tangentyere Landcare and Environmental Health Unit nursery in Alice Springs in collaboration with Reedy Creek Nursery in south-east SA has resulted in some progress in this area and indicates that most of the species on our list will be amenable to more or less standard horticultural practices (Simon Ledbeater, Tangentyere nursery; Peter Cowham, Tangentyere CDEP; and Mike Quarmby, Reedy Creek Nursery, pers. comms, 2003).

A more detailed discussion of the pros and cons of wild harvest versus horticulture is provided in Part 5.

But a significant number of initial candidates were not foods …

Apart from foods, many species may provide materials and/or products of several different kinds. The main types of possible products considered (under separate headings, below) included:

- Therapeutical substances including medicines
- Fragrances and essential oils
- Cut flowers and foliage
- Seeds for horticulture
- Timber and tree products
- Craft materials and products

While the bush therapeutics referred to in this report are all species used traditionally by Aboriginal people, many species not used traditionally by Aboriginal people were included in the assessment process and considered as sources for other kinds of products. As was the case for foods, a range of information sources were used to compile lists of potential candidates for consideration. And as was the case for foods, a major impediment to comprehensive and accurate assessment is, despite the range of sources, the lack of information about the species of interest. So, once again, there is a certain degree of subjectivity and uncertainty in the selections made.

… and identifying best bets among these was not so easy

The initial selection of non-food species with possible commercial potential was less straightforward than that of foods because of the wide range of potential products considered, and the limited information available for many species. Criteria for initial inclusion in the 'possibles' lists reflected the broad and inclusive approach to identification of candidate species for this suite of applications and included:

- Characteristics of candidate species compared to characteristics of similar or related species currently used to produce commercial products here or elsewhere.
- Characteristics of potential products which might be made from candidate species compared to characteristics of existing products made from other species.
- Opinions of knowledgeable people in relation to potentially useful species and products which could be produced from them.

In many cases this process led not to a list of particular species but to a set of characteristics that candidate species should possess, so as to leave the door open for the broadest possible range of future possibilities. Ultimately, the individual entrepreneur or group whose enterprise is dedicated to the development will identify and realise the potential in any particular species.

The initial list of non-food species and groups of species was subjected to the same availability assessment process applied to foods. Details of the species selected are given below in sections relating to each set of product types.

The resources selected and how they might be used

This section provides an overview of species and materials derived from them which could be harvested from natural populations or grown in horticultural plots in central Australia. The discussion is based on the species identified during the selection process described above. The focus is primarily on plant products, with brief consideration of a few animal products.

Foods – overview

Bushfoods are probably among the best known resources used traditionally by Aboriginal people in central Australia. At least, the idea of central Australian bushfoods is well known; however, detailed information about which species are used and how they rate and how central Australian species differ from those available from elsewhere is very poorly known in the wider community.

In terms of their current commercial importance, bushfoods can be thought of as belonging to one of three groups – wattleseed, bush tomatoes, and all the rest. While there are established and growing markets for wattleseed and bush tomatoes (*Solanum centrale*, also known as 'bush raisins'), it is possible that the 'all the rest' category includes some of the best prospects for the medium- to long-term future of bushfood enterprises in central Australia. Good summaries of modern (as opposed to traditional) uses of wattleseed and numerous other bushfood species are provided in several popular books on bushfoods such as Cherikoff 1994a, Cherikoff and Isaacs 1989, Isaacs 1989, and Bruneteau 1996.

The current recognition and commercial demand for wattleseed and bush tomatoes is due to their high food value and exceptional availability. The lack of commercial markets for other species with equal or better food value is entirely due to the fact that quality material cannot be harvested sufficiently

reliably or in sufficient quantities to sustain a regular supply. Building a market for these less well known species with good prospects is likely to depend on horticultural development and possibly some initial cross-subsidisation from trade in wattleseed and bush tomato products.

Table 4, below, lists the central Australian species identified as having tangible commercial food potential. Based on scores for food value, the species listed have been given a ranking on a scale of 1 to 4 in one or more of five food categories: seed, fruit, gum (i.e. exuding an edible sap or gum), grub (i.e. harbouring edible larvae) and 'other', which includes roots and tubers, mushrooms and fungi, honey, and lerps (types of leaf-eating insects with a sugary, sweet scale covering). A ranking of 1 indicates excellent quality, and 4 indicates marginal quality. Of the 70 or so species listed (the actual number is imprecise because some entries on the list include more than one species in a group), more than half (45) have value for their seeds, almost a quarter (19) for fruit, 12 for gum and 10 each for grubs and other products. While some species have value for more than one product, only 13 species do not have seed or fruit as their primary value, thus clearly indicating the importance, in this study, accorded to seeds and fruits in conferring commercial potential upon bushfoods. It is also clear that the most important group of seed-producing plants is the acacias, which comprise almost a third of the species on the list (plus one included for its gum only), and half of which are ranked 1 or 2.

On the basis of scores in the product categories, plus availability and other information, the species themselves were given an overall ranking out of four, indicating the strength of their commercial potential. The large proportion of seed and fruit species included in the list is accentuated by their prominence among top-ranking species. All except one of the 14 top-ranked species were valued mainly for their seeds or fruits, the exception being *Cyperus bulbosus*, an annual sedge species producing a small, tasty, easily harvested tuber, often in great abundance.

The dominance of seeds and fruits continues for second-tier species, with only two out of 18 having no seed or fruit value. The assessment of these two may be optimistic since their long-term prospects will probably depend heavily on successful cultivation. The two are both bush potatoes (*Ipomoea* spp.), whose tubers are excellent foods but are produced too deep in the ground for efficient harvest. Notwithstanding the importance of seed and fruit, other types of products are also of considerable interest. Gums, in particular, may have excellent potential in the long term, and several species produce gum of excellent quality in good quantities. Gums and other food products are discussed in more detail in the relevant sections below.

The food plants included in Table 4 can be used in a great variety of ways to produce marketable products. Some of the potential products using material derived from central Australian species include: traditional bushfoods (relatively little-processed); 'new' foods using bushfood ingredients (ranging from staple to gourmet and already numerous in supermarkets); and variations on existing mainstream foods incorporating bushfood ingredients (e.g. coffee substitutes, spices and flavourings, biscuits, drinks, sweets, bread and cake mixes etc.).

Low-glycaemic index foods

Due to its low sugar content, wattleseed might be appropriate for inclusion in 'low-glycaemic' foods, for consumption as part of diabetic and other specialty diets. 'Low-glycaemic' refers to foods that are low on the Glycaemic Index (GI). The Glycaemic Index is a numerical system of measuring the characteristics of circulating blood sugar responses triggered by a carbohydrate. A low GI food will

cause a small, sustained rise in the blood sugar response, while a high GI food will trigger a brief, dramatic spike. The GI value of a particular food is meaningful only in relation to a previously established base number. The base against which the GI is measured is the average blood sugar response to 50g of white bread. This response is given a value of 100, and responses to 50g of other foods are measured in relation to this. For example, *Acacia aneura* seed has a GI value of 11. This means that the seed raises blood glucose levels 11% as much (on average) as white bread does (with the rise lasting correspondingly longer). This compares to soybeans, which have a GI of 25, and lentils, which have a GI of 42 (Mendosa 2000). Further research is required to evaluate the size and potential of this market value of low-glycaemic characteristics and how best to promote wattleseed products in this market.

Foods: specific groups

Wattleseed is number one

Wattleseed is the most important resource, in terms of volume and value, currently collected in central Australia, making up between 60% and 100% by weight of all material traded in any given year. Most wattleseed currently shipped from central Australia is sold in raw form (i.e. as whole seeds), following basic cleaning to remove impurities. Local processing (roasting and grinding) to produce a range of grades of roasted and ground wattleseed adds significantly to the value of the material exported, and is being undertaken by one local Alice Springs company (Outback Bushfoods Pty Ltd).

Currently most manufacturing using wattleseed is undertaken outside central Australia but there appear to be opportunities for further local processing, including packaging and labelling, and possibly the manufacture of finished products. Considerable investment will be required to realise such potential.

Box 2: The wattleseed story

Wattleseed is the roasted and ground seed of various species of *Acacia*, the most species-rich native Australian plant genus, with around 1,000 species, a fair proportion of which have edible seeds. It has been used in commercial or semi-commercial food products for more than two decades, its use steadily growing over that time. Even so, wattleseed today is still an exotic food for most Australians, and mainstream products incorporating it are yet to emerge.

Wattleseed is versatile and highly nutritious, being high in protein (typically around 20%), carbohydrate, fibre and fat as well as trace minerals (Brand and Maggiore 1992, Murray 1984), and has a spicy, aromatic nutty flavor. It also has the valuable quality of a low glycaemic index, which can make diets incorporating it useful in helping to moderate blood glucose and alleviate diabetes, a major and growing disease affecting Aboriginal people (Thorborn et al. 1987a, b).

The versatility of acacias has been demonstrated in recent years by developments in sub-Saharan Africa where Australian species, introduced for windbreaks, shade, soil stabilisation and firewood, are now being grown for the food value of their seeds. The acacias grown in Niger can produce seed crops even in dry years when local annual cereal crops fail, providing a nutritious reliable food source in this impoverished, drought-prone region (House and Harwood 1992).

Table 4. Food plant species selected for further investigation and development

Ff	Common name	Species name	Plant part used for food (ranked)					Overall Rank
			Seed	Fruit	Gum	Grub	Other	
T	Mulga	*Acacia aneura*	1		2			1
S	Wattle	*A. colei* *	1					1
T	Dogwood	*A. coriacea*	1					1
S	Colony wattle	*A. murrayana*	1		3	3		1
S	Victoria wattle	*A. victoriae*	1		2	3		1
S	Bush passionfruit	*Capparis spinosa var. nummularia*		1				1
S	Conkerberry	*Carissa lanceolata*		1				1
V	Native cucumber	*Cucumis melo ssp agrestis*		1				1
G	Yalka	*Cyperus bulbosus*					1	1
S	Sandhill grevillea	*Grevillea stenobotrya*	1					1
V	Bush banana	*Marsdenia australis*		1				1
S	Quandong	*Santalum acuminatum*	1	1				1
S	Plum bush	*S. lanceolatum*	1	1				1
s	Desert raisin	*Solanum centrale*		1				1
S	Wattle	*A. adsurgens*	2					2
S	Wattle	*A. dictyophleba* **	1					2
T	Wattle	*A. jennerae*	1		3			2
S	Dead finish	*A. tetragonophylla*	1			3		2
T	Kurrajong	*Brachychiton gregorii*	2					2
S	Wild orange	*Capparis umbonata*		2				2
T	Coolibah	*Eucalyptus coolibah ssp arida*	2			4		2
T	Blue mallee	*E. gamophylla*	2					2
T	Red-bud mallee	*E. pachyphylla*	2					2
G	Woollybutt	*Eragrostis* spp.	1					2
S	Desert yam	*Ipomoea polpha*					1	2
S	Bush potato,	*I. costata*					1	2
T	Desert walnut	*Owenia reticulata*	1					2
G	Native millets	*Panicum* spp.	2					2
s	Bush tomato	*Solanum chippendalei*		2				2
s	Bush tomato	*S. cleistogamum*		2				2
s	Bush tomato	*S. ellipticum*		3				2
s	Bush tomato	*S. esuriale*		3				2
S	Wattle	*A. acradenia*	2		3			3
S	Witchetty bush	*A. kempeana*	3			1		3
S	Wattle	*A. stipuligera*	3		3			3
S	Wattle	*A. tenuissima*	3					3
S	Wattle	*A. torulosa*	2					3
S	Split jack	*Capparis lasiantha*		2				3
S	Wild orange	*C. loranthifolia*		2				3
S	Wild orange	*C. mitchellii*		2				3
V	Paddy melon	*Citrullus* spp.	3					3
S	Honey grevilleas	*G. eriostachya, G. juncifolia*			3	4		
H	Munyeroo	*Portulaca oleracea*	3					4
S	Bush tomato	*S. diversiflorum*		3				4
S	Bush tomato	*S. gilesii*		3				4
H	Samphire	*Tecticornia verrucosa*	3					4
F	Mushroom	Mulga bolete (unnamed)					2	4

F	Native truffle	*Choiromyces aboriginum*					1	4
F	Native truffle	*Mycoclelandia bulundari*					1	4
T	Supplejack	*Ventilago viminalis*			3			4
H	Kalpari	*Dysphania* spp.	3					3
T	Rock fig	*Ficus platypoda ssp minor*		2				3
G	Sedges	*Fimbristylis* spp.	3					3
V	Pencil yam	*Vigna lanceolata*					3	3
G	Desert Flinders grass	*Yakirra australiensis*	2					3
T	Ironwood	*A. estrophiolata*	4		1			4
T	Gidgee	*A. georginae*			1			4
T	Black gidgee	*A. pruinocarpa*	4		1			4
S	Wattle	*A. ammobia*	3					4
S	Umbrella bush	*A. ligulata*	4		2	2		4
S	Wattle	*A. pachyacra*	3					4
S	Wattle	*A. ramulosa*	4					4
T	Desert oak	*Allocasuarina decaisneana*	3					4
T	Whitewood	*Atalaya hemiglauca*			4			4
s	Ruby saltbush	*Enchylaena tomentosa*		3				4
T	River red gum	*Eucalyptus camaldulensis*				4	2	4
T	Mallee	*Eucalyptus normantonensis*	3					4

Ff = form of plant : F: fungus; H: herb; G: grass or grass-like; V: vine; s: small shrub; S: large shrub; T: tree
* includes *A. cowleana* and *A. elachantha*,
** includes *A. melleodora*

At present, the major species collected commercially for wattleseed is *Acacia victoriae*, with modest amounts of *A. aneura*, *A. murrayana*, *A. colei*, *A. elachantha*, *A. cowleana*, and *A. coriacea* contributing to the total. Small amounts of another half dozen or so species are traded, mainly for mine rehabilitation or other horticultural uses. Apart from the top-ranking species, there is considerable food potential for the seed of a further five, second-tier, species (*A. adsurgens*, *A. dictyophleba*, *A. melleodora*, *A. jennerae*, and *A. tetragonophylla*).

All of the first and second ranked species are widespread and common and are relatively reliable producers whose seed is easily harvested and processed. Seven other third and fourth ranked species have some potential in that they are at least moderately common and often produce reasonable quantities of edible seed that is relatively easily harvested.

Local experience indicates that the species on the list have high food quality and exhibit a significant range of tastes and texture qualities that will probably make different species better suited to different uses. In the long term, clear market differentiation and individual species-based product development is possible based on these significant differences. Such elaboration must await considerable growth in the sophistication of the market and the development of consumer appreciation of the material.

At present, *A. victoriae* remains the de facto industry standard for 'wattleseed' and some manufacturers are only interested in this species. This situation is the result not of inherent excellence in food qualities but of historical circumstances in which *A. victoriae* was, for many years, the only species whose seed was available in sufficient quantities to satisfy demand. The major reason for this is that *A. victoriae* is a widespread species, common in drier parts of New South Wales, Queensland and South Australia, and is fairly reliable and prolific in its seeding habits. Ironically, from investigations on this project, it is clear that all the other first

and second ranked species have inherently superior food quality to that of *A. victoriae*. This situation indicates a significant opportunity for the development of central Australian species. The involvement of Aboriginal people in the collection and processing of seed of other acacias is likely to greatly increase the availability of other top-ranked species and allow the development of products and market niches based on them.

The push to develop wattleseed farming systems for mainstream farmers in wetter areas closer to markets may pose a serious threat to the medium to longer term viability of Aboriginal people wild harvesting in central Australia. Recent research in this area (Simpson and Chudleigh 2001, 2003), aimed at the development of a new industry for farmers facing land degradation, particularly in the form of rising salinity and water tables, and lower real commodity prices is optimistic about these prospects. The conclusions from these preliminary assessments appear to be that before broad acre wattleseed farming could be viable a many-fold increase in demand/consumption would be needed, which could not occur unless there was a significant reduction in wholesale prices. Any significant reduction of wholesale prices would probably mean wild harvesting of wattleseed by Aboriginal people would be eliminated from the industry.

Bush tomatoes, bush raisins

Several edible species of *Solanum* are found in the region but only *S. centrale* has any commercial significance at present. Six other species are included on the list (Table 4, above), four of them ranked 2, and two ranked 4. All of these species have characteristics that significantly detract from their commercial potential, especially in terms of wild harvest. Four species –
S. ellipticum, *S. cleistogamum*, *S. esuriale* and *S. gilesii* – have small fruits like *S. centrale*. The first two of these have spoilage-prone soft fruits which must be collected and used as soon as ripe. *S. esuriale* has quite hard, long-lasting fruit, but has a limited distribution, and the fourth species is quite rare and its fruits are strongly protected by sharply spiny calyxes, rendering hand harvesting problematic. The other two species – *S. chippendalei* and *S. diversiflorum* – possess larger fruits, up to the size of a mandarin, with very bitter black seeds. The flesh of these species has an 'interesting' taste, which Aboriginal people love, but which few whitefellas really enjoy.

Bush tomatoes can be very productive. In some years – due to a congruence of favourable rains and suitable burning – crops of bush tomatoes are outstanding and 10 tonnes or more of material can be collected. 2001 was such a year – the best since 1993 – and collectors in the region north and north-east of Alice Springs gathered more than eight tonnes of high quality fruits between August and December. But productive years are not common and 2001 followed four years of virtually no bush tomato crop throughout the region.

Nevertheless, provided that suitable storage facilities are available, and demand for bush tomatoes does not increase drastically over previous years, market needs can more than adequately be met by wild harvest. In recent years Outback Bushfood's sales have amounted to between one and a half and three tonnes per year. Even if demand grows beyond that which can be supplied by wild harvest, there are good reasons for continuing to foster wild harvest by Aboriginal people in the region. The relative benefits of the wild harvesting of bush tomatoes will be considered in Part 5.

S. centrale grows in disturbed areas and regenerates, often in great abundance, from rootstock (i.e. it suckers) and/or seed following fire or physical disturbance such as road grading. Indeed a fair proportion of the crop produced in central Australia is collected from plants growing beside roads, with the remainder collected from accessible, recently burned areas. Such areas can be highly productive, producing as much, if not more, fruit as could be expected from cultivated areas of equal size.

Proper management of land for bush tomato (and wattleseed) production in the region could have profound impacts, many of them positive, on fundamental arid zone ecological processes. In addition, a host of important social, cultural, economic and environmental factors that affect Aboriginal people in the region could be improved. These important issues have been discussed in Part 2.

Other edible seeds

As noted above, a large proportion of species identified as having commercial potential are valued for their seeds. This group includes about 38 species ('about' because some genera such as *Eragrostis*, *Panicum* and *Citrullus* each include several useful species), more than one-third of which are given a rating of 1 for the food quality of their seed. It is likely that the main challenge in using the seed of species identified here will be developing ways of preparing the seeds and inventing foods and food ingredients that make use of them.

The seed-bearing plants can be divided into five natural groups:

- *Acacias* (described above)
- Other tree species
- Shrubs
- Herbs
- Grasses (including sedges in the genus *Fimbristylis*)

Non-acacia tree species

This group includes species with some of the best prospects for commercialisation in the region, including several eucalypts, desert kurrajong, desert walnut, quandong and desert oak. Apart from desert oak, all of these are ranked 1 or 2 on the list, and between them possess seeds offering a great range of textures, sizes and flavours, from the large, rich seeds of desert walnut and quandong, through the bean-like kurrajong, to the smaller, nutty eucalypts and desert oak.

Eucalypts While the four eucalypt species included are little tried, they have several factors in their favour: they are (except for *E. normantonensis*) widespread and common, they are generally reliably productive, their fruits are relatively easily harvested and the seeds are easily extracted and ready to eat raw or with little preparation. This combination of factors means that with a modest effort, considerable quantities of seed could be collected in a relatively short time. The seeds are surprisingly nutritious, being high in energy (average about 1800 kJ per 100 g), protein (around 25%), fat (around 20%) and carbohydrate (around 38%) (Brand and Maggiore 1992).

Quandong – *Santalum acuminatum* Better known for its tart, fleshy red fruits, this species also possesses a high quality seed which must be mechanically extracted from within a formidably hard seed coat (this seed coat is similar to that of macadamia nuts). Some work, especially by way of breeding programs, is likely to be required in order to overcome a perceived taste defect caused by the presence of methyl benzoate in the seed (Loveys et al. 1984).

Currently the viability of wild harvest in central Australia is compromised by the sharp decline in the numbers of mature trees in the wild in the last decade or so due to the severe destruction of trees by feral camels. The value of wild harvest is also reduced by the high variability in the fruit from tree to tree and the subsequent lack of consistency in product from wild sources. These difficulties are being overcome through breeding programs and horticultural cultivation, mainly based in South Australia, and significant quantities are available on the market. In order to bring benefits from trade in quandong products to central Australia, plantations of the species will need to be established and processing capacity for both the flesh and the seeds will need to be set up to add value locally.

Plum bush – *Santalum lanceolatum* This less well known relative of the quandong occurs throughout central Australia and is especially common among rocky hills and along minor drainage lines. Like quandong, both the flesh and the kernel of plum bush are edible (though perception of the taste varies between people!) but, unlike quandong, the plum bush kernel has a thin seed coat and can easily be eaten raw. In fact the fruit can be eaten whole, with no need to separate flesh and seed, the seed providing a delicate crunchy counterpoint to the quite strongly flavoured flesh. While the taste and texture is quite different to that of quandong, uses are likely to be similar. The limited nutritional data available for the species indicates that, like quandong, the kernel is high in protein (about 11% c.f. 16% for quandong) and very high in fat (about 77% c.f. 63% for quandong) (Brand and Maggiore 1992).

Naturally occurring trees do not appear to produce much fruit, except in very good seasons, despite prolific flowering often over extended periods. Since cultivated trees do set fruit readily, the lack of fruit in the wild is probably due to environmental factors such as moisture availability or nutrition. As the species usually occurs in extensive clonal stands, there is also the possibility that disinclination to set fruit in the wild may be due to limited cross-pollination (Warburton et al. 2000).

Note that another member of this genus – the native sandalwood, *S. spicatum* – also has an edible seed that may also have significant medicinal qualities (Lui and Longmore 1996). While this species does not appear on the potential food species list, it is recommended for planting for sandalwood production, important by-products of which may be edible and medicinal seeds.

Desert kurrajong – *Brachychiton gregorii* Well known for its edible seed, this species is widely distributed and is common in certain habitats. Harvesting fruits and extracting seeds is less straightforward than for the eucalypts (traditionally, seed was harvested by gathering from the ground following dehiscence and yandying to remove sand), and the seeds require treatment to remove a coating of seriously irritating hairs (this is easily done mechanically).

Nevertheless, the trees are productive and the crops reliable, and the seeds are large, versatile and nutritious (20% protein, 20% fat, 28% carbohydrate and 24% dietary fibre [Brand and Maggiore 1992]).

Desert walnut – *Owenia reticulata* This species is not common in the NT, being confined to sandy desert areas of the Tanami region, where it is scattered and uncommon. It is, however, abundant in sandy desert areas of the northern Great Sandy Desert in WA, where it occurs in extensive stands in dunefields. Despite presenting collection challenges due to distance and hostile terrain, the seeds are of such high quality that it will be worth the effort to overcome these problems. While fruits are readily harvested (by picking them up off the ground after they fall), seed extraction will probably require some mechanical means, as the fruits are thick, tough and fibrous. The seeds, however, are large (about cashew size), rich and very tasty, especially after light roasting, and have been likened to macadamias in quality.

Desert oak – *Allocasuarina decaisneana* Ranked 4 for its seed because of problems with harvesting the seed and because other seed trees appear to present better prospects, the desert oak is, however, abundant and accessible in the region. These advantages are offset by variability in cone production, which falls sharply in dry times, and the difficulties of harvesting fresh cones from tall trees (since seeds fall from cones before cones fall from trees, the cones must be harvested direct from trees in order to collect the seed). It is not clear that seeds have such high food value that these disadvantages can be discounted, and the species' inclusion on the list is marginal.

Shrubs

Significant shrubs include sandhill grevillea (*Grevillea stenobotrya*), which produces richly flavoured seeds somewhat reminiscent of sunflowers that have as much potential as those of any of the tree species. Sandhill grevillea occurs widely across the region in sandy areas, often at high densities in extensive mixed species stands on sand dunes, as its colloquial name suggests. Seeds are produced in significant quantities and are easily harvested and cleaned. They can be eaten raw or lightly roasted and have excellent versatility.

Herbs

Herbs that produce edible seeds include kalpari, paddy melons, munyeroo and samphire. These species present a range of tastes, textures and potential options for use, and offer significant development opportunities.

Kalpari Kalpari is the Pitjantjatjara name as well as the species name for one of two species (*Dysphania kalpari* and *D. rhadinostachya*) also known as crumb weeds or rat tails. For once, a widely known vernacular name – now applied to both species – that has some evocative resonance has been applied to a bushfood species. These plants are abundant throughout central Australia in a broad range of habitats, especially favouring – as you would expect from such weedy species – areas of disturbance, and respond quickly to good growing conditions. The plants, which grow to less than 300 mm, produce abundant tiny, round, shiny black seeds that remain on the plant for lengthy periods of time – a feature which facilitates their collection. The seeds are very nutritious, being high in protein (averaging around 15%) and carbohydrate (around 70%) and low in fat (around 2.3%) (Brand and Maggiore 1992),

and are among the very few species currently harvested in commercial quantities in the region (although the quantities of kalpari collected amount to less than 5% of the quantities of wattleseed and bush tomatoes harvested). Much greater quantities could be harvested if demand increased, and the next challenge for these species is to develop suitable products using the seed. Kalpari, which has strongly aromatic foliage, is also well regarded by Aboriginal people as a useful medicine.

Munyeroo – *Portulaca oleracea* Another of that rare group of species known by a distinctive and evocative vernacular name, this flat-growing (rosette form) succulent herb is widespread and abundant throughout the region. Its seed, produced in large quantities at certain times, was an important traditional staple food source, and like so many species on our list, is highly nutritious, with around 20% protein, 15% fat and 50% carbohydrate (Brand and Maggiore 1992). Leaves of this species were also eaten, and probably provided important vitamins and minerals. Recent work has described a potentially useful gum which can be extracted from a closely related species (Garti et al. 1999).

Paddy melons – *Citrullus lanatus* and *C. colocynthis* Native to various parts of Africa, the Mediterranean region and tropical Asia, paddy melons are introduced in Australia and are now widespread in all mainland states. The fruits of paddy melons should be edible – they are members of one of the world's larger plant families and related to most of the world's most widely cultivated melons such as watermelons, rockmelons, pumpkins and cucumbers. Sadly, the fruit is worse than inedible, leaving a long-lasting, repulsive bitter taste in the mouth of anyone who tries to eat it. Curiously camels and cattle don't seem to mind the taste. The species has several things in its favour – it is abundant in the region, especially along roadsides and in other disturbance areas, produces abundant fruit, even in quite dry periods, and possesses edible nutritious seeds. Wild harvesting and local processing, although not yet tried, should be relatively straightforward, as fruits are long-lasting and seed can be extracted easily from the dried fruits. It is understood that certain compounds in the fresh fruit may be active against scabies (Peter Yates, Alice Springs, pers. comm., 1998).

Samphire – *Tecticornia verrucosa* The term samphire is a fairly general one, referring to a group of herbs in the saltbush family *Chenopodiaceae* which typically occur in sometimes salty, moist or periodically inundated habitats. Only occurring in north-western parts of central Australia, it was an important food for Pintupi people, who collected the seed, often in great abundance, from the stand lines of ephemeral claypans. Research in Victoria in relation to this and several other halophyte species has identified it as a species of interest for oil-seed production on saline land (Schultz 1996) as it contains reasonable quantities of a high quality seed oil, comparable to soybean oil (Mike Schultz, Victorian Department of Agriculture, pers. comm., 1997). Unfortunately the researchers in that project were unable to stimulate germination in the species and this remains a serious impediment to horticultural development.

Grasses

Several grasses and grass-like species are included on the list of species with commercial food potential. Those included here comprise only a small proportion of all the grasses whose seeds were used traditionally for food by Aboriginal people in the region. The grasses included on the list are those which appear, from the limited information available (Latz 1995, O'Connell

et al. 1983, Bryce 1992, Turner and Henderson 1994, Goddard and Kalotas 1988), to be the probable best bets for further development. Since no species have been tried in cultivation yet, other species may prove more useful or more amenable to development in the long run. At this stage so little research has been conducted into these plants that predictions would be pointless.

Of the grasses and sedges listed (grasses – *Eragrostis*, *Panicum* and *Yakirra* species; sedges – *Fimbristylis*), only *Eragrostis* seed (probably *E. eriopoda* – woollybutt or wanganu, the most widespread and commonly used species in the region) has, in recent years, been collected for sale from the wild in any quantity. Traditionally, wild harvest of these grasses was facilitated by their typical occurrence in extensive stands, often of only one or two species, and by their habit of retaining seed on plants for some time after ripening. Wild harvest is labour intensive, and the processing of grass seed into food items even more so, so it is not surprising that Aboriginal people largely gave up grass seed harvesting and processing quite soon after store-bought flour became available. Nevertheless, the skills and knowledge relating to these species are still held by many people – especially middle-aged and older women – in the region and collections are still occasionally undertaken. Unusually for bushfoods, *Eragrostis* and *Panicum* are both high in protein (16% and 13% respectively), low in fat (< 2% and 4.6% respectively) and high in carbohydrate (~50% and 65% respectively), making them well suited to modern diets. *Fimbristylis*, on the other hand, has the seemingly more typical high fat (20%) and moderate protein (11%) and carbohydrate (43%) levels (Brand and Maggiore 1992). Nutritional analyses undertaken by Fiona Walsh and Judy Gedeon reveal that *Yakirra australiensis* has 14.4% protein, 5.7% fat, 62% carbohydrate, and is particularly rich in aleosome (Fiona Walsh, pers. comm., 2004). Fiona Walsh reports that it should have good potential for horticulture, where the ready dehiscence and clean seed could be advantageous.

Other fruits

Fruit-producing species are very well represented on the list, being second only to seed producers in importance, with 19 species in eight genera. Seven of these species are solanums, described above. The other 12 comprise a diverse group of small trees, shrubs and vines, including five small trees and shrubs in the genus *Capparis*. Seven of the 19 species are ranked 1 on the list, including bush tomato, bush passionfruit, conkerberry, bush banana, native cucumber, quandong and plum bush, of which bush tomatoes and quandongs are already commercially important. One species – *Capparis umbonata* – is ranked 2. These first and second tier species comprise arguably the best prospects for commercial bushfood development in the region. All of these species have the potential to gain considerable importance within a few years, provided that production and handling systems can be developed to ensure the regular availability of high quality produce. Lower-ranked species – those with less commercial potential, including three species of *Capparis*, rock fig, the six lower-ranked solanums discussed above, and ruby saltbush – are held back by a range of factors including food quality, rarity, inherent harvesting difficulties or other attributes.

The succulence of the fruits of some of the top-ranked species is both their best and worst attribute, resulting in a sweet, juicy fresh product with excellent eating qualities, and at the same time providing technical and logistical difficulties for maintaining quality through harvesting, handling and storage. While fruit of some species (bush tomato, conkerberry,

quandong and plum bush) can be dried for later use, fruit quality is greatest when fresh. Other species on the list (bush passionfruit, wild orange and native cucumber) bear highly perishable fruit whose harvest must be timed precisely and which must be handled quickly and with great care in order to reach the market in good order as fresh fruit.

Technical problems associated with handling perishable fresh fruits may be addressed in various ways such as by harvesting fruit slightly green when it has better keeping qualities, or processing material immediately following harvest. While post-harvest processing and handling is an important area of research in horticulture, it is yet to be conducted in relation to the species in question.

Of all the fruit species on the list, only bush tomatoes and quandongs are currently available in any quantity. The issue of a reliable high quality supply of other species can probably only be addressed by developing horticultural production systems for these species. Successful horticultural development of most of the listed fruit species is likely to depend critically on research into harvest, post-harvest and processing questions.

In the long term, it can be expected that quality can be improved through breeding programs aimed at improving size, taste and responsiveness to horticultural production. Such breeding programs depend vitally on having a broad range of material available from which to make selections and crosses. Breeding programs will thus have to start by assembling range-wide, provenance-based germplasm collections representing as broad a genetic base as possible for each of the species of interest. An important issue somewhere down the plant breeding–horticulture track will be at what point does a 'bushfood' resource become a mainstream horticultural product?

Quandong Quandongs are commonly grown in cultivation, especially in South Australia, and have been cultivated for many years (Grant and Buttrose 1978). In a way the quandong epitomises bushfood development and progress; it seems to have been around for years and yet the fruits and products made from it can in no way be regarded as mainstream yet. Registered varieties have been produced and an industry association that supports research and marketing development has been advancing the development of the species as a commercial crop. Research into quandong cultivation includes work on an important pest species, the quandong moth (Ferguson 2000, Ferguson and Bailey 2001), improvement through genetics and cultivation (Lethbridge and Randell 2003), the effects of soil biology on growth and survival (Warren and Ryder 2003), and a range of more technical ecophysiological topics (Loveys et al. 2001, 2002, Tennakoon et al. 1997). A modest amount of useful information, including several research papers, a set of fact sheets and links to a number of websites, are available on the Australian Quandong Industry Association website (www.users.centralonline.com.au/aqia/).

As mentioned above in the discussion on the seed of this species, it has been so severely reduced by camel grazing that these days it is hard to find specimens in the wild. The precipitous loss of wild stock in the region should provide a strong impetus for an effort to assemble a comprehensive germplasm collection of this valuable species. Such a collecting effort will be aided by the fact that the species can be grown from cuttings using modern tissue culture techniques (Barlass et al. 1980), grafting (Prenzel n.d.) or reliably from seed where it is available (Loveys and Jusaitis 1994).

Plum bush Plum bush is perhaps the 'Cinderella' of central Australian bushfood species – the fruits have excellent taste and texture qualities and great versatility, as well as excellent keeping qualities, size and appearance. It is not clear why much more work has not been done on this species, given that it has such good prospects. The species is common throughout the region, and while fruit productivity in the wild is variable and usually limited, plants respond well to cultivation, adapting to a wide range of host species and growing well with irrigation and fertilisation. As is the case with the quandong, and other fruit-bearing species for that matter, considerable variation in fruit characters is apparent between individuals and between stands in the wild. Comprehensive germplasm collection programs should be initiated prior to establishing production plantings of any size, and research into natural genetic variation in parallel with investigations of cultivation techniques will be beneficial.

Bush passionfruit – *Capparis spinosa var. nummularia* This species is not a passionfruit (*Passiflora* spp.); the vernacular name refers to broad similarities in some qualities of the fruit. The only qualities that their fruits have in common are a certain fleshy consistency and a very sweet pulp containing the seeds. A more sensible vernacular name might be 'native caper' since the central Australian species is closely related to the true caper bush, being regarded, technically, as a variety of the same species. Nevertheless this name would also be entirely misleading as the 'bush passionfruit' is valued for its mature fruit, not its flower buds.

The species is the most common of five species in this genus and is the one judged to have the best commercial prospects in the group. A range of factors diminish the commercial potential of other species in comparison to *C. spinosa*, most important of which is the variable, usually lower, quality of their fruit, their rarity, spiny branches, very slow growth rates, limited fruit productivity, and the susceptibility of fruits to spoilage through infestation with insects. Accordingly most of the other species are ranked 3 on our list, the exception being the second-ranked *C. umbonata*, which, while being regarded by Aboriginal people in the region as having the best quality fruit of the group, is hampered by its rarity, slow growth, limited fruit production and spiny branches. It may well be possible to ameliorate some of these problems through cultivation. *C. spinosa* is ranked 1 because while it does have spiny branches, it is very common throughout central Australia, typically on river flats and lower slopes, produces sweet, juicy, soft-fleshed fruit, and appears to be reasonably productive in the wild, responding strongly to relatively wet periods. The potential for wild harvest is limited by problems with handling ripe fruit, discussed above, and by the species' habit of ripening progressively over a period of time. The species is susceptible to severe defoliation by a white caper butterfly but it is not known what effect, if any, this has on fruiting.

It is likely that all of the *Capparis* species can respond well to irrigation, fertilisation, pest control, weed control, pruning and so on in cultivation.

Conkerberry – *Carissa lanceolata* One of the few species selected in which the vernacular name of this species does not allude to some well-known mainstream fruit to which it bears no resemblance.

The fruit of this species, about the size and shape of a smallish olive, shiny black in appearance, and very sweet and juicy, is judged to have excellent commercial potential. The species is relatively widespread and common in central Australia, mainly along drainage lines and on lower slopes. Commercial wild harvest has not been successful to date for two main reasons – the erratic and unreliable fruiting (which is occasionally heavy, but is more usually light and scattered), and problems of spoilage during post-harvest transport and handling. There may be opportunities to manage existing natural stands by watering, weeding and fertilisation, but even if plants responded well to such treatments, it is unlikely that this kind of exercise could be economically viable without a severe discounting of the time and effort expended, and significantly increased production. The limited experience that exists of growing the species in the Alice Springs region indicates that the species is particularly slow growing, at least in the first few years, and research will be required to improve post-planting survival, growth rates and early flowering and fruit set. In the long run, breeding work will be needed to improve fruit size and to synchronise fruit ripening while maintaining flavour.

Bush banana – *Marsdenia australis* This vernacular name is among the worst applied to central Australian species, insulting both the species and bananas, and is likely to seriously impede the commercial development of this species. It is hard to see how *Marsdenia australis* could be less like a banana, to which it bears not the slightest resemblance. The species grows as a slender vine, usually employing trees or shrubs as trellises to support its stems and allow its fruits to hang while maturing. The leaves, fruits, flowers and roots are edible, though not, in the opinion of the author, particularly tasty. With development, experimentation and cultivation, it is likely that the appeal of the fruit in particular can be greatly improved. Harvesting and processing the fruit while immature appears to offer the best prospects for improvement. Several efforts to grow the species have demonstrated that it is entirely amenable to cultivation and good progress towards commercial development could be made using simple trellising and cultivation techniques.

Native cucumber – *Cucumis melo* ssp *agrestis* This species is indeed a cucumber, as its classification indicates, and bears very cucumber-like, small, rough-textured, yellow-green fruits. The main limitation to its commercial potential is perhaps its lack of differentiation from some commonly available cucumber varieties, which may serve to reduce the extent to which it can be marketed as unique. The excellent keeping qualities of the fruit should present good prospects for wild harvest but it is held back in this regard by its quite limited distribution, which has contracted in recent decades due to grazing pressure from cattle and camels, for whom it is a sought-after food item. The species should respond well to cultivation, although some effort will be required to search out and collect representative germplasm from across its range.

Rock fig – *Ficus platypoda* var. *minor* This fruit-bearing small tree to large shrub is found throughout central Australia, where it grows on rocky slopes and cliffs, often in sheltered gorges. The species is quite productive, the fruits small, yellow to red, and usually fairly dry and subtly flavoured. Its commercial prospects are probably better as an ingredient in some kind of processed product rather than as a fruit to be eaten raw. The bland taste and dry texture of fruits collected in the wild have resulted in this species being ranked 3, but this may prove to be an unfair assessment if fruit quality can be improved through cultivation.

Productivity is good in the wild but wild harvest is hampered by the difficulty of harvesting from steep rocky sites and the scattered nature of its distribution. Fruits also tend to ripen sporadically over lengthy periods of time, restricting the amount that could be collected at any one time.

Good examples can be found growing in Alice Springs (and probably other towns as well) and the species appears to respond well to irrigation and good soil; the trees do not need to grow on steep rocky slopes and are probably restricted to such sites in the wild by their susceptibility to fire and frost. Casual observation indicates that planted trees can be quite productive and they are likely to be well suited to orchard production systems.

Ruby saltbush – *Enchylaena tomentosa* This low shrub species is widespread and common in central Australia and is commonly observed to produce fruit all year round, with peaks in spring and autumn. Like many central Australian species, the fruit of this species is small (tiny!), the flesh enclosing a relatively large seed, and ripening is progressive, with the full range of development stages held on a plant at any time. Despite good taste and texture qualities, this species is ranked 4 because of the lack of synchronicity in ripening, and the small fruit, which is finicky and time consuming to harvest in relation to the amount that is obtained. Planted specimens respond well to cultivation.

Edible and other gums

Vegetable gums are complex carbohydrates, usually consisting of polysaccharides of a very large molecular weight. These naturally occurring plant exudates are collected from planted or wild trees by tapping the inner bark, xylem or phloem of trees in much the same manner as latex is collected from rubber plants. Vegetable gums are used in a huge number and variety of foods and other products in four main categories: foodstuffs; pharmaceutical products; textiles; and paper, ink and a large range of other products and processes (Howes 1949, Beshai 1984). Most of the gum-producing species in Table 4 yield gums that act as hydrocolloids, being soluble in both oil and water, and their utility is mainly as emulsifiers, stabilisers of water–oil emulsions, thickeners, carriers and soluble fibre. Worldwide consumption amounts to thousands of tonnes per year (Anderson 1993).

Only a few kinds of naturally occurring gum exudates are currently approved internationally for use in foods and pharmaceuticals (Anderson 1993, JECFA 2003). These include gum arabic (from the African tree species *Acacia senegal* [L.] Willd. and A. seyal Del.), gum karaya (from various African and Indian *Sterculia* species), gum ghatti (from *Anogeissus latifolia* Wall.) and gum tragacanth (from Middle Eastern species of *Astragulus*). Gum arabic is the most important of these vegetable gums in terms of its qualities as a food additive and its dominance of world trade, with annual production in the order of 20,000 tonnes (Anderson 1993). Australian imports of plant biopolymers, including gums, amounts to around $A40 million per year and the world market is valued in the area of $A40 billion (CRC for Plant Biopolymers website – see www.botany.unimelb.edu.au/html_pages/foodgums.html). The application of international and national standards to vegetable gums used as food additives in Australia (ANZFA 2003; note that this standard appears to replace the earlier Standards A10 and A11, which provided

more specific definitions for acacia gum [gum Arabic], referring to the definition provided by the Committee on Codex Specifications, 1981) is a significant but perhaps not insurmountable barrier to the use of central Australian species for these purposes.

Various chemical, structural and other analyses have been carried out on several Australian species, especially acacias (Anderson and Bell 1976, Anderson et al. 1972, Anderson and Gill 1975, Annison et al. 1995), including several species either included on our list or from central Australia (Anderson et al. 1983 – *A. stipuligera*, *A. torulosa*; Anderson et al. 1984 – *A. murrayana*, *A. georginae*; Anderson et al. 1985 – *A. jennerae*; Anderson and McDougall 1985, 1988 – *A. victoriae*, *A. pruinocarpa*, *A. ligulata*, *A. jennerae*). Work has also been done on *Atalaya hemiglauca* (Anderson and Weiping 1990), and while these extensive studies have shown that many Australian species have useful attributes and resemble accepted food-grade gums in many ways, they are not yet accepted for food and pharmaceutical use by international regulatory agencies. Non-acceptance for these uses does not mean that the gums are unsafe or unsuitable for such uses, only that the very expensive, comprehensive testing, including large-scale human feeding trials, that would allow them to be accepted, has not been undertaken.

It is possible that the opportunity for using naturally occurring local gums in foods may have passed, as most research into natural plant polymers these days is focused on artificial production systems as a way of eliminating the vagaries of plant-based production (the Cooperative Research Centre for Industrial Plant Biopolymers, based at the University of Melbourne, is currently working on projects in this field – for website, see above).

Several central Australian tree species are highly productive, produce gum exudates of apparently very high quality and show potential for commercial gum production, at least at a local scale. Among these the acacias are prominent – 10 of the 12 species valued for gum production and quality are acacias, including all six species receiving a ranking of 1 (*A. estrophiolata*, *A. georginae* and *A. pruinocarpa*) or 2 (*A. aneura*, *A. victoriae* and *A. ligulata*) in this category. Informal field experiments conducted during this project, which involved naturally growing trees near Kaltukatjara settlement (the experiments were discontinued when local children discovered the site and began raiding the gum produced), indicated that *A. pruinocarpa* in particular can produce large amounts of high quality gum.

Neither international nor national specifications apply to gums that are used for applications other than foods or pharmaceuticals, and it is these applications that may offer the best prospects for central Australian species. The utilisation of central Australian gums will involve an assessment of all the relevant aspects of the gums in relation to particular applications, and may require substantial research. The extensive research required in order to realise the potential of acacia and other gums, and the significant barriers to their use in foods and pharmaceuticals, reduced the ranking of gum-producing species on the list. The limitations for gum use in food and pharmaceuticals as well as the realistic prospects for their use in other applications have lead to the gum-producing species being included on the list but being ranked at level four.

Tubers

Four species appear on the list on account of the edible tubers they produce. These four include two bush potatoes – *Ipomoea costata* and *I. polpha* – which should more correctly be known as bush sweet potatoes in recognition of the close resemblance of *Ipomoea* tubers to those of some *Dioscorea* species. The other two species are pencil yam, *Vigna lanceolata*, a variable, endemic Australian species widespread throughout the tropics and subtropics, and yalka (or 'bush onion' – but it's not an onion or like an onion and the name is misleading), *Cyperus bulbosus*, which produces small basal tubers.

Bush potatoes The bush potatoes are sought after by Aboriginal people wherever they grow – *Ipomoea costata* is a common plant in red sand-plain country and dunefields north of the Tropic of Capricorn, while *I. polpha* is a seemingly rare and poorly known species occurring in the Sandover–Plenty region north-east of Alice Springs. Some uncertainty remains about the identity of *I. polpha* in the region. The species that this name refers to occurs mainly in western Queensland and specimens from the NT are yet to be formally ascribed to it. Bush potatoes are productive and widespread and have excellent food qualities – not so much for their nutrition (they are more than 70% water and contain only about 1.3% protein, 0.3% fat and 27% carbohydrate, almost half of which is in the form of soluble fibre [Brand and Maggiore 1992]), but for their taste and texture. Unlike true sweet potatoes, the bush potatoes remain crisp and crunchy when cooked, and have a strong and pleasant flavour. Ranked 1 for flavour, productivity and food quality, these species are downgraded to 2 overall for two reasons – firstly, because the tubers closely resemble ordinary sweet potatoes, they may not be able to attract the premium prices afforded exotic foods and, secondly – and perhaps more significantly – because harvesting the tubers is a serious and time-consuming undertaking, due to the fact that they are produced a metre or more underground, and in the wild are difficult (impossible?) to find for someone with an untrained eye. Cultivation techniques that force the plants to produce fruits close to the surface will be required in order to realise the excellent potential of these plants.

Pencil yam – *Vigna lanceolata* The pencil yam is a member of a pan-tropical bean genus, many members of which have enjoyed success in cultivation for their seeds and the pasture value of their foliage. In central Australia the species is widespread but not particularly common, being found mainly in heavy soils along drainage lines. Plants produce swollen roots which are harvested when the above-ground parts have died off a month or so after rain (Latz 1995). The 'yams' are not particularly tasty or nutritious (being nearly 80% water and having negligible protein and fat, and only 21% carbohydrate, including 6% soluble fibre), but may have value as a novelty native vegetable. The species is quite variable in a number of traits, including the propensity to root tuberisation, indicating that breeding efforts using a comprehensive collection of germplasm could be expected to make good progress in tuber improvement. Research into variation in this species indicates that as currently circumscribed it may actually include seven or more separate taxa (currently informally termed morphotypes [Lawn and Holland 2003]), the distribution of one of which is focused on central Australia.

Yalka – *Cyperus bulbosus* This species is an important traditional food due to its widespread and often abundant occurrence, ease of harvesting and year-round availability. It occurs in extensive swards near drainage lines and around claypans and salt lakes. The plant is an annual

sedge, and produces large numbers of small (up to about 1 cm or so diameter), tasty tubers on its roots, within a few centimetres of the ground surface. The tubers are easily processed to remove dry papery outer layers. Although collectable in fair quantities from the wild, commercial harvests are very few and sporadic, most material being consumed on site by collectors. With cultivation, this species could become a very important element in bushfood-based enterprises in the region.

Fungi

The inclusion of fungi on our list of candidates for enterprise development is definitely optimistic, and they must be considered the wild card in the pack. They have almost everything going against them. For a start, and probably fatally, they are rare or cryptic to the point of being all but impossible for anyone except experienced and knowledgeable Aboriginal people in the region to find. The 'native truffles' are said to occur in red sand country, especially near the base of dunes overlying limestone, and to be declining in abundance (Latz 1995). The so called 'mulga bolete' is so poorly known that it does not yet have a technical binomial (Kalotas 1996) but is said to occur in inland Australia wherever there are good stands of mulga.

The only redeeming feature of the fungi is that they are said to have excellent food qualities, and in the light of the exotic aura attached to European truffles and typical market prices for exotic mushrooms (when they are available), the central Australian species could be expected to attract premium prices. Given the highly exotic nature of native central Australian truffles especially, prices in the order of $A100 to $A500 per kg or more may be expected (at a guess). Current general mushroom sales in Australia are worth more than $A100 million annually (Agtrans Research 1994) and growing. Exotic or specialty mushrooms currently represent a relatively small proportion of that market, but again this quantity is growing in line with increasing production and awareness. Imported European mushrooms currently command the highest prices – Italian 'porcini' type mushrooms are said to sell for $A400 per kg wholesale (Agtrans Research 1994). The high prices and evident market potential of exotic fungi has prompted a modest amount of research into their cultivation in Australia (Stahle and Ward 1996, Barnes and Wilson 1998, Garvey and Cooper 2001).

There is a real but remote possibility for fungi to be developed as an enterprise in central Australia; considerable research and development will be needed to fully assess and then realise the potential and reap the substantial benefits likely to result. In view of the 'longshot' nature of fungi potential, they are ranked 4 on the list.

Animals

Aboriginal people in the region have harvested wild animal resources for food for as long as they have been here and still do so actively, and animals have provided a very significant proportion of human nutritional requirements throughout that time. While butchered meat purchased from settlement stores and town shops now provides a significant portion of protein and other dietary requirements, hunted game is still widely and actively sought, and still provides a range of social, cultural and economic benefits that go beyond nutritional needs. Despite significant changes in hunting and foraging patterns since colonisation (see, for example, Devitt 1988, Hetzel 1978, Latz and Griffin 1978, Macfarlane 1978, O'Connell et al. 1983, Walsh 1990), for most Aboriginal people, especially those residing in remote

settlements, local native game species are very much preferred over store-bought meats. The main species groups currently hunted are kangaroos (*Macropus* spp.) and goannas (*Varanus* spp.), with significant numbers also of cats (*Felis catus*) and bustards (*Ardeotus australis*) and smaller quantities of camels (*Camelus dromedarius*) and rabbits (*Oryctolagus cuniculus*). Other species such as witchetty grubs (in the broadest sense; *Cossidae* spp. and other genera) and honey ants (*Melophorus* spp.) are highly prized and considerable effort goes into their collection from time to time. Emus (*Dromaius novaehollandiae*) may be suitable candidates for farming in the region, but, given the existing well-established mainstream industry based on them, the likelihood that local producers could compete profitably appears low. There may well be a viable opportunity to produce emu meat for local sale and consumption, as emus are reportedly becoming scarce in the wild and considerable unmet demand may exist in Aboriginal settlements, and perhaps local restaurants.

Considerable nutritional benefits derive from the consumption of native wildlife compared to commercial meats. Analysis reveals that bustard, goanna and kangaroo meats contain moderate levels of protein (averaging 24%, 30% and 24% respectively) and modest to very low levels of fat (averaging 0.4%, 7.2% and 2.3% respectively [Brand and Maggiore 1992]), a good proportion of which, especially in kangaroos, is polyunsaturated (Naughton et al. 1986, O'Dea 1988, Sinclair 1988). Wilson et al. (1992) and Davies et al. (1998) provide useful reviews and analysis of wildlife use and management by Aboriginal groups.

Commercial wildlife harvesting is, or can be, carried out at two distinct levels. Firstly, and most importantly at present, hunting provides a significant economic benefit to individuals and settlements by providing a complement to store-bought meat. This activity can be thought of as semi-subsistence in that it is activity undertaken on the hunter's (and their family's) own account and is in no way directed to profit making, and at the same time has a significant (probably measurable) economic impact on the community by allowing meagre funds to be directed to other purposes. It is not clear how the transition may be made, and what economic and social parameters will be important, between this semi-subsistence harvest and a harvest aimed more purposefully at earning income. A modest literature addresses some of the key points in this analysis and should be consulted for further discussion on the topic (Cane and Stanley 1985, Altman and Taylor 1987, Palmer and Brady 1991, Altman and Allen 1992, Trudgen 1995, Altman et al. 1995, Bomford and Caughley 1996).

Sustainability will be an important issue in any effort to develop commercial wildlife harvesting ventures, and will require a very significant research effort both for establishing baseline population and ecological parameters and for monitoring impacts into the future. At this stage, given the lack of knowledge of the status and dynamics of natural populations, no commercial harvesting of native animals beyond that which is already being undertaken could be justified. On the other hand, commercial harvesting of feral animal species, especially of camels, and possibly horses and cats, is unlikely to be problematic from an ecological point of view and may present significant opportunities in terms of economic viability and social acceptability. Ramsay (1994) provides a comprehensive review of the current situation (as at 1994) and future prospects for commercial wildlife use in Australia. A number of sources discuss various aspects of sustainable use of wildlife (see, for example, ACIL Economics 1997, Aslin and Norton 1995, Bennett, D.H. 1995, Bomford and Caughley 1996, and Brown

and Haworth 1997). More particularly, a number of papers address the important issue of the role of sustainable utilisation in achieving conservation aims (see Davies et al. 1997, Grigg et al. 1995, Preuss and Rogers 1995).

Despite the current lack of knowledge, future possibilities for commercial development may exist for a few native species. These developments are likely to require a degree of domestication or at least moderately intense population management, including some confinement and captive or augmented wild breeding. The five groups considered to have some potential in this area include: kangaroos, bustards, goannas, witchetty and witchetty-like grubs, and honey ants. Of these, a reasonable body of knowledge about natural population dynamics and ecology exists only for kangaroos, which are already harvested commercially in New South Wales, South Australia and Queensland; very little is known about the other species.

Bustards These birds would appear to offer the most interesting, if challenging, possibilities for the development of totally new game-meat enterprises and it is likely that, with suitable promotion and consumer awareness programs, a significant market could be developed for this species. There are indications from extensive work on similar species overseas, especially in Saudi Arabia, that captive breeding programs may be feasible for managing bustards in central Australia (Schweitzer et al. 2000, Hemon et al. 2000, Launay et al. 1999, Seddon et al. 1999, van Heezik et al. 1998). Research into population ecology and behavioural aspects of this species in Australia would be required as a first step.

Goannas Initial work investigating goanna farming in Australia (Chudleigh et al. 1995) found that while goanna farming was technically feasible and markets could be developed, the industry faced serious economic and technical challenges and may not be profitable in the longer term. The report indicated that the Northern Territory was the place where legal and bureaucratic barriers were least likely to prohibit farming. Further work under realistic conditions in central Australia would be required to test the assumptions on which the report by Chudleigh et al. (1995) was based before ultimate decisions on probable viability could be made.

Kangaroos Although relatively common throughout central Australia, kangaroos are naturally thin on the ground, and never occur at anything like the numbers or densities found in drier parts of western NSW, South Australia and southern Queensland, where commercial shooting operations are based. And while kangaroos are important food items for Aboriginal people in central Australia, it is unlikely they could be harvested from the wild at a rate that was commercially viable and at the same time ecologically sustainable. Unless some form of farming operation could be established in which kangaroo numbers could be boosted significantly above natural levels – a situation that has not as yet been tried anywhere else – commercial enterprises based on kangaroo harvesting are unlikely to be viable in the region. Nevertheless, it may be possible with relatively little outlay to encourage population growth and manage the population for modest harvest levels purely for local outlets, thereby improving economic and nutritional outcomes for settlement residents. A model has recently been developed for the Anangu Pitjantjatjara Yankunytjatjara Lands of north-west SA in which watering points are to be established in strategic locations across the lands, and harvesting levels linked to a monitoring program. The model should give a strong indication of the value

of this 'augmentation and management of wild populations' approach, and the results will be keenly awaited (George Wilson, consultant, and Alex Knight, APYLM coordinator, pers. comm., 2003).

The development of enterprises using witchetty grubs or honey ants must await the completion of considerable basic research on ecology, population dynamics, life cycles, pathogens and a host of other issues, about which virtually nothing is currently known. Until basic research is carried out, we have no way of evaluating the sustainability of harvests or the effects of harvest on the long-term stability of populations.

Obviously the development of any enterprise based on native animals would require the establishment of reliable monitoring systems to ensure that species conservation is in no way compromised.

Non-food resources

Bush medicines

Bush medicines are often cited as offering among the best economic prospects for Aboriginal people in the region. While this may be so, it is also true that of all central Australian bush resources, the development of bush medicines faces the toughest and most extensive hurdles. In particular, bush medicine development will be strongly influenced by the operation of the federal *Therapeutic Goods Act 1989* (as amended) and the associated Therapeutic Goods Regulations 1990 (as amended). These are formidable bodies of legislation and regulation which control all aspects of the approval, documentation and use of all medicinal products in Australia.

In order for therapeutic goods (which includes medicines of all kinds) to be legally supplied for use in Australia, they must be included in the Australian Register of Therapeutic Goods, under one or the other of two categories of medicines. The two categories are Registered medicines and Listed medicines. Registered medicines are those considered risky and whose registration requires high levels of assessment, detailed documentation and circumscription of use. They include manufactured pharmaceutical preparations and substances that have specific therapeutic actions. These are divided into two groups – prescription medicines and non-prescription or over-the-counter (OTC) medicines (such as analgesics, flu treatments and antihistamines).

Listed medicines are those medicines that are considered to be relatively benign, mainly being things which consumers self-select for their own treatment. Listed medicines are assessed by the Therapeutic Goods Administration (TGA) for quality and safety but not for efficacy, and usually contain well-established ingredients with a long history of use and include such things as vitamins, minerals, sunscreens and the like. While TGA does not assess the efficacy of Listed medicines, sponsors of their inclusion on the ARTG are required to hold information to substantiate any claims made for the effects of the materials or substances.

Listed medicines also include most of the 'complementary medicines', which include a wide range of therapies 'not considered ... part of mainstream medical care' (ECCMHS 2003, p. 12) such as alternative medicines, herbal medicines, homeopathic and aromatherapy preparations,

vitamin and mineral preparations and traditional medicines. Indigenous Australian traditional medicines are not referred to specifically. The Listed medicines category of the ARTG is likely to be the primary avenue for establishing Aboriginal traditional medicines as legal medicines and allowing their commercial development.

With the dramatic events of 2003 in which the TGA recalled more than 1,600 complementary medicines manufactured by Pan Pharmaceuticals Pty Ltd, significant changes to the complementary medicines assessment and approval systems are expected. An expert committee set up in response to the perceived crisis of confidence in complementary medicines has recently submitted its 167-page report to parliament (ECCMHS 2003). Parliament has called for submissions in response to the report (see www.health.gov.au/tga/docs/html/cmreport1.htm).

As indicated above, in order to approve medicines for inclusion in the Listed Medicines Register of the ARTG, the TGA needs to be satisfied that the medicine is safe and of high quality and that the sponsor (the entity applying to have the medicine listed) can demonstrate the medicine's efficacy. In line with these requirements, the TGA will assess an application in terms of a range of criteria including:

- The nature of the materials in question, including any known substances they contain
- How they are to be used and in what sorts of doses
- What effects are claimed for the medicine
- Proposed manufacturing methods and facilities, including quality assurance and control systems
- What evidence there is for the safety and efficacy of the medicine (including, presumably, a verifiable account of established traditional use).

In their favour, relatively few traditional medicines from central Australia (summarised in Table 5, below) were taken internally, most being used externally as a smoking treatment, a wash or an ointment. Medicines involving such external uses may be easier to shepherd through the TGA's approval process.

The list in Table 5, which summarises information provided by Latz (1995), includes all species documented by him and does not indicate whether or not there is a favourable assessment of the commercial potential of medicines. Identification of candidates for further development is left to people with particular expertise in the area. In general, the 75 species listed in Table 5 offer a large range of materials from which to select species for further assessment and development. Initial assessments – in terms of ethnopharmacology, active constituents and effectiveness in some situations – of many of the species included on the list have been undertaken and an extensive literature in the area deals with many of the species. For example, general surveys of traditional medicines are provided by Aboriginal Communities of the NT (1988, 1993), Cribb and Cribb (1990b), Lassak and McCarthy (1983), and Low (1990); ethnopharmacology for particular groups is documented in Reid (1979), Rose (1987), Richmond (1993), and Scarlett et al. (1982); surveys of basic constituents and pharmacology are provided for many species in Aboriginal Communities of the NT (1990, 1993), and Collins et al. (1990); and more detailed investigations for specific groups or

species are provided in Chan et al. (2000), Dellar et al. (1994), Ghisalberti (1994), Jones et al. (1995), Lindsay et al. (2000), Palombo and Semple (2001), Pennacchio et al. (1996), Rogers et al. (2000), Semple et al. (1998), and Sweeney et al. (2001). This considerable body of work provides a sound starting point for further development of the commercial medicinal potential of central Australian species.

Table 5. Traditional Aboriginal medicines in central Australia

Species	Part used	Preparation and use	Who or what treated
Acacia adsurgens	leaves	boiled, wash; smoke	babies – diarrhoea
A. ancistrocarpa	leaves	smoke	babies – diarrhoea
A. dictyophleba	leaves	smoke	mother & newborn, young girls
A. estrophiolata	roots	soaked in water, wash	headaches, sore eyes, skin
A. kempeana	leaves	chewed	general complaints
	roots – inner bark	?	general complaints
A. ligulata	leaves	smoke	range of illnesses
	bark	decoction, wash	
A. lysiphloia	leaves ?	smoke	mother & newborn, sick babies
	plant	infusion	itchy skin
A. monticola	leaves ?	smoke	mother & newborn, sick babies
	plant	infusion	itchy skin
A. pruinocarpa	leaves	smoke	mother & newborn
	seeds	?	headaches
A. tenuissima	leaves	soaked in water, wash	?
Amaranthus spp.	leaves	soaked in water, wash	?
Atriplex elachophylla	?	medicinal wash	?
Callitris glaucophylla	leaves, resin	crushed & soaked or mixed with fat, applied	various ailments
	twigs	burnt, odour	babies – diarrhoea
Carissa lanceolata	inner bark of root	soaked in water, wash	skin and eye conditions
Centipeda spp.	plant	aromatic vapours	coughs and colds
Chrysopogon fallax	swollen roots	body wash, laxative	? ; constipation
Cleome viscosa	seeds	unsure	?
Clerodendrum floribundum	leaves, wood	decoction, drunk	aches and pains
Convolvulus erubescens	plant	decoction, drunk	stomach troubles
Crinum flaccidum	bulb	raw, rubbed on skin; decoction, wash	sores, boils, itchy areas
Cymbopogon ambiguus	leaves	crushed, inhalation	chest complaints
	leaves and roots	soaked in water, drunk or rubbed on body	most ills, especially colds
Cyperus ixiocarpus	leaves and stems	crushed & soaked, wash	
	rhizomes	mixed with fat, applied	
C. vaginatus	flowers, foliage	decoction, drunk	sore throats
Dodonaea viscosa	branches	heated, fumes inhaled	internal pains
Dysphania spp.	leaves	soaked in water, wash	?
		ground, mixed with fat	?
Eremophila alternifolia	leaves	infusion, rubbed on or drunk	various ailments
E. dalyana	leaves	ground with fat, rubbed on	colds, chest ailments
		decoction	scabies

E. freelingii, E. duttonii, E. elderi & E. gilesii	leaves	decoction, wash or drink	sores, headaches, chest pains
		in septum, as pillow	colds and chest complaints
E. goodwinii	leaves	decoction, wash	
E. latrobei	leaves	decoction, wash	scabies
		smoke	babies – diarrhoea
E. longifolia	leaves	smoke	mother & newborn, strength, stop bleeding, milk supply
		decoction, eye wash	eye, skin ailments, headaches
		decoction, body wash	various ailments, good sleep
E. neglecta	leaves	heated, fumes inhaled	?
E. paisleyi	leaves	decoction, body wash	scabies
E. sturtii	branches	heated, fumes inhaled	backaches
Eucalyptus camaldulensis	bark	infusion, wash or drink	
E. leucophloia	inner bark	infusion, wash or drink	most ailments
Corymbia opaca (= E. terminalis)	kino	mixed with water, wash, drink	sore eyes & lips, wounds, burns and sores
	bark	burnt, mixed with fat, applied	burns
C. aparrerinja (= E. papuana)	sap, kino	applied direct or wetted	burns, sores and wounds
Euphorbia drummondii	milky sap	decoction or applied direct	skin complaints
Grevillea juncifolia	bark	burnt to ash, applied direct	sores, wounds, skin conditions
G. stenobotrya	leaves	heated, fumes inhaled	
		decoction, wash	
G. striata	itchy grub nests	carefully prepared, soaked in mother's milk, poultice	burns
Hakea chordophylla	bark	burnt, mixed with goanna fat	burns, skin conditions
H. divaricarta & H. suberea	bark	burnt	burns, sore lips, gums, nipples
Heliotropium tenuifolium	leaves	decoction, wash	skin complaints
Isotoma petraea	leaves	crushed, poultice	headaches
Melaleuca glomerata	branches	smouldering fumes, smoke	
Mukia maderaspatana	leaves	pulped, wetted, compress	headaches, insomnia
M. sp. c (Latz 1995)	fruit	pulped, rubbed on	sore eyes, skin sores, headache
Myoporum acuminatum	leaves	decoction, wash,	general ailments
	branches	smouldering, fumes	general ailments
Nicotiana excelsior	leaves	chewed with ash	ringworm
N. rosulata ssp ingulba	leaves	juice, applied	itchy caterpillar rash
Owenia acidula	bark, gum	decoction, wash	eyes
O. reticulata	oil from nuts	?	skin complaints
Petalostylis cassioides	leaves	heated, crushed, rubbed on	skin, various ailments
Phyllanthus lacunarius	leaves	decoction, wash	measles
Pimelea microcephala	root bark	decoction, drunk	throat and chest complaints
	bark	tied around stomach and head	pain alleviation
Pittosporum phylliraeoides	seeds	ground, used as poultice	?
	leaves	warmed, compress	induction of milk in new mum
		decoction, drunk, wash	colds
	oil on seeds	rubbed on	sore muscles and sprains
Pluchea tetranthera	leaves	decoction, wash	?
Prostanthera striatiflora	leaves	pounded, with fat, ointment or decoction, wash	?
Pterocaulon serrulatum	leaves	in septum, as pillow or mixed with fat, ointment	colds

P. sphacelatum	leaves	in septum, as pillow or mixed with fat, ointment	colds
Pycnospora coccineus	bracket fungus	chewed or rubbed on mouth	skin complaints POISONOUS
Santalum lanceolatum	kernels	ground to paste, liniment	?
Sarcostemma australe	milky sap	applied direct or wetted	skin and eye complaints
	branches ?	burnt, smoke	babies – diarrhoea
	branches	compressed as bed	sick babies
Senna artemisioides	leaves	boiled, wash; smoke	pain alleviation; babies
S. planitiicola	leaves	crushed and boiled, steam inhaled, or wash	?
Sida spp.	plant	decoction, wash	scabies
Stemodia viscosa	plant	in nasal septum or as pillow, bruised or warmed, on chest	colds
		decoction, wash	various internal complaints
Streptoglossa odora	plant	in nasal septum or as pillow, bruised or warmed, on chest	colds
		decoction, wash	various internal complaints
Tinospora smilacina	sap	dabbed on	sores
	leaves	tied on direct; chewed	wounds, severe colds
	stems	pounded, tied around head	headache
Triodia pungens etc.	antbed at base	burnt or heated, ground, wet, swallowed or rubbed on	swallowed for diarrhoea, rubbed on babies

Source: Latz 1995

It is interesting to note the kinds of ways in which medicinal plants are prepared and the kinds of ailments they are used to treat. It is probably true to say that preparations and ailments reflect not so much the actual potential utility of the species, but the kinds of ailments and afflictions suffered by Aboriginal people living traditional lifestyles and the methods at their disposal to prepare materials. Significant proportions of traditional medicines were used on babies and their mothers, and to treat colds and chest complaints, skin conditions, sore eyes, sores and headaches. And preparations generally reflect the limited capacity to boil water using the technologies available – one of the most common ways of using medicines was as smoke or fumes from burning leaves. Other common preparations include decoctions, which were made by soaking material in water and were used as a wash, and ointments made by mixing herbs with animal fats. Many species containing volatile oils were simply used as is, perhaps with some crushing to release the vapours that were inhaled.

While these preparations and ways of using medicines offer useful baseline information, traditional medicines probably have much greater potential both in terms of preparation methods and the range of ailments for which they may offer effective treatments.

Apart from the commercial-development-following-official-approval road, which is likely to be long, involved and possibly expensive, there is also considerable potential for expansion in the existing, informal use of traditional medicines by Aboriginal people in the region. Currently several species, notably *Eremophila alternifolia* (irrmanka irrmanka) in the APY Lands of South Australia, are collected and processed in various basic ways by Aboriginal people for internal trade and exchange within and between communities throughout the region. This exchange activity has important social and cultural benefits over and above any health benefits conferred, and it would be worth exploring (legal) ways of fostering and promoting it.

Essential oils

In addition to research programs in several university chemistry departments, the national research funding body RIRDC actively supports wide-ranging research into essential oils in Australia under the banner of its Essential Oils and Plant Extract Research Program (see: www.rirdc.gov.au/programs/eop.html). Nevertheless, little research has been undertaken into the properties of volatile aromatic essential oils from central Australian species, many of which have strongly aromatic foliage. Most species with aromatic foliage were used traditionally for their medicinal properties and are included in Table 5. Several species from the region probably contain worthwhile amounts of volatile and fragrant oils which could be extracted and used for a range of purposes, particularly as fragrances and as ingredients in cosmetics, soaps, ointments, skin creams, massage oils, aromatherapy and so on. Some may have properties that go beyond simple cosmetic utility. For example, some species may contain substances similar to those found in tea-tree oil, which have antiseptic (anti-microbial and anti-fungal) properties. In confirmation of this notion, RIRDC is currently supporting a project investigating the anti-inflammatory and anti-bacterial properties of *Dodonaea viscosa*, a species occurring commonly in central Australia.

Included in the group of potential bush products are the aromatic herbs and grasses *Centipeda* spp., *Cymbopogon ambiguus* (native lemon grass), *Dysphania* spp. (kalpari – also valuable for its edible seeds), *Stemodia viscosa*, *Streptoglossa odora*, *Pterocaulon serrulatum* and *P. sphacelatum*. Several tree and shrub species are also likely to be suitable for essential oil extraction: *Callitris glaucophylla*, *Dodonaea* spp., *Eremophila alternifolia* and several other aromatic *Eremophila* spp., *Melaleuca glomerata* and other *Melaleuca* spp. (for example, *M. uncinata* and *M. dissitiflora*), and *Prostanthera striatiflora*. Many (most or all?) of these species would be amenable to cultivation and could form the basis of a worthwhile local enterprise. Clearly much research and development work is required to realise the considerable potential of this traditionally well-known group of plants that are little tried in modern applications.

Trees for timber, craft and specialty wood products

Five or six types of timber are thought to offer the best prospects for enterprise development opportunities in the region. The first three are naturally occurring species that grow in sufficient numbers over sufficiently extensive ranges that they could be harvested sustainably (and with good management, their numbers increased). These are:

- Desert oak – *Allocasuarina decaisneana*, which is currently undergoing very significant expansion throughout the region (Peter Latz, pers. comm., 2003).
- River red gum – *Eucalyptus camaldulensis*, which is common along drainage lines throughout the region.
- Mulga – *Acacia aneura* (in the broad sense, which includes several subspecies and varieties), which is common throughout the region, often in very extensive stands, although its ongoing status in the face of the significant alteration of fire regimes is unclear.

The fourth type of wood-producing tree species in this group is sandalwood (*Santalum spicatum*), which occurs naturally in the south-west part of the central Australian region. Although sandalwood is collected commercially in large volumes in WA, where the industry is worth millions of dollars annually, very little has been harvested from the central Australian

region. Small quantities have been harvested under licence (from the WA Department of Conservation and Land Management) by members of the Warburton settlement in WA (Keith Noble, former Ngaanyatjarra Council land management coordinator, pers. comm., 1998) but the current status of collections and licence holdings is not known. Because sandalwood occurs only as scattered individuals in the south-western parts of the region, any development of the industry will depend on establishing planted material. As noted elsewhere, sandalwood also produces a sizeable fruit with an edible kernel which also appears to have medicinal properties (Lui and Longmore 1996).

The fifth main potentially useful source of commercial timber (and non-wood tree products) is planted trees – particularly non-local species. Though currently not extensive, this group is diverse and has good prospects for enhancement through effluent irrigation. Small effluent-irrigated plantations may be well suited to establishment near settlements, many of which now have centralised sewerage treatment plants in place. The effective use of effluent to grow trees in the region has been demonstrated at the Alice Springs treatment ponds, where 15 hectares of red gums more than 20 years old await harvest, and at Ayers Rock Resort, Yulara, where a mixed plantation less than 15 years old contains trees of more than 50 cm diameter and 25 metres height. Several younger plantations also exist. Street and park trees in Alice Springs and elsewhere also demonstrate good tree growth. Among the species planted to date, *Corymbia citriodora* (lemon-scented gum, previously known as *Eucalyptus citriodora*) stands out, typically growing fast, straight, tall and with a long, branch-free bole. This species is also known to produce beautiful, dark timber of the highest quality.

Local growers may benefit from recent research into growing trees in low rainfall areas. Although 'low rainfall' is generally assumed to be at least a little more than usually occurs in central Australia (e.g. less than 600 mm), the results may still be applicable, especially in situations where some irrigation is available. The work of the Australian Low Rainfall Tree Improvement Group (ALRTIG) set up under the Joint Venture Agroforestry Program sponsored by RIRDC, the Forest and Wood Products Research and Development Corporation, Land and Water Australia, and the Murray–Darling Basin Commission is particularly pertinent. Harwood and Bush (2002) list several 'key species' that are considered to be particularly suited to growing in dry areas. These include the timber species *Eucalyptus cladocalyx*, *E. occidentalis*, *E. tricarpa*, *E. sideroxylon*, *E. camaldulensis*, *Corymbia maculata* and *C. variegata*, the softwood species *Pinus brutia* and *P. pinaster* and the oil mallees *Eucalyptus polybractea* and *E. horistes*. Other research has reviewed commercial prospects for a wide range of products derived from trees grown in agroforestry systems (Fung 2001, Zorzetto and Chudleigh 1999, JVAP 2002). Some of the potential products identified include: wood products (e.g. sawn timber), energy from biomass (including firewood for communities – see also Morse et al. 2002 for a review of firewood needs in central Australian settlements), eucalyptus oil (see below), sandalwood, carob bean gum (from the seed of *Ceratonia seliqua*), guayule (a rubber alternative from the bark of *Parthenium argentatum*, an American arid zone species that is likely to be seriously weedy in central Australia), flowers (see above), essential oils (see above) and carbon credits. Detailed investigations would be needed in each case before the viability of these products in central Australia could be realistically assessed.

The putative sixth type of timber source is not one species but a miscellaneous group that includes a number of less common or widespread species, both local and introduced, which could be used in small quantities to make smaller specialised timber products. In these cases, the grain, colour, texture and aroma of the timber are likely to be the main feature. Members of the Proteaceae family (grevilleas and hakeas), casuarinas and *Callitris glaucophylla* are particularly well suited for such uses, as are *Erythrina vespertilio* – the bat-winged coral tree – which produces soft, workable wood favoured by Aboriginal carvers for making coolamons, and other species such as any of the eucalypts and smaller trees such as *Ventilago viminalis*.

Clearly, wherever harvesting of naturally occurring trees is proposed, careful study, monitoring and management will be required in order to ensure the ecological and economic sustainability of the operation.

It should be noted that the making of didgeridoos has not been mentioned here, even though these items constitute the largest number of timber products sold in the region and they are available in every tourist outlet in the region. Didgeridoos are not included in the study for two reasons. Firstly, the ones sold in central Australia are sourced from areas in the tropical northern parts of the NT (the Top End) and north Queensland and it is not clear that the specific kinds of termite action that produce branch hollows in those areas occur in central Australia; the species used certainly do not. Secondly, central Australian Aboriginal groups see didgeridoos as 'belonging' to Top End groups and view their production in central Australia as culturally inappropriate.

Seed for horticulture and mine rehabilitation

As discussed above, the seeds of a modest number of species in central Australia have been traded over the years for use in rehabilitating mine sites and other horticultural applications both within Australia and overseas. The two businesses currently operating in partnership to provide the seed are filling the existing and foreseeable demand in this area. These businesses both work closely with Aboriginal people in the region by commissioning collections of particular species.

A very wide range of central Australian species are potentially suitable for use in horticultural applications both in large-scale settings such as mine site rehabilitation and in more intimate settings such as garden plantings. Genera that are commonly used in mine site rehabilitation and other industrial horticultural work and landscaping include the eucalypts, acacias, sennas, *Dodonaea* and some grasses. A large range of other species are used less commonly. Many more species than are currently used or available through nurseries have good potential for various uses. The utility of species is limited mainly by the availability of seed and the ability of seed to germinate under suitable conditions. Unfortunately some genera and species with good potential for horticultural application in terms of their adaptation to arid conditions and poor soils are effectively not available due to either chronically poor seed set or the disinclination of their seed to germinate. Prominent among this group are the eremophilas and mulla mullas (*Ptilotus* spp.) (see, for example, Richmond and Ghisalberti 1994a, 1994b, and Richmond and Chinnock 1994). While eremophilas are widely grown, mainly as ornamentals, they are almost universally propagated from cuttings.

The large amount of work undertaken by the Alice Springs Desert Park in recent years has considerably advanced our knowledge of the cultivation of many local species. Nevertheless, significant research effort will be required before the full potential of many useful and attractive central Australian genera and species can be fulfilled.

In addition to the trade in seed, there may well be a niche opportunity to use the seed to propagate live plants for sale in tubes or pots to the nursery trade. The Alice Springs Desert Park has undertaken some work in this area, producing modest numbers of many local species for wholesale nursery sale (Mark Richardson, former botanical curator, Alice Springs Desert Park, pers. comm., 1999), and both Greening Australia and Tangentyere Nursery propagate local species for sale in Alice Springs. While it is too early to adequately assess the long-term viability or potential value of this trade – all of the work to date has been subsidised from various sources – there may well be a modest but reliable future for this enterprise, and opportunities for Aboriginal people within it.

Crafts and craft materials

A wide range of materials and products can potentially be used for craft materials and finished objects. Materials that could be used for craft-based enterprises include grasses, foliage, flowers, woody fruits, wood, driftwood, leather, stones and rocks, ochre and sand. Like any enterprise based on the creativity of individuals, the materials used and objects made are limited only by the imaginations of the makers. Apart from the range of objects currently made in the region (including Aboriginal artefacts, strings of beads, baskets, small traditional wood carvings and wire toys, which are all discussed in Part 4), any number of other kinds of objects could be produced. Examples include hats, dyes, soaps with bush medicine additives, pot-pourris, pillows, pottery with central Australian themes and so on.

Flowers and foliage

Central Australian wildflower species are little known outside the region and there is currently no organised supply of material. Compared to south-west Western Australia, where many famous Australian wildflowers (such as kangaroo paws and Geraldton wax) originate, the central Australian flora has relatively few species suitable for use as cut flowers or foliage. Nevertheless, a recent assessment of central Australian species for cut flower production, both in cultivation and wild harvest, has identified 28 species as worthy of attention for research and development (Mansfield and Kenna 1995); there may well be other suitable species not identified in that study. Mansfield and Kenna's selections are listed in Table 6, below, and include species from several families and genera, including 10 everlasting daisies (family Asteraceae) and eight species of (family Amaranthaceae), usually known as mulla mullas. Most of the species considered by Mansfield and Kenna (1995) are endemic to central Australia, and offer opportunities unique to the region. To date, no species identified as being suitable for cut flowers are known to have been tried in cultivation.

As well as species suitable for cut flowers, a number of central Australian trees and shrubs should be suitable for cut foliage. These include several eucalypts, especially red-bud mallee (*E. pachyphylla*), and round-leaf gum (*E. orbifolia*), and possibly one or two glaucous-foliaged species such as *E. gammophylla* and *E. pruinosa*.

Table 3. Potential cut flower species for central Australia

Botanic name	Common name	Botanic name	Common name	Botanic name	Common name
Everlastings		**Paper daises**		**Desert shrubs**	
Anemocarpa podolepidium	rock everlasting	*Leucochrysum stipitatum*	woolly sunray	*Dodonaea coriacea*	hopbush
Bracteantha bracteata	golden everlasting	*Rhodanthe floribunda*	white paper daisy	*Thryptomene maisonneuvei*	desert heath myrtle
Chrysocephalum apiculatum	small yellow button	**Mulla mullas**		*Micromyrtus flaviflora*	yellow heath myrtle
C. eremaeum	hill everlasting	*Ptilotus sessilifolius*	crimson foxtail	*Calytrix carinata*	pink fringe myrtle
C. semicalvum	hill everlasting	*P. exaltatus (three varieties)*	purple mulla mulla	*Grevillea eriostachya*	honey grevillea
Cremnothamnus thomsonii	Thomson's daisy	*P. helipteroides (two varieties)*	hairy mulla mulla	*Hakea grammatophylla*	
Lawrencella davenportii	Davenport daisy	*P. latifolius (two varieties)*	tangled mulla mulla	*Newcastelia bracteosa*	
Ozothamnus kempei		*P. macrocephalus*	featherheads	*N. spodiotricha*	
Schoenia ayersii		*P. nobilis var. nobilis*	yellowtails		
S. cassiniana	pink everlasting	*P. obovatus (four varieties)*	silvertails		
S. ramosissima	dainty everlasting	*P. polystachyus (four varieties)*	green mulla mulla		

Source: Mansfield and Kenna 1995

5. Issues relating to bush resource development

Introduction

It is one thing to identify and describe central Australian bush resources that could be collected for sale, but quite another to develop and sell products made from those resources and to expand existing enterprises or build new ones based on them. This section considers a range of cultural, social, environmental and economic issues likely to impact both on the feasibility of realising the commercial potential of bush resources in central Australia and on the involvement of Aboriginal people in bush resource enterprises.

Issues affect all the kinds of bush resources discussed …

Part 4 identified and discussed seven different kinds of potentially useful bush resources from the region – bushfoods, traditional medicines, essential oils, timber and other wood products, seeds for horticultural uses, craft products and materials, and wildflowers. As outlined in Part 3, four of these seven – bushfoods, some timber products (traditional carvings or *punu*), craft work and seeds for horticulture – are currently the subject of commercial activity at least in a limited way (not counting the very limited amount of non-cash local trade in some medicines) and Aboriginal groups and individuals figure strongly in all of them. The discussion of issues affecting bush resource enterprise development will be based mainly on these four groups, with a distinct emphasis on bushfoods.

… especially bushfoods

Bushfoods are of special interest because of their unique position in relation to mainstream commerce. *Punu* and crafts – baskets and beads – are unambiguously identified as Aboriginal craft objects aimed squarely at the considerable tourist market, and seeds need no special 'Aboriginal' identity, since their primary value is based on ecological utility in low-rainfall, often disturbed situations. However, bushfoods, seemingly, must simultaneously achieve both 'Aboriginal' – or at least unambiguously Australian – identification (and thus the attractiveness of the unique or exotic), and mainstream acceptance (and thus broad-scale consumption) in order to support successful enterprises.

The impact of the issues affecting bush resources development and enterprise viability is likely to be felt in two distinct domains – that of the industry (or generically related industries) as a whole in Australia, and the more specific focus of the central Australian region. While overall industry issues are likely to impact on regional enterprise development in important ways, the specifically local issues are likely to present the most profound challenges to building local enterprises and increasing the involvement of Aboriginal people.

Bushfood industry issues – the big picture

Those studies of the bushfood industry cited in Part 3 in relation to the nature of the bushfood industry also include some discussion of issues facing the industry at the national level (Econsult 1996a, Beal 1996, Phelps 1997, Graham and Hart 1997, 1998, Atech 1999, Cherikoff 2000, Robins 2001). These reports paint a mixed picture, identifying a number of realistic opportunities and pointing out the large amount of work required to bring the bushfood industry into mainstream production, where it is most likely to be able to generate and sustain development into the future.

Imagining the future by understanding the past

Prominent among national issues is the important area of understanding the nature of the industry and developing realistic options for future growth and development. Of primary importance, from the industry's point of view, is the ability to develop believable scenarios about what the future will be like. For planning purposes it would be good to have reliable information about growth, directions, products most likely to do well and so on. As discussed in Part 3, the projections presented in existing industry analyses, and the information on which they are based, appear to the author to be somewhat unreliable. The main reason the projections cannot be considered reliable is that at the time the primary study (Econsult 1996a) was undertaken (seven years ago), the industry was not sufficiently well developed to yield reliable data on sales or product prospects. It is doubtful that more reliable projections could be generated today, as, despite considerable progress since 1996, the industry is still very much in a rapidly changing developmental phase, and no new comprehensive baseline studies have been undertaken. Bushfood marketing is so new and poorly developed that there are no well-established market sectors in which bushfoods are represented consistently enough to allow reliable market statistics to be generated.

Image is important – 'bushfoods' v 'Australian native foods' …

Of crucial importance in relation to bushfood marketing is the issue of image. While this report has referred to traditional foods with commercial potential as 'bushfoods', this appellation has been thoroughly analysed and criticised recently and a strong proposal has been put that the industry adopt the term 'Australian native foods' as the generic term of choice (Cherikoff 2000). Cherikoff's analysis argues that a fundamental re-positioning is required in order for the industry to take up new opportunities, such as expanding into the 'middle market' and establishing new 'mainstream products' which can generate significantly increased production and sales. Basically, although the 'outback feel and gimmicky terminology (bushfood, bush tucker) which was adopted for the initial introduction of products has proven very successful at gaining significant ... media attention for the last 18 years' (Cherikoff 2000, p. iv), it is now time to move on. The analysis argues that in order to realise the perceived considerable market potential of native foods, the 'whole category needs a new name and re-positioning in order to imbue native foods with values relevant to modern consumers: prestige, modernity, food interest, flavour appeal, pride in local produce and a uniquely Australian dining experience' (p. iv). At the same time Cherikoff cautions the industry to take care in this revision as the old image is very well known and continues to provide an important conduit for consumer interest worldwide. The proposed name change is all about raising the industry's profile and establishing a preferred image.

… but some fundamentals may need attention first

In the author's view, the current early stage of development of the industry is at the root of many of the fundamental factors currently limiting enterprise development and the uses to which species described in Part 4 can be put. For the sake of future progress, addressing these limitations may be as important as refining the industry's image. Some of the factors relating to these themes which are limiting momentum or at least affecting outcomes include, among other things:

- Factors associated with the current early-development stage of bush resource industries: limited coordination, coherence and stability overall; high levels of individualism and lack of trust between players; few medium to large companies and very many micro businesses doing their own thing; high volatility in the availability and prices of raw materials; no overarching industry strategies, policy forum, associations or coherent industry voice.

- Limited awareness of native foods and ingredients and other natural products among the general public, including very limited knowledge of what is available and how to use it.
- The ambiguous place of Aboriginal knowledge and interests in the industry, and the lack of high-profile Aboriginal participants.
- The perceived high-priced, specialty nature of products, and the lack of everyday products that anyone can use.
- Few or no widely available, high-profile products that can focus consumer attention on bush products more generally, which, along with the large numbers of different products available only locally or occasionally, leads to confusion and undermines consumer and retailer confidence in relation to the identity, consistency and quality of products.
- Lack of willingness on the part of larger manufacturers and operators to participate in industries due to perceived supply issues – new product start-up costs cannot be justified if companies don't believe that regular, consistent, high quality supplies and moderate price can be guaranteed.
- Limited ability of smaller businesses to develop critical mass due to the problems of keeping the growth of supply lines and the growth of product sales in step.
- The need for (because of the seasonal nature of wild crops and the threat of crop failure due to unsuitable growing conditions), and high capital costs of, building and holding stocks and maintaining supply lines, especially for small bushfood enterprises.
- The limited availability and high costs of operating capital and management expertise for what are perceived in mainstream business circles as untried (and hence high-risk) enterprises.
- Lack of existing research and funding for improvements in product development, manufacturing techniques, the knowledge base about raw materials, and so on – especially in terms of product characteristics and quality.
- The perceived (and actual) high prices of both raw materials and finished products, and insufficient differentiation of some important bush resource products from similar, cheaper products in the minds of retailers and consumers.

… especially the serious consideration of the role and place of Aboriginal people in the industry

Another issue which is important for the industry is the role of Aboriginal traditional knowledge, and how the interests of Aboriginal people are to be dealt with in what is rapidly becoming a mainstream industry that is aggressively aligned with modern global sensibilities, values and outlooks. This issue represents a fundamental question of values, and is a significant blind spot that has never really been addressed adequately by the industry as a whole. It is possible that the industry will continue to develop without properly addressing this primary question while paying lip service to a vague objective of acknowledging the key place of traditional knowledge. This may be the Rubicon that fundamentally tests the collective value systems underpinning the industry.

This is not to say that no significant developments in favour of Aboriginal people's interests have occurred, or that they are unlikely to in the future. There have been important developments (such as the CIFF and IAF, described in Part 3), and many players are working hard in this area, but the industry as a whole has not fundamentally embraced the issues. This should be an important element in any bush resource enterprise developments, or research supporting such developments, in central Australia.

Closer to home – local and regional issues for central Australia

Quite apart from the 'big picture' issues affecting the industry overall, a range of important issues will affect the ways in which enterprises are established and operate in central Australia. While there is likely to be some overlap between issues that are significant at the local level and those important nationally, the two arenas are basically independent; although, one issue that is important at both levels, and is fundamental to this report, is the place of Aboriginal people's interests in the industry.

This report identifies five main areas in which issues affecting potential outcomes for developing enterprises are likely to arise. While many individual issues are relevant in more than one area, it is useful to discuss local and regional issues in relation to five relatively discreet aspects of Aboriginal bushfood enterprise. These aspects are:

- Aboriginal culture and society
- Environment
- Bush resource supply
- Marketing
- Economics and commerce

First, keeping in mind who this is for and why they should be involved – cultural and social issues …

A range of issues pertaining to Aboriginal traditional culture may affect the enterprise opportunities available to Aboriginal people in the region and how opportunities can be taken up. Issues to do with knowledge, authority and traditional divisions of labour are likely to be particularly relevant. Anthropological investigations will be needed to properly describe and analyse such issues, and they are only briefly discussed here. It should be noted that all of those benefits and opportunities outlined in Part 2 represent important social and cultural issues relating to the involvement of Aboriginal people in bush resource enterprises. These will not be reiterated here.

… resource and property rights, intellectual property – problematic issues with no satisfactory resolution in sight

Ownership of country, the resources that occur there and information relating to those resources is governed by traditional cultural relationships. Though often complex, these relationships are well known and understood by traditional owners and custodians of land and members of their clans. Traditional ownership and custodianship entail a range of rights, entitlements, obligations and responsibilities and are serious matters within traditional society.

Although no instances are known to date, it is possible that the wild harvest of bushfoods could be affected by the complex pattern of traditional ownership and authority which applies to the land where collections are made, and that obligations of collectors may affect their ability to collect in some situations. The possibility of conflicts arising between cultural obligations and sensibilities and commercial trading in culturally important resources has also been raised but is not known to have occurred.

In western society, the idea of intellectual property (IP) is well developed and a range of instruments have been put in place over time to provide protection of this often intangible but valuable resource. Legal protections provided by instruments such as copyright, trademarks, patents and designs legislation are commonly used by western enterprises to protect the ideas and creations on which

their businesses depend. Of equal, or perhaps greater, importance for the protection of intellectual property are systems for maintaining confidentiality – trade secrets. Unfortunately, at this stage no legal protection is available in Australia for unregistered information that exists in the public domain, a situation that applies to traditional knowledge of all bush resource plant species used so far and identified as having potential for commercial development. Western legal systems also rarely provide protection for intellectual property that is collectively owned. Indeed the ability to obtain legal protection is usually predicated on the ability to identify a specific individual or organisation that owns the rights to the information contained in the intellectual property.

Of course, when Aboriginal people reported what they knew of their environment to anthropologists and ethnographers, they didn't know that the information they were revealing was, or could become, a valuable resource that might one day be exploited by others. They also didn't know that once their traditional knowledge was made available in the public domain, they would have no legal control over its use and no avenue, apart from ethically driven voluntary agreements made with those who profited from using the information, for claiming a share of benefits arising from its commercial use.

In the last couple of decades around the world, as realisation has grown of the value of biological resources and the information about them that Indigenous peoples hold, and the wealth that could be had by exploiting them, considerable attention has been applied to issues relating to traditional knowledge, the intellectual property rights and cultural heritage of Indigenous people, and the ethical and equity issues involved in these kinds of developments. In the international realm, these questions have related more often to the exploitation of traditional medicines than foods, but the principles are the same. An extensive and detailed international literature relating to Indigenous knowledge, intellectual property, resource development and property rights has been built up over the last few decades. As a starting point for further information, readers are directed to the modest sample of this literature listed in the accompanying bibliography. Much of the literature has direct relevance to Australian Aboriginal people's struggle for recognition and just dealings in relation to the commercial use of natural resources, especially those resources whose use is indicated and guided by Indigenous knowledge that is now in the public domain.

Box 3: Differences between western and Indigenous systems of intellectual and cultural property conception and ownership

Non-Indigenous	Indigenous
Emphasis on material form	Generally orally transmitted
Emphasis on economic rights	Emphasis on preservation and maintenance of culture
Individually based – created by individuals	Socially based – created through the generations via the transmission process
Intellectual property rights owned by creators or their employers and research companies	Knowledge [intellectual property] communally owned, but custodians may be authorised to use and disseminate it
IP can be freely transmitted and assigned – usually for economic returns – for a set time, in any medium and any territory	Generally not transferable but transmission, where allowed, is based on a series of cultural qualifications
IP rights holders can decide how or by whom information can be transferred, transmitted, used or assigned	There are often restrictions on how transmission can occur, particularly in relation to sacred or secret material, individuals can't decide on their own
IP rights are generally compartmentalised into categories such as tangible, intangible, arts and cultural expression	A holistic approach, by which all aspects of cultural heritage and the information on which it is based are interrelated.

Source: Janke 1997, p. 47

The Land Rights Act provides traditional owners with unlimited and exclusive use and occupation of Aboriginal land in accordance with Aboriginal tradition [section 71(91)]. That exclusivity, the inalienability of the title held by Land Trusts under the Act and the respective functions of and relationship between Land Trusts, traditional owners and Land Councils provides more 'leverage in terms of property and resource rights' than exists in any other part of the country. Any NT legislation (such as Parks and Wildlife laws) can only apply to Aboriginal land 'to the extent that that law is capable of operating concurrently with' the Land Rights Act, e.g., provided it does not impact on the traditional rights of Aboriginal people to use or occupy Aboriginal land. That leverage is further supported by the controls over access to Aboriginal land provided for in both the permit provisions of the Land Rights Act and the NT Aboriginal Land Act. This combination of factors provides the basis for Aboriginal people to negotiate agreements for access to and use of resources on their land.

Another area in which Aboriginal people may have some leverage in terms of property and resource rights is under the Commonwealth's *Native Title Act 1993*, which includes various provisions for allowing qualified rights to both property and resources (Altman et al. 1995). These rights, however, relate only to the use of specific resources on specific parcels of land and confer no overall ownership of the resource type or knowledge relating to it. A range of legislation in the states and territories also provides for access to, and use of, wildlife and other natural resources by traditional custodians of country (for example, the *Pastoral Land Act 1992* and the *Parks and Wildlife Commission Act 1980* in the NT both have clauses allowing Aboriginal people to hunt and gather for traditional subsistence and cultural purposes). These kinds of provisions almost invariably (I only say almost because a complete review of all relevant legislation in all jurisdictions is beyond the scope of this work and theoretically Acts that contain other provisions may therefore exist) specify a strict distinction between subsistence use – hunting and collection for own use or non-commercial exchange within family or clan groups – and commercial use or market exchange in the wider community. In most jurisdictions, the state claims ownership of natural resources (though not information about them) and commercial use is invariably prohibited or controlled by special permit requirements that in no way favour Aboriginal people's interests.

Protection of intellectual property may be partly possible using international instruments that protect the ownership of brand names and the links which can be established between brand names and particular products from particular locations – termed 'appellation'. A recent example where such protection has applied is the placement of legal restrictions on the use of names denoting geographic origins of certain cheeses and wines (such as champagne, burgundy), where the names had become synonymous with the character of the product rather than the place of origin and were commonly used for cheeses and wines made elsewhere to indicate that character.

A range of international instruments may have a bearing on the capacity of Aboriginal groups to protect their knowledge, and the products they may develop using that knowledge, but this field is highly complex and its role is by no means clearcut. Except to mention that it may be relevant, this field is considered too large to address adequately here and is not considered further. It is also true that a sizeable and diverse international body of experience exists in the fields of developing the involvement of Indigenous people in natural resource–based enterprises and in building appropriate partnerships and other arrangements for protecting the knowledge base on which the enterprises are based. Some of these are reported in the Earthscan 'People and Plants' series, such as Laird (2002),

Cunningham (2001), and Shanley et al. (2003). A range of other literature may be found in the bibliography and readers are referred to these and to the ample material available on the web such as: <www.ceh-wallingford.ac.uk/research/winners> and <www.cgiar.cifor.org>.

This suite of topics warrants a full report of its own, and to avoid overwhelming the current discussion, readers are advised to consult the considerable literature for detailed analyses. A range of issues relating to Aboriginal intellectual property, cultural heritage and so on are dealt with comprehensively from a legal point of view by Janke (1997) and more recently by O'Bryan (2004), and from an intellectual/cultural point of view in a seminal work by Nancy Williams (1998). These works, together with useful analyses provided by Fourmile (1996), Blakeney (1996), Christie (1996) and Dodson (1996), provide a wealth of background on this broad and complex topic as it exists in Australia.

Second, managing the resource and preventing degradation – environmental issues

Aboriginal land management in relation to bush resource harvesting

Management of land, and especially undertaking proper burning, is crucial to sustaining the wild harvest of bush resources. Bush tomatoes and other species and products can be lost from an area or seriously set back if fires are too frequent, too infrequent, burn at the wrong time of year, or in the wrong places, or burn too hot (or not hot enough), and so on. Production can also be affected by other factors that are susceptible to land management activities, such as grazing, trampling and weed invasion. For example, there is reasonable anecdotal evidence that the distribution and abundance of bush tomatoes in parts of the APY Lands of north-west SA have declined significantly as a result of the 'no fire' policy enforced during the time the region was used for cattle grazing. In short, there is a clear link between the productivity of natural populations and the management history of the land on which they grow.

Bushfood harvesting may facilitate land management …

The growing commercial value of bush resources in general (and bush tomatoes in particular) could provide an impetus, and a focus, for positive activities in Aboriginal land management in the region. This process is likely to be twofold. Firstly, the opportunity to earn money from the collection and sale of bush tomatoes and other bush resources will encourage collectors to pay attention to the link between the productivity of those resources and land management – especially burning. Focusing greater attention on bushfood productivity should lead to an increase in active and careful burning practices that encourage the growth and regeneration of bushfood species. Such attention to land management issues may be facilitated by carefully planned and directed projects involving scientists and other suitable experts. And, secondly, with the incentive of earning money by collecting bush resources, more people will spend more time in their country, renewing knowledge and skills, and creating more opportunities for carrying out land management activities and passing on knowledge to younger people, and sometimes to scientists.

… because bushfood harvesting IS land management

Aboriginal landowners do not see land management as an activity that can be separated from living on and using the land and harvesting its resources. An extensive literature on Aboriginal land management in Australia consistently points out the significant differences

in conception and outlook between western and Aboriginal views of land management (e.g. Young et al. 1991, Young and Ross 1994, Rose 1995, Johnston 1996, Davies et al. 1998, Walsh 2000). In recognition of this fundamental difference in outlook, the term 'caring for country' has been adopted as a primary descriptor for Aboriginal land management. Johnston (1996, p. 92) summarised the views of many Aboriginal people thus: 'Aboriginal people see caring for country as an integral part of living on their country. Caring for country forms part of the relationship individuals have with each other and with the land. It is not seen as a separate activity which must be "carried out".' And as Rose's (1995) informants point out, 'an important part of "caring for country" is being able to access country, travelling to renew contacts with sites and to see and use the resources that are available. The activities involved in caring for country revolve around being on country, observing its responses to seasons, maintaining an intimate knowledge of its resources and significance in terms of the Dreaming' (Rose 1995, p. 12). Bushfood harvesting can play an important role in facilitating the access to, and presence on, country that is fundamental to Aboriginal people's ability to care for their country. Perhaps more importantly, bushfood harvesting generates a clear and practical purpose for land management, reducing the problematic artificiality of land management for the sake of land management.

… and traditional ownership and tenure are also relevant

Land tenure is an important factor that is relevant to the work Aboriginal people do caring for country and collecting and using resources. While approximately half of the land area of the southern half of the NT is now Aboriginal owned and presents few difficulties, significant quantities of the bushfood resource that is collected commercially is currently sourced from pastoral land to which Aboriginal groups have access but do not own. At this stage collections are carried out either with the pastoralist's consent or without their knowledge. While collections themselves are unlikely to adversely affect any pastoral activities, some of the management activities that could be employed to enhance bushfood production may do. In particular, burning, which is an important tool in encouraging the regeneration of both bush tomatoes and acacias (and many other native species), is likely to be a contentious issue in dealings between pastoralists and Aboriginal groups accessing their leases.

Sustainability of resource use – it's important but what does it mean and how can we tell it's happening?

Sustainability as it relates to resource use and management is a complex issue that is likely to be extremely difficult to assess in relation to wild harvesting in central Australia. Ecological sustainability, an important part of sustainable resource use, is itself somewhat of a vexed concept. On the one hand, it seems to be a straightforward idea characterised by such statements as 'the persistence of an ecosystem and its components into the future', or alternatively we might think of it as 'meeting the needs of the present without compromising the ability of future generations to meet theirs' (Brundtland et al. 1987, quoted in Davies and Young 1995, p. 150). In these senses it is easy to see when sustainability is not achieved – the resource disappears, diversity is quantifiably reduced or future opportunities are lost. On the other hand, when we start to look a little deeper into the notions implied, we see that a considerable amount of qualification and clarification may be needed, depending on the case in question. For example, do we mean species, or whole ecosystems, or functional parts of ecosystems? Do we mean no change, or only change within certain parameters and limits, and if so, which parameters and what limits? And what sorts of spatial and time scales are relevant in each case?

And also there seems to be an unstated assumption in the term that it can only be understood within the framework of some kind of management regime applied to the resources in question. Ecological sustainability is an easy thing to say but not necessarily an easy concept to understand or apply in a management sense.

So, as a working definition, we can take ecological sustainability of biological resources to mean the management of those resources in such a way that that management does not compromise their indefinite persistence as viable populations. In a practical sense, we can think of sustainable wild harvesting as being that level of harvesting that, in combination with appropriate management actions, and relative to the growing conditions that resource populations have experienced, can be undertaken from time to time in any given area.

There is reason to think that wild harvesting IS sustainable ecologically …

With these general definitions in mind we can refer to our own observations to identify a number of aspects of wild harvesting by Aboriginal people, as currently carried out, which indicate its inherent ecological sustainability:

- Species currently wild harvested commercially in the region (several acacia species and *Solanum centrale*) are widespread, abundant and occur in a wide range of ecological habitats. Their broad distribution and abundance is generally attributed to their tendency to be favoured by disturbance events such as fire and flood. In various important ways harvesting is likely to resemble disturbance events and actually enhance species survival.
- Only the fruits or seeds of plants are harvested and the plants are left to grow and produce again.
- Harvesting pressure is relative to the crops produced – if crops are too light, no harvesting is done, as it is simply not worth the collectors' while to do so.
- For various reasons collectors never harvest more than a portion of the crop produced by a species or in an area. These reasons include: all plants are not accessible and of those that are accessible, some are too difficult to harvest; collectors don't bother with plants holding only light crops; only in parts of a species' distribution are crops produced on enough plants to warrant collecting attention; in any given area only a portion of plants produce fruit in any particular season and so only some plants are available to be harvested; a fair amount of fruit or seed is spread on the ground during the harvesting process, thus enhancing seed soil banks rather than depleting them.
- The best harvest results occur in areas and/or seasons where many plants hold heavy crops – harvesting under these conditions is especially effective in enhancing soil seed banks and spreading seeds beyond the area they would fall naturally, thus enhancing chances for perpetuation of species populations in the wild.
- Seed produced in heavy cropping events is generally of significantly higher quality than in light cropping events due to higher levels of out-crossing, higher than average endosperm content, stronger and healthier seed, lower levels of seed predation and broader ranges of genetic variability within the total seed population. Again, these factors enhance the chances of species populations being perpetuated.
- Factors other than harvest pressure on seeds and fruits are more likely to affect the ongoing viability of populations of bushfood species in the wild. While harvesting may, arguably, affect the quantity of seed available in soil seed banks, other factors, especially fire,

rainfall amounts and patterns and grazing, will exert profound influences on germination, regeneration (bush tomatoes are clonal and require fire to regenerate; acacias are generally short-lived and also require periodic fire for regeneration), establishment success, growth rates, flowering and seed set phenology, longevity and distribution. In the overall scheme of things, these factors are likely to be several orders of magnitude more important in affecting the perpetuation of species and populations than the relatively minor effects of bushfood harvesting on the quantities of available propagules.

… but cultural and social sustainability, which is just as vital, is harder to assess

Of course, ecological parameters comprise only part of the suite of factors that affect sustainability. Perhaps more important, since our focus here is on human society and culture, are factors which impact on the social, cultural and, by necessity, economic sustainability of Aboriginal settlements. If bushfood harvesting can help sustain communities in country where very few other options are available, then not only will Aboriginal society and culture be more likely to survive in those areas, but a range of important human–land interactions entailed in the concept of caring for country will also be more likely to survive into the future. Ultimately these factors are likely to be significantly more important positive influences on ecological sustainability than any negative effects harvesting is likely to have.

Overall, bushfood harvesting and Aboriginal land management may provide useful models for other resource managers

Traditional land management practices, including their modern expression in commercial bushfood harvesting, may have implications that go beyond the immediate ambit of their operation. Indeed traditional caring for country may provide important lessons for other land management approaches and conservation issues. On the basis of studies of bushfood harvesting in relation to traditional cultural constraints, Brown and Haworth (1997) assert that ‘the establishment of a bush tucker industry adapting some of the methods and philosophies of traditional land management may have the potential to be a viable, environmentally appropriate operation and at the same time rehabilitate and strengthen Aboriginal culture. It may also have important lessons for sustainable land management elsewhere in Australia’ (1997, p. 3). Ideas of rangeland conservation being enhanced through multiple use strategies and conservation outcomes being motivated and facilitated by utilitarian values (conservation through sustainable use) have significant and growing credence in rangeland management and research circles. An extensive literature discusses the wide range of topics and views in this field, and readers are referred to examples in the bibliography such as Webb (1995), Grigg (1995a, 1995b), Davis (1995), and Sattler (1995), and a range of other papers in Grigg et al. (1995), Davies et al. (1997, 1999), and Walsh (1992, 1995).

In regard to the wild harvest of bushfoods in central Australia, there would appear to be a significant need for research into various topics, including the nature and magnitude of sustainability parameters, a range of social and cultural questions, and more detailed work on the economic implications of the development of bushfood and other bush resource–based enterprises.

Third, making sure we have something to trade – supply issues

Extent and availability varies between species and is likely to be a limiting factor in many cases …

Very few central Australian bush resources are readily and reliably available in sufficient quantities to support commercial product development on a large scale. Exceptions are limited to wattleseed, bush tomatoes and possibly quandongs, although the great majority of production of this latter species now comes from plantations located in South Australia. Wattleseed, which includes seed from half a dozen or so species, with the possibility of more being used (see Table 4, Part 4), is available throughout the region and in most parts of the country, especially sub-tropical areas. While some of the major species are somewhat unreliable in their seeding habits (especially mulga and to a lesser extent *A. victoriae*), others are both reliable and prolific. Current and probable future demand levels can easily be met by wild harvest for many years to come. Bush tomatoes occur throughout the region but produce collectible crops only in some years, depending on the burning pattern and weather conditions in the previous year or so (bush tomatoes can set fruit at any time but to fruit well they need good rain soon after fire and then follow-up rain over a couple of months; rain during or straight after flowering can ruin a potential crop). Suitable conditions for bush tomato crops only occur once every few years, but when they do, crops can be extensive, heavy and persist for months, allowing large quantities to be collected. Provided material can be stored effectively, it should be possible to meet current and foreseeable future demand from wild-harvested material.

A number of other species may be available in sufficient quantities to support the small-scale development of products for local and/or seasonal sale; this is especially true of traditional medicine species and trees species for timber such as desert oak, river red gum and mulga. Other species with commercial potential will probably need to be cultivated in order to be available in sufficient quantities to support product and market development.

… and access to natural stands will also affect availability

Wattleseed and bush tomato resources occur and are collected throughout the region, on both Aboriginal land and pastoral leases. Aboriginal people have access to stands on an informal basis across the region, and there are no known reports of access restrictions. While this informal situation is working satisfactorily for now, there may be a need in the future, as demand increases, to develop a more formal access system for collectors on pastoral land.

… especially as legal issues may be problematic

The legal situation is more complicated than the informal system that currently operates and would impose significant barriers to Aboriginal collectors if it were ever enforced. Technically, Aboriginal people wishing to collect commercially (and anybody else wishing to collect plants or animals at all in the Northern Territory, South Australia or Western Australia) are required to obtain a permit or licence to do so from the relevant state authority. In the NT, Aboriginal people can, by law, enter most land types to undertake collections that are part of traditional cultural activities, but if they intend to collect commercially, they are supposed to obtain collection permits, even for Aboriginal land. The process for obtaining permits is a convoluted, time-consuming and paper-intensive exercise, requiring the written permission of landowners and details of specific dates and locations where collections are planned. Since

applications for collection permits require up to several months to be processed, they must be submitted before there is any way of knowing if or where crops are going to be available. In view of these bureaucratic requirements, Aboriginal people are unlikely to participate in the collection permit system unless seriously threatened with legal repercussions.

In the NT the up-front payment of substantial royalties prior to any commercial collections being undertaken is required for some species (including the economically important *Acacia victoriae*). For any bushfood species subject to royalties, the amount payable (usually between $5 and $10 per kg) can be as much as the buying price from collectors, and its payment would render harvesting of the species totally uneconomical. In effect, the permit and royalty system as currently configured is a serious impediment to commercial wild harvest in the NT. At present the collection permit and royalty systems are not seriously policed, and are ignored by Aboriginal collectors, but the issue will need to be addressed at the level of the NT government and its agencies if wild harvest is to be included in any government-based monitoring or management initiatives in the future.

Collector's confidence in the system is crucial

The industry in central Australia at present is critically dependent on the willingness of collectors to put in the necessary time and effort to gather bushfood materials from the wild, purely on the word of a buyer that this is required. This situation is unlikely to change in the foreseeable future, regardless of production systems that may be in place. The benefits noted above notwithstanding, Aboriginal people have demonstrated that they are unlikely to undertake the necessary extensive collections unless they have confidence that they will receive payment for their efforts at the time they deliver their collections to the buyers.

In the past too many Aboriginal people have been given too many false promises of payments they will receive in the future for many now to believe any such promises. Aboriginal collectors are willing to undertake the often arduous work involved in collecting purely on the basis of a verbal agreement that they will be paid when they deliver the goods in satisfactory condition. The system only works because the few operators currently in business understand the vital role that collectors play and the need for mutual trust, and they ensure that collectors are paid fairly and promptly at the time of delivery. In the case of Outback Bushfoods, the system of trade involves the material being inspected and weighed, the payment calculated in the presence of the collector, and a cash cheque being issued on the spot. Other operators are believed to operate in a similar way. This system has the important advantage of ensuring that collections can be organised with a minimum of fuss and expense and without the need for lengthy discussions about the details of payment arrangements. Collectors need to be absolutely certain that the system will work in their favour, and the only way to build such certainty is for buyers to be totally straight, up front and consistent in their dealings with collectors. Of equal importance is the need for buyers to inform collectors in good time when they have enough material for the time being or will soon be unable to afford to purchase more.

Overall, the aim is to ensure continuity and reliability of supply …

The seasonality of crop production of wattleseed and other species, and the even more unpredictable productivity of bush tomatoes, poses a challenge to enterprises striving to build a reputation as reliable suppliers of these materials. Currently, the only feasible way to ensure continuity of supply is to collect as much at seeding time as is expected to be needed (plus a margin to allow for extra demand), and store the material in suitable facilities. Though unavoidable – even with horticultural cultivation, supplies will be seasonal – this system is problematic in three ways. Firstly, predicting the amount of material needed is virtually impossible in the current volatile markets; secondly, arranging the necessary storage facility may be difficult, expensive and unreliable; and, thirdly, obtaining all the material needed for at least one and preferably two or more seasons to come is expensive and ties up scarce capital (because collectors must be paid at the time of delivery in order to maintain their confidence in the system), potentially for long periods of time. In most cases the availability of working capital, rather than natural production, will be the factor that limits how much material can be collected and stored. This system imposes a significant opportunity cost on capital, which has the potential to strain the elasticity of wholesale prices that are already seen by some in the industry to be at unsustainably high levels. This situation is likely to be most acute for small players in the industry, with larger organisations better able to absorb the costs of maintaining sufficient stockpiles of materials.

… combined with consistency and quality control

As the native foods industry grows, both in size and sophistication, issues of food quality are likely to gain prominence and require the attention of suppliers. In central Australia, in relation to wattleseed and bush tomatoes, this is unlikely to be of concern since material currently supplied from the region is among the best available anywhere in terms of the quality parameters that are within the ability of local collectors and processors to determine.

Collectors in the region have generally been involved for long enough to understand the buyers' need for clean, consistent and hygienic material. Buyers and processors also understand the qualities required in the material supplied from the region. Problems are only likely to arise where new players, unfamiliar with general standards or without the means to impose and maintain quality standards, enter the industry. At the moment, standards are maintained on an informal basis, but in time it can be expected that more systematic approaches will be developed and adopted.

The kinds of systems likely to be adopted will include stock control systems utilising batching and numbering procedures, the adoption of the government sponsored and administered Hazard and Critical Control Point (HACCP) system of risk analysis and management used for identifying and dealing with hazards within the processing and storage system, the development and adoption of detailed food safety plans for each facility, the establishment of fully approved and licensed premises for processing foods, routine testing of produce samples taken from all steps in the processing chains, and the adoption of standardised grading systems for raw materials. Such systems are likely to be introduced gradually as capital growth permits and quality control imperatives direct. Systems such as these should be able to deal with any quality issue likely to arise, including the minor problem of seasonal variation of bushfoods in parameters such as colour, size, texture and flavour.

Local supply lines – transport, storage, infrastructure and distribution

Currently in central Australia, bushfood species harvested in the wild by Aboriginal collectors are either delivered by them to buyers and processors, or picked up by the buyers in the settlements where collectors reside. Both of these approaches work satisfactorily and are likely to be adequate for the foreseeable future. Wattleseed and bush tomatoes are both relatively robust materials and, in suitable storage, will survive indefinitely without significant deterioration; for wattleseed, suitable storage involves protection from vermin and moisture, and for bush tomatoes, it involves cool storage (100C is adequate) to protect against infestation by warehouse moth and similar insect pests (to which they are particularly susceptible).

If and when further species become available through horticultural or other developments, there is likely to be a need for other kinds of storage and transport such as cold-chain facilities for fresh fruit and flowers, possibly including mobile coolrooms for packing perishable products as soon as possible after harvest. Packaging systems will also need to be investigated as new products, greater volumes and greater local processing are developed. In view of the large distances to markets from the region, and the often exceedingly rough roads over which material is transported, there will be a need to develop local solutions to the logistical and cost challenges which apply to central Australian enterprises.

Wild harvest versus cultivation – a fundamental issue linking all others

Round 1 – 'Cultivation is needed to ensure continuity of supply and quality'

Throughout the literature on the bushfood industry, a constant theme is the need to develop a mainstream horticultural or farming basis of production. This idea appears to be part of a body of received wisdom for the industry and to be based on the twin ideas that a) the attributes of most value to the industry are product consistency, reliable supply, and reduced production costs, and these can only be attained through farming, and b) the wild harvest of bushfoods is inherently unsustainable and should be eliminated for that reason. In short, there is a general, though never explicitly stated, acceptance that in order to survive, grow and go forward into the future, bushfoods must become mainstream agribusiness crops. Concomitant to that view is the idea that if financial or other benefits are to accrue to Aboriginal groups (especially those in remote regions where agribusiness approaches are not possible), it should be by way of royalties or other forms of compensation, and that such rewards can be equivalent to (or better than) the benefits that could accrue through participation in wild harvest.

Round 2 – That idea is probably not true and, in any case, cultivation won't deliver the benefits available from wild harvest

This report takes the view that these notions are fundamentally flawed and that such an outlook has the potential to greatly diminish the range of values offered by bushfoods, and, more seriously, will inevitably severely limit the opportunities available to Aboriginal groups in inland areas and probably kill off both economic benefits and the many other significant collateral benefits (set out in Part 2) likely to accrue to Aboriginal people through active participation in the industry, especially through the wild harvesting of bush resources. Benefits

that do accrue from the development of horticultural production are likely to be mainly economic, and are likely to favour that very small group of people – most likely young men and women already involved in CDEP projects – who do the work in the plots. These may be real and worthwhile benefits but fall a long way short of the wide range of benefits outlined above that are potentially available to wild harvesters.

Round 3 – But some species will only be available if they are cultivated

This is not to say that horticulture and farming should not be developed – clearly for commercial development of many species this is the only feasible option. Cultivation systems offer significant opportunities for advancing a wide range of potentially commercial species and thereby greatly improving the overall size, breadth, sophistication and economic standing of bush resource based enterprises in the region and Aboriginal people's involvement in them.

Round 4 – Cultivation is only acceptable if wild harvest is not adversely affected

The development of suitable horticultural systems will present a significant challenge. Such horticultural systems need to exhibit two particular features: Aboriginal people must be able, and feel inclined to, participate in cultivation; and development of horticultural systems should be undertaken in a way that does not jeopardise opportunities for Aboriginal people to participate in the industry through wild harvest. Indeed, the most important issue facing horticultural development will be ensuring that not only does it not jeopardise wild harvest, but, if possible, it also enhances it.

Round 5 – Horticulture has a poor record, and is at odds with traditions

Horticulture has a poor record on Aboriginal settlements, for a range of reasons. The most commonly cited reasons for lack of success revolve around the notions of 'ownership' and inclination. Typically, a horticultural project will get started on a settlement at the instigation of a non-Aboriginal worker living there or who approaches the settlement from outside. Local residents usually see such plots as 'belonging to' the non-Aboriginal instigator, and it is that person's job to keep it going. There are many stories in the region of market gardens failing rapidly when the instigator leaves to work elsewhere. The long-term success of community horticultural plots is not guaranteed, and such plots are likely to continue to be problematic in terms of continuity and reliability.

There are also instances where Aboriginal residents, often on outstations, have maintained gardens for a time, only to have them fail when cultural imperatives compel the gardeners to leave the settlement. This is always likely to be a problem, as Aboriginal people in remote areas have a strong cultural tradition of moving around the land, of moving on when a significant person dies, and so on. While traditionally people did plan their immediate futures, their traditions included nothing that could prepare them for the fundamentally different lifestyle and outlook entailed in agriculture, particularly the idea of undertaking work now with the expectation of a return many months in the future. In remote settlements people live culturally rich lives that are still fundamentally based in tradition and the inclination to travel to visit relatives and country and never stay too long in one location is still strong. Taking

up the long-term commitment to a single location required for growing crops is a very great challenge for people with such a history and traditions. Of course, no blame can be attached to Aboriginal people for the impact of these traditions, and for the range of other reasons that gardens fail, but the limitations will need to be seriously addressed if horticulture of bushfood or other bush resource species is to be carried out by Aboriginal people on settlements in the region.

Round 6 – Even so there have been successes

Some moderately successful projects have existed and do exist, and the elements that these successful examples have in common may provide useful experience for improving success rates and production output in the future. The most obvious examples of at least partial success are plots established by Reedy Creek Nursery in collaboration with community councils and CDEPs in several locations, including Hidden Valley town camp in Alice Springs (which, when recently inspected, was heavily overgrown and infested with weeds). Other locations established by Reedy Creek are subject to 'commercial-in-confidence' arrangements and the author has not had access to them. Titjikala, 100 kilometres south of Alice Springs, is one community which has, for several years, been able to establish an extensive horticultural plot and maintain it at a reasonable level. Factors in the success of this project to date include: a committed and active community coordinator (who is likely to move on at some future time), a particular local resident who has taken a leading role in running the project, and a team of younger residents who have worked in the garden using CDEP support and have undertaken on-site training supported by the NT education department and the Centralian College of TAFE Horticulture Unit. Despite these examples, reliable horticultural production by Aboriginal people on their land appears to be some way off.

Round 7 – Aboriginal people are strongly motivated to harvest bushfoods from the wild and this has important economic implications

In a region where Aboriginal unemployment is extremely high (CDEP notwithstanding) and weekly household incomes (mostly from welfare payments) are well below the national average, with few prospects for increases, wild harvest offers a chance for people to double their weekly income for a couple of months each year; the importance of wild harvest must not be underestimated. In the words of Rod Horner, who has been working with Aboriginal people in central Australia on seed harvesting for more than 28 years, and who spoke about wild harvest at a recent workshop on bushfood development in central Australia:

Aboriginal people in central Australia were offered a market for their produce. They have responded enthusiastically. By their hard work and skill they have laid the foundation of a mini industry. They have done this with no government money or grants or direction. They are not supposed to be doing things like that. Their role in NT society is as passive recipients of welfare. In your deliberations on Bush Tucker, be careful that you do not harm those people. (Horner 2001)

Round 8 – With cultivation still standing, maybe a compromise is possible

One approach to cultivation that may generate productivity improvement while preserving at least some of the potential benefits available from wild harvest could be to develop systems of augmenting production in wild stands of different species. Simple activities such as fertilising, watering during critical periods, weed and pest control, mulching, encouraging regeneration in various ways, and so on may yield significant increases in productivity for relatively little effort and, importantly, are unlikely to lead to loss of plant stock if stands are left untended for periods of time.

The upshot: cultivation has plenty of supporters – even if it doesn't take off in central Australia, it may well happen elsewhere …

More probable than the development of Aboriginal horticultural capacity is the horticultural development of central Australian species by mainstream farmers and others in locations outside central Australia. Mainstream farmers have many advantages over remote settlements – horticultural and farming knowledge and experience, and the ability to easily find out what they need to know; access to capital, business contacts and networks; the ability to borrow money; locations that are close to facilities, raw materials and markets; access to suitable growing conditions (soils, rainfall and reticulated water etc.); individual ownership and control of production; established infrastructure, equipment and machinery on farms; long-established cultural background in farming; and so on. The price pressure on raw materials arising from mainstream production is likely to pose a significant challenge for Aboriginal horticultural projects and even more so for wild harvest. A significant research effort is likely to be needed to address this important issue.

… and in any case, cultivation will work best if it uses the best material

Whatever path horticulture takes, it is important that any development is based on the best possible planting material. In order to have the best material available, research will need to be carried out to investigate and characterise natural populations and the variation within and between them. For this research, the starting point would be assembling a comprehensive collection of seed or other germplasm from populations throughout the natural range of each plant species of interest. Such a research program presents an excellent opportunity for researchers and other interested parties in central Australia and the Aboriginal people with whom they might collaborate. It is very much in the interest of Aboriginal groups in the region to get involved in any projects of this kind and if possible to retain property rights to materials collected and varieties that may be developed from them; without such involvement, there will be no way to ensure that the benefits that arise from breeding programs and horticulture based on the varieties developed through them will flow to Aboriginal people.

Fourth, selling what is collected – marketing issues

In general, marketing is a relatively specialised field that is largely beyond the scope of this review. Nevertheless, it is considered briefly in view of the fact that the marketing of bush resources will be a vital step in the process of enterprise development; commercial viability will ultimately depend on the ability of operators to sell the materials and products with which they work. Marketing will involve, among other things, product development and definition, building a clear, attractive image for central

Australian products, raising awareness among consumers, arranging distribution and retail outlets, and so on. The challenge for central Australian enterprises is to find and develop the key ingredients that distinguish regional products and come up with ways of making potential customers aware of the products and inclined to try them.

Some markets already exist, others will need to be created from scratch …

Bushfoods and cut flowers are probably the best known resource types with commercial potential, and have the advantage of being associated with existing markets, into which they can be promoted. Several other kinds of resources appear to have excellent prospects in the longer term but do not appear to suit any obvious existing market. Indeed many central Australian bushfood and flowering species are poorly known beyond the region, and will need to be well promoted in carefully targeted campaigns in order to build new markets in which their full potential may be realised. Promotion and consumer education are major issues for resources for which there is as yet no established market. This group includes bush medicines in particular, which may eventually surpass all other resources in commercial value.

Box 4: The problem of capital availability and the opportunity costs of building and maintaining stocks

The bushfood industry in central Australia faces a significant challenge in accessing sufficient capital to build commercial viability. In order to increase viability, enterprises must increase efficiency, throughput and the value of products, all of which require capital investment. At the same time, in order to be able to increase throughput, the enterprise must have access to sufficient raw materials. An enterprise's reputation for the reliable supply of quality materials will depend on its capacity to build and maintain a sufficient quantity of raw material to meet all projected demand. But obtaining and holding stock is expensive, and most small enterprises will have difficulty in the early stages when cash flow is insufficient to support stock replenishment. On the other hand, in order to achieve sufficient cash flow, they will need to have the stock to start with – a classic chicken and egg situation. As bushfood crops are seasonal, crops (especially of bush tomatoes) frequently fail, and demand in the following year(s) cannot be accurately predicted, a large margin must be allowed so that stocks can meet all contingencies, often for several years. For these reasons, substantial stock must be held at all times and as much as possible collected when the opportunity arises. As well, because collectors must be paid at the time of delivery, a large draw on capital occurs each year, the return on which may take up to five or more years to be realised. For example, a harvest of four tonnes of bush tomatoes and eight tonnes of wattleseed will require an outlay of about $130,000. Storage will add about another $9,000 per year. Outback Bushfoods estimates that it requires throughput of at least six tonnes per year in order to be able to achieve long-term commercial viability, meaning that at the end of each harvest season it must have on hand a minimum of about 12 tonnes of raw materials or two years' stock in order to ensure continuity of supply. The issue is further exacerbated by the practice of some larger companies who purchase products from local enterprises and effectively use those enterprises as sources of free credit, withholding payments of significant amounts of money for long periods – up to six months or more in some known cases.

… but even existing bushfood markets are not well developed

Markets for most of the kinds of bushfoods available in central Australia are as yet poorly to moderately developed or non-existent. Only wattleseed, bush tomatoes and quandong have any national profile or volume of sales. Significant amounts of these three bushfoods are currently sourced from areas other than central Australia (for example, southern SA, central Queensland and western NSW). Other bushfoods from the region would most likely find a place in the kinds of markets that already exist for these more widely known and available bushfoods. These markets primarily focus on moderate to high priced, usually gourmet, specialty food sectors and niche markets.

The prime limiting factors in marketing bushfoods identified in this study, other than wattleseed and bush tomatoes, is the limited and unreliable availability of useful quantities of material and the profound lack of consumer knowledge of these native desert foods.

… and markets for non-food resources are very poorly known

To our knowledge no market research has been conducted in relation to any central Australian bush resources other than bushfoods. Markets for non-bushfood resources are likely to be found as niches within existing markets for mainstream products and materials similar to those available in central Australia. Central Australian resources may attract a premium in some markets due to their apparent uniqueness or rarity. Products such as traditional-style wood carvings (*punu*) and handmade baskets appear to have settled firmly into the tourist market, where they enjoy considerable success. Other avenues may be available.

Market development should heed market research, build on strengths and focus on unique local/regional attributes …

Issues which will need to be addressed in developing marketing strategies for central Australian bush resources include such things as the role of identifiers such as ‘the outback’ or ‘the desert’ in the development of distinctive, local brands, wild harvest, organic qualities or the particular qualities of the products (e.g. for foods the taste, texture, nutritional qualities etc.). Market research will be useful in order to gain some insight into current consumer awareness, attitudes and values, and the kinds of market niches in which central Australian products are most likely to succeed. There is currently some debate as to whether the best approach is to identify central Australian bushfoods (or any bushfoods for that matter) as exotic, luxury goods which should be sold in low-volume, high-price exclusive outlets, or whether to take a more egalitarian approach aimed at developing more mainstream native food products which consumers could use more regularly in their everyday lives. Other products can exploit the fact that they are available nowhere else and/or have unique desirable qualities that are not available in other kinds of products – a situation likely to be particularly relevant to bush medicines in the future. For most bush resource products from the region, various appropriate avenues for building on the unique and attractive characteristics specific to central Australian products will be available.

It is possible that web-based marketing approaches may prove particularly well suited to central Australian bush resources, as this avenue offers the chance to reach a large audience of potential customers and to provide detailed information about, and images of, the resources offered.

… especially the involvement of Aboriginal people

Aboriginal traditional uses, the involvement of Aboriginal people in wild harvest (or horticulture), Aboriginal ownership – or benefits flowing to Aboriginal people – and the sourcing of materials from Aboriginal land are all facets of marketing the Aboriginal aspects of regional bush resources. The commercial and social feasibility of any Aboriginal owned/operated bush resource based enterprise in central Australia may be assisted by emphasising the enterprise's 'authentic Aboriginality' as a key part of its marketing strategy. It is likely that in many cases a considerable premium will be available by identifying and marketing this aspect of a product or product range.

Fifth, operating successfully in the marketplace – economic and commercial issues

From the outset of this study it has been clear that for most kinds of bush resources the commercial viability of a small business set up merely to act as a dealer arranging sales (especially for just one or two settlements) of raw materials to processors in the cities is likely to be marginal – the volumes traded are too small, the pressure on prices is high, and margins are too thin to allow sufficient profits to be made. Such arrangements can only continue with substantial subsidisation from external sources (such as through government grants, councils absorbing costs and so on).

It is vital to consider commercial strategies at the planning stage …

In order to afford the costs associated with business structures and administration, handling and storage facilities and other infrastructure necessary to operating serious bush resource enterprises, various commercial strategies will need to be adopted to help reduce or defray costs, increase production, and increase the value of products sold. The main kinds of strategies envisaged are:

- Limiting destructive local competition by establishing one or only a small number of enterprises which can operate throughout the region, rather than many local micro-enterprises. One or two larger enterprises which coordinate the collection, processing and sale of resources from a large region will be more likely to be economically viable than many widely dispersed small enterprises, based on individual settlements, handling the same amount of produce.
- Building enterprises to a moderate size in order to achieve the economies of scale available through reducing the ratio of fixed to variable costs and making more efficient use of facilities.
- Adding value by developing and improving local processing capacity, including local product development.
- Diversifying enterprises to include processing and trading in a range of bush resource types.
- Having enterprises pool expensive or capital-intensive resources and equipment such as coolrooms, warehouse space, processing facilities, transport etc.

… as well as a range of 'Critical Success Factors'

Several important issues relating to the likelihood of medium to long term commercial success face any new enterprises based on bush resources. While detailed relevant analysis has not been undertaken specifically for bushfood or other bush resource enterprise types, discussion in relation to other agricultural industries is informative. Hyde (1998) and McKinna (1999)

provide analyses of factors affecting the commercial success of new agricultural enterprises, and their conclusions are likely to be useful for developing bush resource enterprises. Hyde (1998) lists seven key success factors:

1. The industry champion or key entrepreneur
2. A strong market focus, including strong market research, contact with customers and analysis of competitors
3. Operating in a suitable location (particularly relevant to horticultural developments)
4. The availability of transferable technologies (including information) which can be adopted or adapted with limited cost from other products or enterprises
5. High quality appropriate financial management, including provision for adequate start-up capital and operational funds
6. Style of operation, such as a focus on quality and profitability, a strategic long-term approach, imaginative marketing strategies, value adding and vertical integration, adoption of new technologies and joint venture arrangements
7. Understanding, and making appropriate use of, government services and agencies.

McKinna's (1999) analysis is more detailed, providing a useful general description of the typical path followed by new industries and offering strategic approaches for dealing with the critical points he identifies on that path. McKinna identifies four stages that apply to new industries (and these can be usefully applied to new enterprises within industries as well):

1. An embryonic stage in which a few pioneers are developing ideas about interesting new enterprise possibilities
2. A speculative stage in which increasing numbers of investors attempt to get on the bandwagon and prices become extravagantly inflated – this invariably ends in a price crash in which many people get burned.
3. A commercial stage in which relatively few operators undertake steady, long-term oriented research and development, often supported by other more established enterprises.
4. A mature stage, which goes on into the future, in which production and prices settle down and the industry begins to resemble other established industries in the field.

McKinna identifies the transition between speculative and commercial stages as the most critical time for new industries (and enterprises within new industries) and the time when careful management strategies are vital for the industry overall as well as individual enterprises. The native food industry is probably close to this point at present, whereas industries for other bush resources are at much earlier stages.

McKinna points to critical mass as the key problem affecting an industry's, or enterprise's, success in negotiating this critical transition. By 'critical mass' he means the industry/enterprise must produce a sufficient volume of product to support: an economical processing and value-adding infrastructure, economical trading and distribution networks, an effective market development and promotional program, and administrative support and finance for long-term development. As McKinna states, achieving a critical mass can be a difficult 'chicken and egg' exercise – producing sufficient volumes of product requires systems and structures to be in place, but the systems and structures can't easily be established until the volume of trade exists to support them.

Clearly, development up to the point where cash flow from throughput can fully support the necessary systems and infrastructure will require considerable capital and must be iterative, with production kept in step with developing support structures. McKinna singles out the availability of adequate start-up capital as the most important factor in achieving critical mass. He goes on to identify a further 12 critical success factors that need to be addressed in the development of new industries/enterprises. These factors are worth detailing here and include:

1. An adequate industry association (does not yet exist for any putative bush resource industry).
2. Adequate funding of the commercial stage, including support for product development, systems, infrastructure and research and development as well as marketing.
3. An efficient production capability – the ability to produce adequate volumes of high quality raw materials in a timely and cost effective manner (which for wild harvest translates as the ability of Aboriginal collectors to undertake the work in ways which make the return to them worthwhile).
4. An efficient processing and value-adding capability – the ability to cost-effectively process raw materials into valuable, high quality goods (depending mainly on suitable technology, skilled labour and sufficient throughput).
5. A market-driven product specification and quality assurance regime – this is about selling the idea of the product and making sure that the actual product consistently fulfils the qualities implied in the idea.
6. An effective trading–distribution mechanism – there is no point having good produce if no one can buy it or it costs so much to distribute that its sale becomes uneconomical.
7. An effective market development program – consumers need to be informed of the product and have a reason to want to buy it before adequate sales can be expected, and if an enterprise is to make the transition from speculative to commercial stages successfully, demand must keep pace with production capacity.
8. A brand-oriented marketing and promotional strategy – the brand is essentially the visual or symbolic embodiment of the idea represented by the product and is an essential tool in focusing attention, raising awareness, generating loyalty and so on; it also helps to distinguish the enterprise product from any similar products offered by competitors.
9. The ability to dispose of all production at economically viable levels – the quality of raw materials will vary considerably, and it is important to be able to sell lower-quality material without jeopardising the reputation of top-quality lines produced from the best raw materials.
10. Managing the transition from speculative to commercial stages – while the speculative stage is characterised by volatile production, sales and prices, it can significantly increase consumer awareness, which will be very valuable for long-term viability; while this factor may be receding for bushfoods, it will be an important one for bush medicines in the future.
11. An adequately funded and well-run R&D function – this will be an important issue for all bush resource industries for some time since these are new industries with significant research needs and little capacity to pay; it is likely that there will be an ongoing need for strategic research support from bodies such as RIRDC and the Desert Knowledge Cooperative Research Centre for some time.
12. Effectively dealing with bio-ethical issues – such as questions of sustainability of wild harvest, social justice issues relating to Aboriginal people's involvement, animal welfare issues for enterprises involving native animals, food safety issues and so on.

Location in central Australia will significantly influence business strategies

A range of factors relating to central Australia as a location for establishing and operating a bush resource enterprise will affect commercial aspects of the enterprise. Some of these issues are discussed below; the analysis is based on the assumption that the most likely location for any new enterprise will be Alice Springs. Obviously other possibilities exist, such as locations peripheral to central Australia (e.g. Kalgoorlie in WA, Port Augusta in SA), or any number of other locations away from central Australia. Location issues will be different for these alternative locations, but of the same general kind.

Some factors relate specifically to location in Alice Springs …

Alice Springs is a moderate-sized and well-serviced town central to the arid central Australian region but remote from the main markets in which bush resources are likely to be offered. This means that an enterprise established here has advantages associated with its proximity to harvest areas and Aboriginal settlements, making the reviewing of crops and communication with collectors easier. Since transport of material from central Australia to city market places will be required regardless of the location of any processing, some advantage can be generated by processing in Alice Springs so that the material transported is of the highest possible value in relation to volume and weight. Against this must be considered the costs of processing and manufacturing, which may be marginally higher in central Australia since some materials, machinery and so on will need to be transported into Alice Springs, and power costs may be higher.

Some other factors which may influence business location planning include:

- The large range of bushfoods and other potentially commercial resources available in the region
- The exotic image of central Australia in the minds of Australian consumers – location and the involvement of Aboriginal people can help to raise the profile of an enterprise in the region
- The potential economic benefits in terms of government concessions, infrastructure and land costs, local loyalty and support etc
- Direct access to a tourist market that is already sizeable and has the potential for significant growth.

Other issues relate to the locations of collection areas – and are likely to be more significant for operations based on wild harvest than for those based on horticultural production. These include the high costs of transporting raw materials from collection areas into Alice Springs and the impact of timing and road conditions on the quality of fresh produce delivered to a central location in town.

… statutory and legal issues are also important, especially government regulations and policies

A range of issues relating to government policies, programs, regulations and so on are also likely to impact on enterprises in the region. In view of the fact that government policies, programs, regulations and so on are numerous, complex and subject to frequent change, a detailed analysis is not attempted here. Rather, a general list of the kinds of issues and organisations, which may be important from time to time, is provided:

- Local government – permits, zoning, concessions, assistance programs
- Territory Government – permits, royalties, conservation, food regulations, business incorporation, business assistance, information and extension services and various other services
- Federal government – Food Act, Therapeutic Goods Act, Food Standards (ANZFA), tax issues and concessions, business incorporation and regulation – export and trade assistance (Austrade), funding programs etc
- Semi-government agencies – involvement of Aboriginal people and communities – Indigenous Land Corporation (ILC), Central Land Council; funding possibilities and information sources – Natural Heritage Trust (NHT), RIRDC, Desert Knowledge Cooperative Research Centre.

Opportunities for discounting and cross-subsidisation may assist enterprise viability

The involvement of Aboriginal people in bush resource enterprises may be assisted by various opportunities for defraying costs through discounting and cross-subsidisation. Some important examples of this already operate – many collectors discount the cost of their labour to an unknown extent in order to be able to participate in collections, and CDEP funding is used in many places to provide support for the involvement of local residents in the various Reedy Creek horticultural projects.

A range of funding opportunities may also be available for specific projects, though probably not for wild harvest support in general. These include Land Management Grants available from the Indigenous Land Corporation (ILC) under the various state Regional Indigenous Land Strategies; funding from the Natural Heritage Trust (NHT) for conservation-oriented projects; and assistance for planning and business development through the federally funded Regional Assistance Programs in each state and territory. Other opportunities are also likely to become available from time to time.

Finally, by way of summary – SWOT analysis

The following SWOT analysis is presented as a simple way of reiterating and emphasising many of the important issues facing new Aboriginal bush resource–based enterprises in central Australia. The items refer specifically to Aboriginal enterprises, but many are applicable to other enterprises which involve Aboriginal people in various ways in their operations.

Strengths

- Availability of traditional knowledge (of country and species) and skills in harvesting and processing.
- Access to wild resources on Aboriginal land, which covers about half of the region.
- Ability and willingness of Aboriginal collectors to discount labour costs in order to gain a range of cultural and other benefits.
- Large informal (and largely unemployed in an official sense) labour force in settlements and outstations throughout the region.
- Wide range of resources available over large land area, and major resources – wattleseed and bush tomatoes – particularly widespread and common.
- Strong interest in bushfood enterprise among Aboriginal people in the region.

Weaknesses

- Early stage of industry development in the region means limited coordination or organisation of bushfood collection, processing and sale at this stage.
- Variable, and somewhat unreliable, wild harvest supply due to climatic factors.
- Lack of transport for collectors, who sometimes have difficulty getting to collection areas as a result.
- No supporting infrastructure in collecting areas (transport, containers, equipment, storage etc.).
- No capacity in the industry to handle perishable goods.
- Lack of business experience and sophistication among Aboriginal participants, and limited experience among others.
- Lack of awareness or knowledge of the bushfood industry beyond central Australia on the part of Aboriginal collectors.

Opportunities

- Enterprises can provide a significant source of extra income, especially for women.
- Positive policy statements in support of Aboriginal participation in economic activities involving bush resources – particularly bushfoods – from ATSIC (recently abolished), and from ILC and other Aboriginal and governmental agencies.
- No other organised Aboriginal bush resource enterprise group exists yet in the region.
- Developments in central Australia may provide a model for other Aboriginal groups around the country.
- Central Australian enterprises may provide an appropriate outlet for Aboriginal producers/ collectors elsewhere in the country.
- Potential to develop new materials and products for various growing markets.
- Marketability of authentic ‘Aboriginality’ and ‘outback’ locale.
- Export potential of the main materials available in central Australia.

Threats

- Non-Aboriginal competition, especially from mainstream producers undertaking large-scale cultivation in better watered areas closer to markets and services.
- Lack of funding or available capital with which to build enterprises beyond critical viability thresholds.
- No government-based policy, political commitment to, or legislative protection for, traditional ecological knowledge in the public domain.
- Limited size of existing markets (and possibility of oversupply of some key products).
- Limited ability or inclination of larger companies to pay up-front (long waits before payment is made are common and can severely strain commercial viability through pressure on capital).

6. Developing enterprises: elements of a strategy

Introduction

While enterprises will differ in many ways, depending on the attitudes and judgements of those who establish them, it is possible to outline a few areas where general principles can be developed that may help in the processes of planning and setting up businesses. The strategic elements listed here should be thought of as being indicative rather than prescriptive, and are based on some of the characteristics of existing successful enterprises in the region and the information and analysis presented earlier in the report. The elements outlined are those which appear to the author to be relatively more important, and no attempt has been made to be comprehensive. Indeed, it is probably not possible to be comprehensive, given the wide range of bush resources on which enterprises could be based and the even wider range of business models which could be developed and employed. So, the disclaimer out of the way, the following elements are provided as a very basic guide to prompt thinking on how one might go about establishing an enterprise based on bush resources and to indicate some of the critical factors which will need to be attended to in the process.

Walk before running – starting small with a local focus

Unless a company can muster very large sums of capital (in the order of several million) it will be restricted in what it can tackle at the beginning. On the other hand, almost any group should be able to manage a modest initial effort focused on modest quantities of locally available resources, processing that is simple and cheap, and basic finished products that don't require expensive or complicated infrastructure to package, store or transport. This means starting with a small number of resources – say one or two bushfood types, undertaking basic processing such as cleaning and possibly roasting, and packing in bulk in simple containers such as strong plastic bags. If all goes well, there will be plenty of time and opportunity for more products, larger volumes, and more complicated processing and packing at a later date.

Begin with products that have the best prospects and are most easily developed

In the long run, it is not possible to predict which of the resources discussed here are likely to be most successful, but most of them will require significant research and development well before they can even be offered to the market. In the beginning, enterprises should focus on resources which offer the best prospects for early returns. At this stage, the immaturity of the bushfood market, even for established species, and the lack of a trading track record for all the rest, makes it very difficult to identify the species with the best prospects. Nevertheless, worthwhile niches are likely to be available for many new products. There may also be useful prospects in wildflowers and craft works. Bush medicines may be the best prospects in the very long term, but at this stage the hurdles are very significant.

Minimum infrastructure and organisational requirements – the question of critical mass

The previous two points notwithstanding, an enterprise will need to operate above a certain critical threshold of turnover in order to be, and remain, viable. That level is at least the point where the enterprise can, or will be able in a reasonable time, to cover its costs.

Spreading the risks and opportunities – vertical and horizontal integration

In time, a successful enterprise is likely to want to expand its operations and improve its profitability. The main ways of going about this include increasing efficiency, increasing its size to achieve economies of scale, and expanding its operations vertically and horizontally. Vertical integration – expanding operations further up the chain of processing and product manufacture – is likely to be an important strategy for increasing the potential benefits that might accrue. Adding value through participating in bush resource–based enterprises all the way from collection to processing raw materials and marketing finished products has the potential to significantly increase overall returns. While there are costs associated with adding value in this way (and significant finance may be needed), returns from the sale of processed and packaged final products are likely to be significantly greater in proportion to inputs than returns for sales of raw produce to processors and wholesalers. Horizontal integration – expanding operations to include a broader range of resources of a particular type, or more resource types – may also yield significant gains but is likely to be more challenging, since each resource targeted will have its own set of special attributes.

Aboriginal ownership, involvement and control – a fundamental grail of bush resource enterprise development in the region

This report assumes that Aboriginal ownership, involvement and control are likely to be important objectives of many new enterprises aiming to work with bush resources in the region. There are numerous ways in which Aboriginal groups may participate in industries based on bush resources, and many levels of involvement possible. Explicitly expressing the objective of involving Aboriginal people, and indicating the level of involvement desired, is likely to be of primary importance in achieving this aim; it won't happen by accident. The expressed objective will need to be backed up by an explicit plan, which should include as one of its first elements the active engagement of the Aboriginal people or groups who may be expected to become involved.

Planning requirements and processes – looking to the future

Every enterprise will need to engage in competent and comprehensive enterprise planning. While it is vital that such planning involve professional business planners, accountants and so on, it is also vital that any Aboriginal enterprise ensures that all of its constituents are fully able to participate in the planning process. There is little point in steering through the shallows and reefs of day-to-day activities unless there is a point on the horizon towards which you're heading. And there is little point in looking at the horizon unless the whole crew is in agreement as to where the ship should be going. It is vital that enterprises that engage with Aboriginal people do so actively and on an equal footing, providing plenty of opportunities for their input. A participatory approach to Aboriginal engagement is likely to be the most successful, and readers are directed to the recent compilation of reports and stories edited by Fiona Walsh and Paul Mitchell for many excellent examples of this approach to planning (Walsh and Mitchell 2002). Levels of engagement with Aboriginal participants are neatly outlined on page 22 of that work.

Developing business and marketing plans

Enterprises will usually need to engage professional business planners at an early stage of their development and work with them to develop detailed short-term and long-term business plans using the best possible data that is available in relation to the proposed enterprise model and the bush resources on which it is to be based. Getting the data to support such a plan will usually be an involved and painstaking exercise and can present a formidable hurdle to the timely establishment of a viable business.

Funding – start-up capital and operating budget requirements

Any new enterprise will require a certain amount of start-up and operating capital in order to operate and grow. In most cases it will be some time – usually several years – before initial capital outlays can be repaid and operating costs met from income. The problem for operators of new enterprises based on bush resources is that the business model will be largely untested and it will be difficult (or impossible) to access commercial capital (i.e. bank loans and such like) until the business has become profitable. Unfortunately, capital is most critically needed well before the business becomes profitable – in fact it is needed in order to get the business to profitability. This fundamental catch-22 situation – you can't get capital unless you're profitable but you can't be profitable unless you have capital – is likely to be a major obstacle to any bush resource based–enterprises in the region and creative ways of dealing with it will be needed.

Business structure options – other successful businesses as models

A successful business in central Australia which involves Aboriginal people, provides a useful model for putative bush resource–based enterprises and has been discussed previously in this report. Maruku Arts is owned by the artists who produce objects (*punu* – wood carvings, traditional weapons and tools such as spears, coolamons and boomerangs, woven baskets and paintings) for sale through the company. The company is managed by a professional manager (currently non-Aboriginal), who answers to a board elected by shareholders. Dividends from company profits are distributed mainly through the pricing structure used to set prices for objects acquired for sale, rather than through separate after-tax payments. The manager's policy of paying artists in full at the time of purchase and of visiting settlements on regular buying trips is also well suited to bush resource businesses. A second model is that of Tjanpi Aboriginal Baskets, run by NPY Women's Council, which buys baskets, paintings, beads and other art works from women in settlements throughout southern NT, northern SA and the central ranges area of WA. While the women who supply objects are not owners of the enterprise, they do benefit in the same way as Maruku artists in that their work is paid for at the time of purchase and dividends from profits are incorporated into profits rather than distributed as separate payments. However, unlike Marjku Arts, Tjanpi is not a standalone business and relies on government grants to maintain its existence and coordinating structures.

For new enterprises the main points are that the structure should, as far as practicable, allow the Aboriginal participants to own the business, should have in place an explicit transition process whereby ownership does accrue to participants, and will need to have suitable democratic processes in place for the making of business decisions so that factions within the participant group cannot take control for their own benefit at the cost of others. A wide range of possible formal structures such as cooperatives, associations, various kinds of companies, and so on can be used.

References and bibliography

Aboriginal Communities of the Northern Territory. 1988. Traditional Bush Medicines: an Aboriginal pharmacopoeia. Greenhouse Publications, Melbourne.

Aboriginal Communities of the Northern Territory. 1993. Traditional Aboriginal Medicines in the Northern Territory of Australia. Conservation Commission of the Northern Territory, Darwin.

ACIL Economics. 1997. Sustainable Economic Use of Native Australian Birds and Reptiles. RIRDC Research Paper No 97/26. Rural Industries Research and Development Corporation, Canberra.

Adewusi, S.R.A., Olumuyiwa, S.F. and Harwood, C. 2003. Chemical composition of Acacia colei and Acacia tumida seeds – potential food sources in the semi-arid tropics. Food Chemistry 80: 187–95.

Agtrans Research. 1994. Domestic Market Potential for Specialty Mushrooms. RIRDC Research Paper No 94/3. Rural Industries Research and Development Corporation, Canberra.

Ahmed, A.K. and Johnson, Krystyna A. 2000. Growing Australian native edible plants using hydroponic techniques. Acta Horticulturae 511: 225–32.

Ahmed, A.K. and Johnson, Krystyna A. 2000. Horticultural development of Australian native edible plants. Australian Journal of Botany 48(4): 417–26.

Alonso, J.C., Morales, M.B. and Alonso, J.A. 2000. Partial migration, and lek and nesting area fidelity in female great bustards. Condor 102(1): 127–36.

Altman, J.C., Bek, H.J. and Roach, L.M. 1995. Native Title and Indigenous Australian Utilisation of Wildlife: policy perspectives. CAEPR Discussion Paper No 95/1995. Centre for Aboriginal Economic Policy Research, ANU, Canberra.

Altman, J.C. and Allen, L.M. 1992. Indigenous participation in the informal economy: statistical and policy implications. In J.C. Altman, ed. A National Survey of Indigenous Australians: options and implications. Centre for Aboriginal Economic Policy Research, ANU, Canberra.

Altman, J.C. and Taylor, L. 1987. The Economic Viability of Aboriginal Outstations and Homelands. Report to the Australian Council for Employment and Training. Australian Government Publishing Service, Canberra.

ANBIC. 1996. Government assistance programs. Paper presented to the ANBIC, Brisbane conference: 'Culture of the Land, Cuisine of the People', 3–4 May 1996. Australian Native Bushfood Industry Council.

Anderson, D.M.W. 1993. Some factors influencing the demand for gum arabic (Acacia senegal (L.) Willd.) and other water-soluble tree exudates. Forest Ecology and Management 58: 1–18.

Anderson, D.M.W. and Bell, P.C. 1976. Partial structural studies of four Acacia gum exudates of the series Phyllodineae. Phytochemistry 15: 301–3.

Anderson, D.M.W., Bell, P.C., and McNab, C.G. 1972. Analysis of six Acacia gum exudates of the series Phyllodineae. Phytochemistry 11: 1751–4.

Anderson, D.M.W., Farquar, J.G.K. and McNab, C.G. 1983. Some highly proteinaceous Acacia gum exudates of the subseries Juliflorae. Phytochemistry 22(11): 2481–4.

Anderson, D.M.W. and Gill, M.C.L. 1975. The composition of Acacia gum exudates from species of the subseries Juliflorae. Phytochemistry 14: 739–41.

Anderson, D.M.W., Gill, M.C.L., Jeffrey, A.M. and McDougall, F.J. 1985. The gum exudates from some closely related Acacia species of the subseries Uninerves and Racemosae (section Phyllodineae). Phytochemistry 24(1): 71–5.

Anderson, D.M.W., Gill, M.C.L., McNab, C.G.A. and De Pinto, G. 1984. Some Acacia gum exudates of the section Phyllodineae. Phytochemistry 23(9): 1923–6.

Anderson, D.M.W. and McDougall, F.J. 1985. The proteinaceous components of the gum exudates from some Phyllodinous Acacia species. Phytochemistry 24(6): 1237–40.

Anderson, D.M.W. and McDougall, F.J. 1988. The chemical characterisation of the gum exudates from eight Australian Acacia species of the series Phyllodineae. Food Hydrocolloids 2(4): 329–36.

Anderson, D.M.W. and Weiping, W. 1990. Composition of the gum from Combretum paniculatum and four other gums which are not permitted food additives. Phytochemistry 29(4): 1193–6.

Anderson, Susan J. and Deeming, D.C. 2002. Dimensions and composition of eggs from captive bustards (Gruiformes: Otididae): houbara (Chlamydotis undulata), rufous crested (Eupodotis ruficrista) and kori (Ardeotis kori). Zoo Biology 21(4): 337–46.

Annison, G., Trimble, R.P. and Topping, D.L. 1995. Feeding Australian acacia gums and gum arabic leads to non-starch polysaccharide accumulation in the cecum of rats. Journal of Nutrition 125: 283–92.

Annas, Mariana. 1997. The label of authenticity: a certification trade mark for goods and services of Indigenous origin. Aboriginal Law Bulletin 3(90): 4–8.

ANZFA. 1994. Functional Foods. Policy discussion paper, July. Australian and New Zealand Food Authority, Canberra.

ANZFA. 1996a. The Safety Assessment of Novel Foods and Novel Food Ingredients. Discussion and options paper, September. Australian and New Zealand Food Authority, Canberra.

ANZFA. 1996b. Proposal to Develop a National Food Hygiene Standard. Information paper, September. Australian and New Zealand Food Authority, Canberra.

ANZFA. 2003. Food Standards Code – Standard 1.3.1 – Food additives. <www.foodstandards.gov.au/foodstandardscode/>

ARBIA. 1996. President's Report. Australian Rainforest Bushfood Industry Association Newsletter No 1, Autumn 1996. ARBIA, PO Box 6407, Lismore, NSW, 2480.

Aslin, H.J. and Norton, T.W. 1995. No one answer – sustainable use of wildlife in a multicultural society. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 73–81. Centre for Conservation Biology, University of Queensland.

Atech Group and Total Earth Care. 1999. Bushfood Production and Marketing Information. RIRDC Publication No 99/158. Rural Industries Research and Development Corporation, Canberra.

ATSIC. 1992. The Australian contribution: a survey of the positions put to the Working Group by representatives of the Australian Government, the Aboriginal and Torres Strait Islanders Commission, and Australian non-government organisations. In Cultural and Intellectual Property, pp. 86–94. United Nations Working Group on Indigenous Populations (10th, 1992, Geneva, Switzerland). Office of Public Affairs, ATSIC, Canberra.

ATSIC. 1997. National Aboriginal and Torres Strait Islander Rural Industry Strategy. Aboriginal and Torres Strait Islander Commission and Department of Primary Industries and Energy, Canberra.

Bailey, T.A., Samour, J.H., Naldo, J.L., Cooper, J.E. and Nicholls, P.K. 1997. The establishment of a biomedical reference collection for a captive breeding and restoration programme. International Zoo Yearbook 35: 337–42.

Barlass, M., Grant, W.J.R. and Skene, K.G.M. 1980. Shoot regeneration in-vitro from native Australian fruit bearing trees quandong (Santalum acuminatum) and plum bush (Santalum lanceolatum). Australian Journal of Botany 28(4): 405–10.

Barnes, S. and Wilson, Ms. A. 1998. Cropping the French Black Morel: a preliminary investigation. RIRDC Publication No 98/44. Rural Industries Research and Development Corporation, Canberra.

Beal, A. 1996. Production, technology and processing. Paper presented to the ANBIC, Brisbane conference: 'Culture of the Land, Cuisine of the People', 3–4 May 1996. Australian Native Bushfood Industry Council.

Bennett, B. 1995a. Seed saviours. Ecos 85 Spring: 25–8.

Bennett, B. 1995b. A legacy in their hands. Ecos 85 Spring: 30–2.

Bennett, D.H. 1995. Issues in the sustainable use of wildlife by Indigenous peoples: the convention on biological diversity and native title. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 60–8. Centre for Conservation Biology, University of Queensland.

Beshai, A.A. 1984. The economics of a primary commodity: gum arabic. Oxford Bulletin of Economics & Statistics 46(4): 371–81.

Bindon, P. 1996. Useful Bush Plants. WA Museum, Perth.

Bindon, P. and Maslin, B.R. 1984. Preliminary account of Acacia usage by Aborigines in part of the Great Sandy Desert, Western Australia. International Conference on Indian Ocean Studies, II.

Blakeney, M. 1996. Bioprospecting and the protection of traditional medical knowledge. Paper presented to the Arts and Cultural Expressions and Traditional Knowledge Conference: 'Intellectual Protection for Arts and Cultural Expression of Aboriginal and Torres Strait Islander Peoples', Brisbane, 28 September 1996.

Boardman, R., Bush, D., Butcher, T., Harwood, C., Spencer, D. and Stackpole, D. 2002. Australian Low Rainfall Tree Improvement Group: compendium of softwood tree improvement strategies. A report for the RIRDC/ Land & Water Australia/FWPRDC Joint Venture Agroforestry Program. RIRDC Publication No 02/028. Rural Industries Research and Development Corporation, Canberra.

Bomford, Mary and Caughley, Judy (eds). 1996. Sustainable Use of Wildlife by Aboriginal Peoples and Torres Strait Islanders. Bureau of Resource Sciences, Canberra.

BPIWG, ed. 2001. Desert Knowledge Bush Food Workshop, August 8, 2001, Centralian College, Alice Springs. Bush Products Initiative Working Group, Desert Knowledge Project, Alice Springs.

Brand-Miller, Jenny C. 1994. Nutrition of Australian Aboriginal foods. Aust. Science Winter: 25–8.

Brand, Jenny C. and Cherikoff, V. 1985a. Australian Aboriginal bushfoods: the nutritional composition of plants from arid and semi-arid areas. Aust. Aboriginal Studies 2: 38–46.

Brand, Jenny C. and Cherikoff, V. 1985b. The nutritional composition of Australian Aboriginal food plants of the desert regions. In G.E. Wickens, J.R. Goodin and J.V. Field, eds. Plants for Arid Lands, pp. 53–68. Proceedings of the Kew International Conference on Economic Plants for Arid Lands. Royal Botanic Gardens, Kew, UK, 23–27 July. Allen & Unwin, London.

Brand, Jenny C., Cherikoff, V., Lee, A. and McDonnell, J. 1982. Nutrients in important bushfoods. Proc. Nutrition Soc. Aust. 7: 50–4.

Brand, Jenny C. and Maggiore, Pat M.A. 1992. The nutritional composition of Australian Acacia seeds. In A.P.N. House and C.E.H. Harwood, eds. Australian Dry-zone Acacias for Human Food, pp. 54–67. CSIRO Forestry and Forest Products, Canberra.

Brand, Jenny C., Rae, C., McDonnell, J., Lee, A., Cherikoff, V. and Truswell, A.S. 1983. The nutritional composition of Australian Aboriginal bushfoods, 1. Food Tech. Aust. 35: 293–8.

Brand, Jenny C., Cherikoff, V. and Truswell, A.S. 1985. The nutritional composition of Australian Aboriginal bushfoods, 3 – seeds and nuts. Food Tech. Aust 37: 275–9.

Brophy, J.J. and Doran, J.C. 1996. Essential Oils of Tropical Aseromyrtus, Callistemon and Melaleuca species: in search of interesting oils with commercial potential. Australian Centre for International Agricultural Research, Canberra.

Brown, A.J., Cherikoff, V. and Roberts, D.C.K. 1987. Fatty acid composition of seeds of Australian Acacia species. Lipids 22: 490–4.

Brown, M. 1996. Aboriginal land management in Yuendumu, central Australia, and the potential impacts of a commercial 'bushtucker' industry: implications for future sustainability. Unpublished Diploma of Natural Resources thesis, University of New England, Armidale.

Brown, M. and Haworth, R. 1997. Culturally embedded sustainability practices among the Walpiri: conservation and commerce in the Tanami Desert. Rural Society 7(2): 3–15.

Bristow, M., Annandale, M. and Bragg, A. 2003. Introduction to Tropical Agroforestry for Indigenous Communities. RIRDC Publication No 03/109. Joint Venture Agroforestry Program, Rural Industries Research and Development Corporation, Canberra.

Brundtland, et al. 1987. Our Common Future. World Commission on Environment and Development, Oxford University Press, Oxford.

Bruneteau, J. 1996. 'Tukka' – Real Australian Food. Angus & Robertson, North Ryde.

Bryce, Suzy. 1992. Women's Gathering and Hunting in the Pitjantjatjara Homelands. Institute for Aboriginal Development Publications, Alice Springs.

Bureau of Resource Sciences. 1994. Commercial Use of Wild Animals. Australian Government Publishing Service, Canberra.

Campbell, A.H. 1965. Elementary food production by the Australian Aborigines. Mankind 6: 206–11.

Cane, S.B. 1986. Bush tucker: intensified use of traditional resources on Aboriginal outstations. In B. Foran and B. Walker, eds. Science and Technology for Aboriginal Development. CSIRO, Melbourne.

Cane, S.B. 1989. Australian Aboriginal seed grinding and its archaeological record: a case study from the Western Desert. In D.R. Harris and G.C. Hillman, eds. Foraging and Farming, pp. 99–119. Unwin Hyam, London.

Cane, S.B. and Stanley, O. 1985. Land Use and Resources in Desert Homelands. ANU North Australia Research Unit (NARU), Darwin.

Chan, K., Islam, M.W., Kamil, M., Radhakrishnan, R., Zakaria, M.N.M., Habibullah, M. and Attas, A. 2000. The analgesic and anti-inflammatory effects of Portulaca oleracea L. subsp. sativa (Haw.) Celak. Journal of Ethnopharmacology 73(3): 445–51.

Charlson, A.J., Nunn, J.R. and Stephen, A.M. 1955. The composition of Acacia cyanophylla gum. J. Chemical Society: 269–73, University of Cape Town.

Cherikoff, V. 1993. The Bush Food Handbook. Bush Tucker Supplies. Boronia Park, NSW.

Cherikoff, V. 1994a. Uniquely Australian. Bush Tucker Supplies, Boronia Park, NSW.

Cherikoff, V. 1994b. Some directions for the development of an Australian bushfood industry association. In Greening Australia. Bush Food Seminar. Papers and proceedings of a seminar held at Bangalow, NSW, 26 February 1994.

Cherikoff, V. 1996. Australian native bushfood industry overview. Paper presented to the ANBIC, Brisbane conference: 'Culture of the Land, Cuisine of the People', 3–4 May 1996. Australian Native Bushfood Industry Council.

Cherikoff, V. 1999. Marketing the bushfood industry. Australian Bushfoods Magazine 9: 25–8.

Cherikoff, V. 2000. Marketing the Australian Native Food Industry. RIRDC Publication No 00/61. Rural Industries Research and Development Corporation, Canberra.

Cherikoff, V., Brand, Jenny C. and Truswell, A.S. 1985. The nutritional composition of Australian Aboriginal bushfoods, 2 – animal foods. Food Tech. Aust 37: 208–11.

Cherikoff, V. and Isaacs, Jennifer. 1989. The Bushfood Handbook: how to gather, grow, process and cook Australian wild foods. Ti Tree Press, Sydney.

Christie, Jean. 1996. Biodiversity and intellectual property rights: implications for Indigenous peoples. In Ros Sultan, ed. ECOPOLITICS IX – Perspectives on Indigenous People's Management of Environmental Resources, pp. 61–77. Proceedings of a conference, NTU, Darwin, Sept 1–3, 1995. Northern Land Council, Darwin.

Chudleigh, P., Bond, Katrina and Bramwell, Tracy. 1995. Pre-feasibility Study of Potential for Goanna Farming in Australia. RIRDC Research Paper No 95/15. Rural Industries Research and Development Corporation, Canberra.

Clarke, P.A. 1985a. Fruits and seeds as food for southern South Australian Aborigines. J. Anthrop. Soc. S.A. 23(9): 9–22.

Clarke, P.A. 1985b. The importance of roots and tubers as a food source for southern South Australian Aborigines. J. Anthrop. Soc. S.A. 23(26): 2–12.

Clarke, P.A. 1986. Aboriginal use of plant exudates, foliage and fungi as food and water sources in southern South Australia. J. Anthrop. Soc. S.A. 24: 3–18.

Cleland, J.B. and Johnston, T.H. 1933. The ecology of the Aborigines of central Australia: botanical notes. Trans. & Proc. Roy. Soc. S.A. 57: 113–24.

Cleland, J.B. and Johnston, T.H. 1937. Notes on native names and uses of plants in the Musgrave Ranges region. Oceania 8: 208–15.

Cleland, J.B. and Tindale, N.B. 1959. The native names and uses of plants at Haast Bluff, central Australia. Trans. & Proc. Roy. Soc. S.A. 82: 123–40.

Collins, D.J., Culvenor, C.C.J., Lamberton, J.A., Loder, J.W. and Price, J.R. 1990. Plants for Medicines: a chemical and pharmacological survey of plants in the Australian region. CSIRO Publishing, Melbourne.

Combreau, O., Gelinaud, G. and Smith, T.R. 2000. Home range and movements of houbara bustards introduced in the Njad Pediplain in Saudi Arabia. Journal of Arid Environments 44(2): 229–40.

Committee on Codex Specifications. 1981 (and subsequent editions). Food Chemicals Codex. 3rd edition. Food and Nutrition Board, Division of Biological Sciences, Assembly of Life Sciences, National Research Council. National Academy Press, Washington D.C., USA.

Commonwealth of Australia. 1998. Commercial Utilisation of Australian Native Wildlife. Report of the Senate Rural and Regional Affairs and Transport References Committee. Parliament of the Commonwealth of Australia, Canberra.

Conn, B.J. 1988. A taxonomic revision of Prostanthera Labill. Section Prostanthera (Labiateae) 1 – the species of the Northern Territory, South Australia and Western Australia. Nuytsia 6(3): 351–411.

Considine, J.A. 1996. Emerging Indigenous crops of Australia. In J. Janick, ed. Progress in New Crops, pp. 26–36. ASHS Press, VA, USA.

Cowley, K.J., Quinn, F.C., Barlow, B.A. and Craven, L.A. 1990. Contributions to a revision of Melaleuca (Myrtaceae), 7–10. Australian Systematic Botany 3(2): 165–202.

Craig, Donna. 1994. Implementing the Convention on Biological Diversity: Indigenous Peoples Issues. Contribution to IUCN Commission on Environmental Law Technical Paper on Legal and Institutional Issues arising from the Implementation of the Convention on Biological Diversity. Regional Conference on the Biodiversity Convention, Manilla, 6–8 June 1994. IUN, Rome.

Crawford, I.M. 1982. Traditional Aboriginal plant resources in the Kalumbaru area: aspects in ethno-economics. Rec. W.A. Museum Suppl. 15.

Cribb, A.B. and Cribb, J.W. 1989. Useful Wild Plants in Australia. Collins, Sydney.

Cribb, A.B. and Cribb, J.W. 1990a. Wild Food in Australia. 2nd edition, Angus and Robertson, North Ryde.

Cribb, A.B. and Cribb, J.W. 1990b. Wild Medicine in Australia. Angus and Robertson, North Ryde.

Cunningham, A.B. 1993. Ethics, Ethnobiology Research and Biodiversity. World Wide Fund for Nature (WWF), Gland, Switzerland.

Cunningham, A.B. 2001. Applied Ethnobotany: people, wild plant use and conservation. Earthscan, London.

Damson, Free. 1996. The significance of property rights for biodiversity conservation in the Northern Territory. The Aust. J. of Natural Resources Law and Policy 3(2): 179–238.

Davies, Jocelyn, Higginbottom, Karen, Noack, Denise, Ross, Helen and Young, Elspeth. 1997. 'Animals for Living': Indigenous community wildlife management in Australia. Draft report of a regional review for the International Institute for Environment and Development international study Evaluating Eden: factors affecting community wildlife management. IIED, London.

Davies, Jocelyn, Higginbottom, Karen, Noack, Denise, Ross, Helen and Young, Elspeth. 1999. Sustaining Eden: Indigenous community wildlife management in Australia. International Institute for Environment and Development, London.

Davies, Jocelyn and Young, Elspeth. 1995. Sustainability, development and rural Aboriginal communities. Aust. Geogr. November.

Davis, R.K. 1995. Using markets to achieve wildlife conservation. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 92–8. Centre for Conservation Biology, University of Queensland.

Dellar, Joanne E., Cole, M.D., Gary, A.I., Gibbons, S. and Weatherman, P.G. 1994. Antimicrobial sesquiterpenes from Prostanthera aff. melissifolia and P. rotundifolia. Phytochemistry 36(4): 957–60.

Desmond, Helen. 2000. Aboriginal Rural Resources Initiative Valuation Methodology. Bureau of Rural Sciences, Canberra.

Devitt, Jeannie. 1988. Contemporary Aboriginal women and subsistence in remote, arid Australia. Unpublished Ph.D. thesis, Department of Anthropology and Sociology, University of Queensland, Brisbane.

Devitt, Jeannie. 1992. Acacias: a traditional Aboriginal food source in central Australia. In A.P.N. House and C.E.H. Harwood, eds. Australian Dry-zone Acacias for Human Food. CSIRO Forestry and Forest Products, Canberra.

Dodson, M. 1996. Indigenous peoples and intellectual property rights. In Ros Sultan, ed. ECOPOLITICS IX – Perspectives on Indigenous People's Management of Environmental Resources, pp. 30–6. Proceedings of a conference, NTU, Darwin, Sept 1–3, 1995. Northern Land Council, Darwin.

Dorwood, D. 1997. Sustainable wild harvesting. ANBIC Ltd Journal 1st edition (June): 7–8.

ECCMHS. 2003. Complementary Medicines in the Australian Health System. Expert Committee on Complementary Medicines in the Health System, Report to the Parliamentary Secretary to the Minister for Health and Ageing, September 2003. Australian Parliament, Canberra.

Econsult. 1996a. Business and Marketing Paper. Paper presented to the ANBIC, Brisbane conference: 'Culture of the Land, Cuisine of the People', 3–4 May 1996. Australian Native Bushfood Industry Committee.

Econsult. 1996b. Broken Hill Bush Tucker Industry Feasibility Study. Prepared for the 'Future of Broken Hill Task Force'.

Edgar, D. 1998a (in prep). Commercialising Indigenous ecological knowledge pertaining to medicinal plants: alternative strategies to secure Indigenous resource rights.

Edgar, D. 1998b (in prep). Intellectual property rights, Indigenous resource rights, and ethnobotanically guided research into medicinal plants in Australia

Ekandayo, C.A. and Idzi, E. 1990. Mycoflora and nutritional value of shelled melon seeds (Citrullus vulgaris Schrad.), in Nigeria. Plant Foods for Human Nutrition (Dordrecht) 40(3): 215–22.

Eskander, E.F. and Jun, H.W. 1995. Hypoglycaemic effects of some Egyptian herbs used for the treatment of diabetes mellitus (type II) in rats. Egyptian Journal of Pharmaceutical Sciences 36(1–6): 331–42.

Ferguson, Kaye. 2000. The quandong moth. Paper presented to the AQIA Conference, Adelaide, 19 August 2000. Australian Quandong Industry Association, Loxton, South Australia.

Ferguson, Kaye and Bailey, P. 2001. Integrated Pest Management of Quandong Moth– control of quandong moth in quandong orchards. RIRDC Publication No 01/172. Rural Industries Research and Development Corporation, Canberra.

Fitt, G.P. 1981. Observations on the biology and behaviour of Paraceratitella eurycephala (Diptera: Tephritidae) in northern Australia. Journal of the Australian Entomological Society 20(1): 1–8.

Forster, P.I. 1992. A taxonomic revision of Carissa (Apocynaceae) in Australia. Australian Systematic Botany 5(5): 581–91.

Fourmile, Henrietta. 1996. Protecting Indigenous intellectual property rights in biodiversity. In Ros Sultan, ed. ECOPOLITICS IX – Perspectives on Indigenous People's Management of Environmental Resources, pp. 37–42. Proceedings of a conference, NTU, Darwin, Sept 1–3, 1995. Northern Land Council, Darwin.

Fox, J.E.D. 1987. Potential of Australian acacias from arid and semi-arid zones. In J.W. Turnbull, ed. Australian Acacias in Developing Countries, pp 101–6. ACIAR Proceedings No 16. Australian Centre for International Agricultural Research, Canberra.

Fox, J.E.D. 1997. Why is Santalum spicatum common near granite rocks? Journal of the Royal Society of Western Australia 80(3): 209–20.

Fung, P. 2001. Potential Non-wood Tree Products for Low–Medium Rainfall Areas. Joint Venture Agroforestry Program, Report No 01/165. Rural Industries Research and Development Corporation, Canberra.

Garti, N., Slavin, Y. and Aserin, A. 1999. Surface and emulsification properties of a new gum extracted from Portulaca oleracea. Food Hydrocolloids 13(2): 145–55.

Garvey, D.C. and Cooper, P.B. 2001. French Black Truffle Establishment and Production in Tasmania. RIRDC Publication No 01/084. Rural Industries Research and Development Corporation, Canberra.

Gaucher, P. 1995. Breeding biology of the houbara bustard, Chlamydotis undulata undulata in Algeria. Alauda 63(4): 291–8.

Gelinaud, G., Combreau, O. and Seddon, P.J. 1997. First breeding by captive-bred houbara bustards introduced in central Saudi Arabia. Journal of Arid Environments 35(3): 527–34.

Geno, L. 1996. Bush tucker. Biolinks No 10: 6–7. Environment Australia, Canberra.

Gharras, L., Hmamouchi, M., Lamnouar, D., Bengoumi, M. 1999. Comparative study of the hypoglycaemic effects of six plants from traditional pharmacopeia of Morocco. Revue de Medicines et Pharmacopees Africaines 13: 71–80 [in French].

Ghisalberti, E.L. 1994. The ethnopharmacology and phytochemistry of Eremophila species (Myoporaceae). Journal of Ethnopharmacology 44(1): 1–9.

Goddard, C. and Kalotas, A., eds. 1988. Punu: Yankunytjatjara Plant Use. IAD Press, Alice Springs.

Golson, J. 1971. Australian Aboriginal food plants: some ecological and culture-historical implications. In D.J. Mulvaney and J. Golson, eds. Aboriginal Man and Environment in Australia. ANU Press, Canberra.

Graham, Caroline and Hart, Denise. 1997. Prospects for the Australian Native Bushfood Industry. RIRDC Research Paper No 97/22. Rural Industries Research and Development Corporation, Canberra.

Graham, Caroline and Hart, Denise. 1998. Bushfoods. In K. Hyde, ed. The New Rural Industries – a handbook for farmers and investors, pp. 227–34. Rural Industries Research and Development Corporation, Canberra.

Grant, W.J.R. and Buttrose, M.S. 1978. Santalum fruit – domestication of the quandong Santalum acuminatum. Australian Plants 9: 316–18.

Greening Australia. 1994. Bush Food Seminar. Papers and proceedings of a seminar held at Bangalow, NSW, 26 February 1994.

Grice, D., Caughley, G. and Short, J. 1986. Density and distribution of the Australian bustard Ardeotis australis. Biological Conservation 35(3): 259–68.

Grigg, G.F.C. 1995a. Sustainable use of wildlife: a new direction in conservation? In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 3–5. Centre for Conservation Biology, University of Queensland.

Grigg, G.F.C. 1995b. Kangaroo harvesting for conservation of rangelands, kangaroos…and graziers. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 161–5. Centre for Conservation Biology, University of Queensland.

Grigg, G., Hale, P. and Lunney, D., eds. 1995. Conservation through Sustainable Use of Wildlife. Centre for Conservation Biology, University of Queensland.

Grubb, P.J. 1977. The maintenance of species richness in plant communities: the importance of the regeneration niche. Biological Review 52: 107–45.

Haigh, D.J. and Coleman, B. 1995. The current legal situation affecting the use of wildlife by Australian Indigenous people. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 45–53. Centre for Conservation Biology, University of Queensland.

Harwood, C.E. 1994. Human food potential of the seeds of some Australian dry-zone Acacia species. J. Arid Environments 27: 27–35.

Harwood, C.E. and Bush, D., eds. 2002. Breeding Trees for the Low-Rainfall Regions of Southern Australia. Joint Venture Agroforestry Program, Rural Industries Research and Development Corporation, Canberra.

Hegarty, M.P. and Hegarty, E.E. 1996. Development of bushfood resources and areas for future research, with particular reference to the chemical constituents and potential toxicities of bushfoods in current use. Paper presented to the ANBIC, Brisbane conference: ‘Culture of the Land, Cuisine of the People’, 3–4 May 1996. Australian Native Bushfood Industry Council.

Hegarty, M.P., Hegarty, E.E. and Wills, R.B.H. 2001. Food Safety of Australian Plant Bushfoods. RIRDC Publication No 01/28. Rural Industries Research and Development Corporation, Canberra.

Hele, A.E. 2003. Researchers' Extension Program for the Native Foods Industry. RIRDC Publication No 03/013. Rural Industries Research and Development Corporation, Canberra.

Hemon, S., Paillat, P., van Heezik, Yolanda and Judas, J. 2000. Captive breeding of houbara bustards in Saudi Arabia: 11 successful years. British Poultry Science 41(Supplement): S49–S50.

Herbert, A. 1999. Cultivation of Bushfoods (preliminary analysis of the commercial cultivation of six bushfoods). Economic Series 99.6. Market Economics and Rural Adjustment Services, WA Agriculture, Perth.

Hetzel, B.S. 1978. The changing nutrition of Aborigines in the ecosystem of central Australia. In B.S. Hetzel and H.J. Frith, eds. The Nutrition of Aborigines in relation to the Ecosystems of central Australia, pp. 39–47. CSIRO, Melbourne.

Hetzel, B.S. and Frith, H.J., eds. 1978. The Nutrition of Aborigines in relation to the Ecosystems of central Australia. CSIRO, Melbourne.

Horner, R. 2001. Wild harvest. In Proceedings of the Desert Knowledge Bush Food Workshop, August 8, 2001, Centralian College, Alice Springs. NT Government and Desert Knowledge Australia, Alice Springs.

Horsman, Christine. 2000. Domestic Market Analysis for Wildflowers. RIRDC Publication No 00/42. Rural Industries Research and Development Corporation, Canberra.

House, A.P.N. and Harwood, C.E.H., eds. 1992. 'Australian Dry-zone Acacias for Human Food. CSIRO Forestry and Forest Products, Canberra.

Howes, F.N. 1949. Vegetable gums and resins. Chronica Botanica.

Hyde, K. 1998. Success factors for developing new rural industries. Agricultural Science 11(2): 14–17.

Hynes, R.A. and Chase, A.K. 1982. Plants, sites and domiculture: Aboriginal influence upon plant communities in Cape York Peninsula. Archaeology in Oceania 17: 38–50.

Isaacs, Jennifer. 1989. Bush Food – Aboriginal food and herbal medicine. Weldon Publishing, Sydney.

Isaacs, Jennifer. 1992. Bush Food. Aboriginal Australia, Culture and Society Series. Aboriginal and Torres Strait Islander Commission, in cooperation with the Council for Aboriginal Reconciliation, Canberra.

Jacquet, Jeanne-Marie and Launay, F. 1997. Diurnal behaviour patterns in the houbara bustard (Chlamydotis undulata) in captivity: effects of temperature and day length. Applied Animal Behaviour Science 55(1–2): 137–51.

James, K.W. 1983. Analysis of Indigenous Australian foods. Food Tech. Aust. 35: 342–3.

James, P. 1994. Bushfoods – a vision for the future. In Greening Australia. Bush Food Seminar. Papers and proceedings of a seminar held at Bangalow, NSW, 26 February 1994.

Janke, Terri. 1997. Our Culture, Our Future. Proposals for the recognition and protection of Indigenous cultural and intellectual property. ATSIC, Canberra.

JECFA. 2003. Compendium of Food Additive Specifications Volume 1. FAO Food and Nutrition Paper 52/1. Joint FAO/WHO Expert Committee on Food Additives. FAO, Rome. <www.fao.org/es/esn/jecfa/database/cover.htm>

Johnston, T.H. and Cleland, J.B. 1943. Native names and uses of plants in the north-eastern corner of South Australia. Trans. Roy. Soc. SA 67(1): 149–488.

Johnston, R. 1996. Still Our Country – Aboriginal perspectives on rangelands management. Submission to the National Rangeland Management Working Group for the National Strategy for Rangeland Management and Action Plan. Central Land Council, Alice Springs.

Jones, G.P., ed. 1985. The Food Potential of Seeds from Australian Native Plants. Proceedings of a Colloquium held at Deakin University, March 7. Deakin University Press, Geelong.

Jones, G.P., Tucker, D.J., Rivett, D.E. and Sedgley, M. 1985. The nutritional potential of the quandong (Santalum acuminatum) kernel. Journal of Plant Foods 6: 239–46.

Jones, G.P., Birkett, A., Sanigorski, A., Sinclair, A.J., Hooper, P.T., Watson, T. and Rieger, V. 1994. Effects of feeding quandong (Santalum acuminatum) oil to rats on tissue lipids, hepatic cytochrome P-450 and tissue histology. Food Chemistry and Toxicology 32: 521–25.

Jones, G.P., Rao, K.S., Tucker, D.J., Richardson, B., Barnes, A. and Rivett, D.E. 1995. Antimicrobial activity of santalbic acid from the oil of Santalum acuminatum (quandong). International Journal of Pharmacognosy 33(2): 120–3.

Jones, R. and Mehan, Betty. 1989. Plant foods of the Gidjingali: ethnographic and archaeological perspectives from northern Australia on tuber and seed exploitation. Chapter 7 in D.R. Harris and G.C. Hillman, eds. Foraging and Farming: the evolution of plant exploitation. Unwin Hyman, London.

JVAP. 2002. Emerging Products and Services from Trees in Low-Rainfall Areas. Joint Venture Agroforestry Program, Research Update Series 2. Rural Industries Research and Development Corporation, Canberra.

Kalotas, A.C. 1980. A list of plant species traditionally and currently utilised by the Pitjantjatjara people of Pipalyatjara and the surrounding region. In H.C. Coombs et al. A Certain Heritage. ANU Press, Canberra.

Kalotas, A.C. 1993a. Recording and applying Aboriginal botanical knowledge in Western Australia: some recent examples and future prospects. In N.M. Williams and G. Baines, eds. Traditional Ecological Knowledge: wisdom for sustainable development. Centre for Resource and Environmental Studies (CRES), ANU, Canberra.

Kalotas A.C. 1993b. The application of Aboriginal botanical knowledge and skills to revegetation in arid lands. Proceedings of the Goldfields International Conference on Arid Landcare 29 October – 1 November. Goldfields Arts Centre, Kalgoorlie, WA.

Kalotas, A.C. 1996. Aboriginal knowledge and use of fungi. Fungi of Australia, 1B, pp. 269–96. Australian Biological Resources Survey, Canberra.

Karingal Consultants. 1994. The Australian Wildflower Industry – a review. RIRDC Research Paper No 94/9. Rural Industries Research and Development Corporation, Canberra.

Kean, J. 1990. Aboriginal–Acacia relationships in central Australia. Rec. SA Museum 24: 111–24.

Laird, Sarah, A. 1995. Fair deals in the search for new natural products. World Wide Fund for Nature, CH-1196, Gland, Switzerland. Available at: People and Plants Online – <http://www.rbgkew.org.uk/peopleplants/dp/dp1.htm>

Laird, Sarah, A. 2000. The botanical medicines industry. In K. ten Kate and S.A. Laird, eds, The Commercial Use of Biodiversity: access to genetic resources and benefit sharing, pp. 78–116. Earthscan, London.

Laird, Sarah, A. 2002. Biodiversity and Traditional Knowledge: equitable partnerships in practice. Earthscan, London.

Lands, Merrilee. 1987. Mayi – Some Bush Fruits of Dampierland. Magabala Books, Broome, WA.

Lassak, E.V. and McCarthy, T. 1983. Australian Medicinal Plants. Methuen, Sydney.

Lassak, E.V. and Southwell, I.A. 1977. Essential oil isolates from the Australian flora. International Flavour and Fragrance May–June: 126–32.

Last, M. 1988. Re-afforestation and horticulture in remote communities in central Australia. In K. Mathew and R. Lantzke, eds. Science and Technology for Remote Communities. Conference Proceedings. Remote Areas Developments Group, Murdoch University, WA.

Latz, P.K. and Griffin, G.F. 1978. Changes in Aboriginal land management in relation to fire and food plants in central Australia. In B.S. Hetzel and H.J. Frith, eds. The Nutrition of Aborigines in relation to the Ecosystems of central Australia. CSIRO, Melbourne.

Latz, P.K. 1995. Bushfires and Bushtucker – Aboriginal plant use in central Australia. IAD Press, Alice Springs.

Launay, F., Combreau, O., Aspinall, S.J., Loughland, R.A., Gubin, B. and Karpov, F. 1999. Trapping of breeding houbara bustard (Chlamydotis undulata). Wildlife Society Bulletin 27(3): 603–8.

Lawn, R.J. and Holland, A.E. 2003. Variation in the Vigna lanceolata complex for traits of taxonomic, adaptive or agronomic interest. Australian Journal of Botany 51: 295–308.

Lea, D.A.M. 1992. Sustainable development: people, planning and ethics. In I. Moffat and A. Webb, eds. Conservation and Development Issues in Northern Australia. North Australia Research Unit (NARU), Darwin.

Leiper, G., n.d?. Mutooroo: plant use by Australian Aboriginal people. Assembly Press, Australia.

Lethbridge, B. and Randell, Barbara. 2003. Genetic and Agronomic Improvement of Quandong. RIRDC Publication No 03/110. Rural Industries Research and Development Corporation, Canberra.

Lindsay, E.A., Yoke, B., Jamie, J. and Bremner, J.B. 2000. Antibacterial compounds from Carissa lanceolata R.Br. Phytochemistry 55(5): 403–6.

Ling, Chee Yoke. 1998. UN moves to protect biodiversity and traditional knowledge. Third World Resurgence 97: 3–7.

Lister, P.R., Holford, P., Haigh, T. and Morrison, D.A. 1996. Acacias in Australia: ethnobotany and potential food crop. In J. Janick, ed. Progress in New Crops, pp. 228–36. ASHS Press, VA, USA.

Levitt, D. 1981. Plants and People: Aboriginal uses of plants on Groote Eylandt. AIATSIS, Canberra.

Lonain, D.M. and Warrington, S. 2001. Is translocation an effective tool to remove predatory foxes from a desert protected area? Journal of Arid Environments 48(2): 205–9.

Loveys, B.R. and Jusaitis, M. 1994. Stimulation of germination of quandong (Santalum acuminatum) and other Australian native plant seeds. Australian Journal of Botany 42(5): 565–74.

Loveys, Beth R., Loveys, Brian R. and Tyerman, S.D. 2001. Water relations and gas exchange of the root hemiparasite Santalum acuminatum. Australian Journal of Botany 49(4): 479–86.

Loveys, B.R., Sedgley, M. and Simpson, R.E. 1984. Identification and quantitative analysis of methyl benzoate in quandong (Santalum acuminatum) kernels. Food Technology in Australia 36(6): 280–2, 289.

Loveys, Beth R., Tyerman, S.D. and Loveys, Brian R. 2002. Effect of different host plants on the growth of the root hemiparasite Santalum acuminatum (quandong). Australian Journal of Experimental Agriculture 42: 97–102.

Low, T. 1989. Bush Tucker – Australia's wild food harvest. Angus and Robertson, Sydney.

Low, T. 1990. Bush Medicine – a pharmacopoeia of natural remedies. Angus and Robertson, Sydney.

Low, T. 1991. Australian Nature Field Guide: wild food plants of Australia. Angus and Robertson, North Ryde.

Lui, Yandi D. and Longmore, R.B. 1996. Notes on, and publications with regard to, the pharmaceutical properties of the seed kernel of Santalum spicatum. Various papers. Proceedings of the Nutrition Society of Australia 20 and Australian Journal of Hospital Pharmacy 26(6).

Macfarlane, W.V. 1978. Aboriginal desert hunter/gatherers in transition. In B.S. Hetzel and H.J. Frith, eds. The Nutrition of Aborigines in relation to the Ecosystems of central Australia, pp. 49–62. CSIRO, Melbourne.

Maggiore, Pat M.A. 1985. Utilisation of some Australian seeds in edible food products. In G.P. Jones, ed. 1985. The Food Potential of Seeds from Australian Native Plants. Proceedings of a Colloquium held at Deakin University, March 7. Deakin University Press, Geelong.

Mansfield, J.G. and Kenna, G. 1995. Cut Flower Potential of Centralian Species – a literature review. RIRDC Project Report – Project DNT–16A. Rural Industries Research and Development Corporation, Canberra.

Maslin, B.R., Dunn, J.E. and Conn, E.E. 1988. Cyanogenesis in Australian species of Acacia. Phytochemistry 27(2): 421–8.

Maslin, B.R., Thomson, L.A.J., McDonald, M.W. and Hamilton-Brown, S. 1998. Edible Wattle Seeds of Southern Australia: a review of species for use in semi-arid regions. CSIRO, Melbourne.

Mays, T.D., Asebey, E.J., Boyd, M.R. and Cragg, G.M. 1994. Quid Pro Quo – a re-examination of the equities in the search for new medicines from biodiversity. In Intellectual Property and Indigenous Rights: alternatives for equity and conservation. National Cancer Institute, National Institutes for Health, US Department of Health and Human Services.

McDonald, I. 1997. Protecting Indigenous Intellectual Property – a copyright perspective. Australian Copyright Council, Sydney.

McGlauchlin, D. 1982. A Checklist of Biotic Resources utilised by Aboriginal People in the Alligator Rivers Region. Northern Land Council, Darwin.

McKinna, D.A. 1999. Critical success factors and strategic issues in new agricultural enterprises. Newcrops Newsletter No 11 – 2 (January). University of Queensland.

Meek, P.D. and O'Brien, P.H., eds. 1992. Wildlife Use and Management: report of a workshop for Aboriginal and Torres Strait Islander people. Bureau of Rural Resources Report No R/2/92, Australian Government Publishing Service, Canberra.

Meggitt, M.J. 1957. Notes on the vegetable foods of the Walpiri Aborigines of central Australia. Oceania 28: 143–5.

Moore, T. 1995. Protecting intellectual property. Ecos 85 Spring: 32–3.

Moreton, S.R. and Pickup, G. 1992. Sustainable land management in arid Australia. Search 23(2): 66–8.

Moreton, S.R. and Price, P.C., eds. 1994. R & D for Sustainable Use and Management of Australia's Rangelands. Land and Water Resources Research and Development Corporation, Canberra.

Morse, J., Cassanet, M. McCarthy, Natalie and Low, W.A. 2002. Firewood for Central Australian Aboriginal Communities – studies of firewood availability and use and impact and sustainability of harvesting in mulga and other woodlands. Consultancy report to Tangentyere Landcare and Environmental Health Unit for NHT project number 20041.

Mortlock, W. 1998a. Native Seed in Australia: a community perspective. Florabank, Greening Australia, Canberra.

Mortlock, W. 1998b. Native Seed in Australia: a survey of collection, storage and distribution of native seed for revegetation. Florabank, Greening Australia, Canberra.

Morton, D., ed. 2001. Bushfood Workshop. Proceedings of a workshop held at the Red Centre Resort, Alice Springs, October 23, 2001. NT Government Department of Community Development, Sport and Cultural Affairs, Alice Springs.

Murray, D.R. 1984. The food value of Acacia seeds. Austr. Plants 13(101): 25–6.

Naughton, J.M., O'Dea, K. and Sinclair, A.J. 1986. Animal foods in traditional Aboriginal diets: polyunsaturated and low in fat. Lipids 21: 684–90.

Nicholls, P.K., Bailey, T.A. and Samour, J.A. 1997. Fatty liver syndrome in captive bustards: clinical, pathological and epidemiological findings. Avian pathology 26(1): 19–31.

O'Connell, J.F., Latz, P.K. and Barnett, P. 1983. Traditional and modern plant use among the Alyawarr of central Australia. Economic Botany 37: 80–109.

O'Connor, P.J., Smith, Sally E. and Smith A.F. 2001. Arbuscular mycorrhizal associations in the southern Simpson Desert. Australian Journal of Botany 49(4): 493–9.

O'Dea, K. 1988. Kangaroo meat – polyunsaturated and low in fat: ideal for cholesterol-lowering diets. Australian Zoologist 24: 140–3.

Orr, T.M. and Hiddens, L.J. 1987. Contribution of Australian acacias to human nutrition. In J.W. Turnbull, ed. Australian Acacias in Developing Countries, pp. 112–15. ACIAR Proceedings No 16. Canberra.

Palmer, K. and Brady, M. 1991. Diet and Dust in the Desert: an Aboriginal community, Maralinga Lands, South Australia. Aboriginal Studies Press, Canberra.

Palombo, E.A. and Semple, Susan J. 2001. Antibacterial activity of traditional Australian medicinal plants. Journal of Ethnopharmacology 77(2–3): 151–7.

Parker, A. 1980. An ethnobotany of the Western Desert, Leonora, WA. Newsletter New Series No 13. Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra.

Parsons, R.F. and Brown, J.H. 1982. Causes of plant species rarity in semi arid southern Australia. Biological Conservation 24(3): 183–92.

Penfold, A.R. and Morrison, F.R. 1994. Australian essential oils. Wanatca Yearbook 18: 70–80.

Pennacchio, M., Syah, Yana M., Ghisalberti, E.L. and Alexander, Elizabeth. 1996. Cardioactive compounds from Eremophila species. Journal of Ethnopharmacology 53(1): 21–7.

Peterson, N. 1978. Aboriginal uses of Australian Solonaceae. In J.G. Hawkes et al. The Biology and Taxonomy of Solonaceae. Academic Press, London.

Phelps, D.G. 1997. Feasibility of a Sustainable Bushfood Industry in Western Queensland. RIRDC Research Paper No 97/37. Rural Industries Research and Development Corporation, Canberra.

Phelps, D.G. and Phelps, W.J. 1994. Economic food plants of western Queensland. Proceedings of the 8th Australian Rangelands Society Conference. June 21–23, Katherine, NT.

Phelps, D.G. and Phelps, W.J. 1996. Australia's bushfood potential in the rangelands: wild harvest or plantation production? Proceedings of the 9th Biennial Australian Rangelands Society Conference. September 24–27, Port Augusta, SA.

Piggot, M.J., Ghisalberti, E.L. and Trengrove, R.D. 1997. Western Australian sandalwood oil: extraction by different techniques and variations of the major components in different sections of a single tree. Flavour and Fragrance Journal 12(1): 43–6.

Pollock, K.H. 1995. The challenge of measuring change in wildlife populations: a biometrician's perspective. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 117–21. Centre for Conservation Biology, University of Queensland.

Posey, D.A. 1996. Indigenous peoples and traditional resource rights: a basis for equitable relationships? In Ros Sultan, ed. ECOPOLITICS IX – Perspectives on Indigenous People's Management of Environmental Resources, pp. 43–60. Proceedings of a conference, NTU, Darwin, Sept 1–3, 1995. Northern Land Council, Darwin.

Posey, D.A. and Dutfield, G. 1996. Beyond Intellectual Property: towards traditional resource rights for Indigenous peoples and local communities. International Development Research Centre, Canada.

Prenzel P., n.d. Simple grafting for growers – winter time is quandong grafting time. AQIA website: <http://www.aqia.com.au/research/grafting.html>

Preuss, P. and Rogers, J. 1995. Consumptive use of wildlife: conservation or exploitation? In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 69–72. Centre for Conservation Biology, University of Queensland.

Radomiljac, A.M. 1998. The influence of pot host species, seedling age and supplementary nursery nutrition on Santalum album Linn. (Indian Sandalwood) plantation establishment within the Ord River Irrigation Area, Western Australia. Forest Ecology and Management 102(2–3): 193–201.

Radomiljac, A.M., McComb, Jen A. and Shea, S.R. 1998. Field establishment of Santalum album L.: the effects of the time of introduction of a pot host (Alternanthera nana R.Br.). Forest Ecology and Management. 111(2–3): 107–18.

Ramsay, B. 1994. Commercial Use of Wild Animals. Department of Primary Industries and Energy, Bureau of Resource Sciences. Australian Government Publishing Service, Canberra.

Reid, E.J. and Betts, T.J. 1979. Records of Western Australian plants used by Aboriginals as medicinal agents. Planta Medica 36: 164–73.

Richmond, G.S. 1993. A review of the use of Eremophila (Myoporaceae) by Australian Aborigines. Journal of the Adelaide Botanic Gardens 15(2): 101–7.

Richmond, G.S. and Chinnock, R.J. 1994. Seed germination of the Australian desert shrub, Eremophila (Myoporaceae). Botanical Review 60(4): 483–503.

Richmond, G.S. and Ghisalberti, E.L. 1994a. Seed dormancy and germination mechanisms in Eremophila (Myoporaceae). Australian Journal of Botany 42(6): 705–15.

Richmond, G.S. and Ghisalberti, E.L. 1994b. The Australian desert shrub, Eremophila (Myoporaceae): medicinal, cultural, horticultural and phytochemical uses. Economic Botany 42(6): 705–15.

Ringer, Sammy, ed., n.d. Australian Bushfood Magazine. Bi-monthly magazine/newsletter. Melaney, Qld [discontinued].

RIRDC. 1998. Draft R & D plan for the Australian bushfood industry 1998–2002. Fourth draft, January. Rural Industries Research and Development Corporation, Canberra.

Robins, Juleigh. 1997. Wild Lime – Cooking from the Bushfood Garden. Allen and Unwin, Melbourne.

Robins, Juleigh. 2001. National and international market background. In BPIWG, ed. Desert Knowledge Bush Food Workshop, August 8, 2001, Centralian College, Alice Springs. Bush Products Initiative Working Group, Desert Knowledge Project, Alice Springs.

Rogers, Kelly L., Grice, I.D. and Griffiths, Lyn R. 2000. Inhibition of platelet aggregation and 5-HT release by extracts of Australian plants used traditionally as headache treatments. European Journal of Pharmaceutical Sciences 9(4): 355–63.

Rose, B. 1995. Land Management Issues: attitudes and perceptions amongst Aboriginal people of central Australia. Central Land Council, Alice Springs.

Rose, Deborah. 1987. Bush Medicines – a Ngarinman and Bilinara pharmacopoeia. AIATSIS, Canberra.

Ross, Helen, Young, Elspeth and Liddle, Lynette. 1994. Mabo, an inspiration for Australian land management. Aust. J. Env. Manag. 1(1): 24–41.

Ross, J. 1995. A Taste of Australia: authentic Australian cuisine. Five Mile Press, Noble Park, Vic.

Sattler, P.S. 1995. The greater conservation gain from a 'new' kangaroo industry for the mulga lands: ecologically sustainable management. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 176–85. Centre for Conservation Biology, University of Queensland.

Savory, C.J. and Deag, J.M. 2000. Factors affecting egg number in a captive population of houbara bustards (Chlamydotis undulata undulata) over a four year period. British Poultry Science 41(Supplement): S51–S52.

Scarlett, N., White, N. and Reid, J. 1982. Bush medicines: the pharmacopoeia of the Yolngu of Arnhem Land. In J. Reid, ed. Body, Land and Spirit: health and healing in Aboriginal society. UQP, St Lucia.

Schultz, M. 1996. Feasibility Study of Salicornieae as Oil-seed Halophytes for Saline Land and Water. RIRDC Project Report – Project DAV-88A. Rural Industries Research and Development Corporation, Canberra.

Schweitzer, J.D., Jacquet, Jeanne-Marie, Tcheredov, D. and Launay, F. 2000. Environmental variables controlling houbara bustard breeding in captivity: Is a wild endangered bird species able to breed in artificial conditions? British Poultry Science 41(Supplement): S52–S53.

Scott, M.P. 1972. Some Aboriginal food plants of the Ashburton District, Western Australia. West. Aust. Naturalist 12: 94–6.

Seddon, P.J., Launay, F., van Heezik, Yolanda and Al Bowardi, M. 1999. Methods for live trapping houbara bustards. Journal of Field Ornithology 70(2): 169–81.

Semple, S.J., Reynolds, G.D., O'Leary, M.C. and Flower, R.L.P. 1998. Screening of Australian medicinal plants for antiviral activity. Journal of Ethnopharmacology 60(2): 163–72.

Simopoulos, A.P., Norman, H.A., Gillaspy, J.E. and Duke, J.A. 1992. Common purslane a source of Omega-3 fatty acids and antioxidants. Journal of the American College of Nutrition 11(4): 374–82.

Simpson, Sarah and Chudleigh, P. 2001. Wattle Seed Production in Low Rainfall Areas: a report for the RIRDC/Land and Water Australia/FWPRDC Joint Venture Agroforestry Program. RIRDC Publication No 01/08. Rural Industries Research and Development Corporation, Canberra.

Simpson, Sarah and Chudleigh P. 2003. Wattle Seed Workshop, Canberra, 12 March 2002 – Proceedings of a Workshop to Assess Prospects and Develop R & D Priorities for a Wattle Seed Industry. RIRDC Publication No 03/024. Rural Industries Research and Development Corporation, Canberra.

Sinclair, A.J. 1988. Nutritional properties of kangaroo meat. Australian Zoologist 24: 146–8.

Slater, A.T. and Carson, Cynthia J. 2003. Australian Cut Flower Best Bets Program. RIRDC Publication No 03/055. Rural Industries Research and Development Corporation, Canberra.

Smith, M.A. 1989. Seed gathering in inland Australia: current evidence from seed grinders on the antiquity of the ethnohistorical pattern of exploitation. In D.R. Harris and G. Hillman, eds. Foraging and Farming, pp. 306–17. Unwin and Hyam, London.

Smith, M. and Kalotas, A.C. 1985. Bardi plants: an annotated list of plants and their use by the Bardi Aborigines of Dampierland in north-western Australia. Records of the Western Australian Museum 12: 317–59.

Smith, N.M. 1991. Ethnobotanical field notes from the Northern Territory, Australia. J. Adelaide Bot. Gard 14(1): 1–65.

Smith, N.M. Wididburu, B., Harrington, R.N. and Wightman, G.M. 1993. Ngarinyman ethnobotany: Aboriginal plant use from the Victoria River area, northern Australia. Northern Territory Botanical Bulletin 16. Conservation Commission of the NT, Darwin.

Smith, N.M. and Wightman, G.M. 1990. Ethnobotanical notes from Belyuen, Northern Territory, Australia. Northern Territory Botanical Bulletin 10. Conservation Commission of the NT, Darwin.

Smythe, D. and Von Sturmer, J. 1981. The Use of Plants by Aboriginal People in the Oenpelli Region of Western Arnhem Land. AIATSIS, Canberra.

Southwell, I.A. 1987. Essential oil isolates from the Australian flora. Flavour and Fragrance Journal 2: 21–7.

Stafford Smith, D.M. McNee, A., Rose, B., Snowdon, G. and Carter, C. 1994. Goals and strategies for Aboriginal cattle enterprises. Rangelands Journal 16: 77–93.

Stahle, P.P. and Ward, D. 1996. Evaluation of the Potential of Growing Tuber melanosporum as a Crop on Mainland Australia for Export and Domestic Consumption. Rural Industries Research and Development Corporation, Canberra.

Stynes, B. 1997. Opportunities for contributing to the development of Aboriginal food plants. Tropical Grasslands 31(4): 311–14.

Sultan, Ros, ed. 1996. ECOPOLITICS IX – Perspectives on Indigenous People's Management of Environmental Resources. Proceedings of a conference, NTU, Darwin, Sept 1–3, 1995. Northern Land Council, Darwin.

Sweeney, A.P., Wyllie, S.G., Shalliker R.A. and Markham, J.L. 2001. Xanthine oxidase inhibitory activity of selected Australian native plants. Journal of Ethnopharmacology 75(2–3): 273–7.

Sweeney, G. 1947. Food supplies of a desert tribe. Oceania 17: 289–99.

Symond, D.E. 1979. Fruit diversity and dispersal in Solanum in Australia. Journal of the Adelaide Botanic Gardens 1(6): 321–32.

Symond, D.E. 1981. A revision of the genus Solanum in Australia. Journal of the Adelaide Botanic Gardens 4: 1–367.

Tennakoon, K.U., Pate, J.S. and Arthur, D. 1997. Ecophysiological aspects of the woody root hemiparasite Santalum acuminatum (R.Br.)A.DC. and its common hosts in southwestern Australia. Annals of Botany (London) 80(3): 245–56.

Tepper, J.G. 1880. Probable curative properties of Melaleuca uncinata. Trans. Roy. Soc. S.A. 3: 174–5.

Testro, N. 2002. The Australian native food industry and ecological sustainability. MEnvSc (Qual) thesis, School of Geography and Environmental Science, Monash University, Melbourne.

Thomson, L.A.J. 1992. Australia's subtropical dry-zone Acacia species with human food potential. In A.P.N. House and C.E.H. Harwood, eds. Australian Dry-zone Acacias for Human Food. CSIRO Forestry and Forest Products, Canberra.

Thomson, L.A.J., Turnbull, J.W. and Maslin, B.R. 1994. The utilisation of Australian species of Acacia, with particular reference to those of the subtropical dry zone. J. Arid Environments 27: 279–95.

Thorburn, A.W., Brand, J.C., Cherikoff, V. and Truswell, A.S. 1987a. Lower post-prandial plasma glucose and insulin after addition of Acacia coriacea flour to wheat bread. Aust. & New Zeal. J. Medicine 17: 24–6.

Thorburn, A.W., Brand, J.C., O'Dea, K., Spargo, R.M. and Truswell, A.S. 1987b. Plasma glucose and insulin responses to starchy foods in Australian Aborigines – a population now at high risk of diabetes. American Journal of Clinical Nutrition 46(2): 282–5.

Tilmouth, T. 1994a. Aboriginal aspirations for land management. In S.R. Moreton and P.C. Price, eds. R & D for Sustainable Use and Management of Australia's Rangelands. Land and Water Resources Research and Development Corporation, Canberra.

Tilmouth, T. 1994b. Indigenous knowledge and sustainable development. Australasian Science Summer issue: 23–8.

Tindale, N.B. 1953. On some Australian Cossidae including the moth of the Witjuti (Witchety) grub. Trans. Roy. Soc. SA 76: 56–65.

Tindale, N.B. 1966. Insects as food for the Australian Aborigines. Australian Natural History 15: 179–83.

Trudgen, R.I. 1995. Aboriginal Traditional Economic Systems in Central and East Arnhemland. Aboriginal Resource and Development Services Inc., Darwin.

Tunbridge, D. 1995. Aspects of Aboriginals' traditional relationship to the environment. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 35–44. Centre for Conservation Biology, University of Queensland.

Turner, Margaret Kemarre and Henderson, J. 1994. Bush Foods – Arrernte foods from central Australia. IAD Press, Alice Springs.

Turner, R. and Nugent, G. 1995. Indigenous people, land and wild resources. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 344–5. Centre for Conservation Biology, University of Queensland.

van Heezik, Yolanda and Seddon, P.J. 1998. Ontogeny of behaviour of hand-reared and hen-reared captive houbara bustards. Zoo Biology 17(3): 245–55.

Vardon, M., Missi, C. and Cleary, Miriam. 1996. Commercial wildlife use: potential benefits and opportunities for Indigenous Australians. In Ros Sultan, ed. ECOPOLITICS IX – Perspectives on Indigenous People's Management of Environmental Resources, pp. 84–7. Proceedings of a conference, NTU, Darwin, Sept 1–3, 1995. Northern Land Council, Darwin.

Various. 1996. Bush foods – special feature. [Articles on bushfoods, quandong, native citrus, tea tree, lemon myrtle and trees selection]. Rural Research 172, Spring. CSIRO, Melbourne.

Vassal, J. and Mouret, M. 1989. Preliminary results of trials of some Australian Acacia species in southern Corsica. Foret Mediterraneenne 11(2): 113–20.

Walsh, Fiona. 1992. The relevance of some aspects of Aboriginal subsistence activities to the management of national parks: with reference to Martu people of the western desert. In J. Birkead, T. DeLacy and L. Smith, eds. Aboriginal Involvement in Parks and Protected Areas, pp. 75–97. Aboriginal Studies Press, Canberra.

Walsh, Fiona. 1995. Interactions between land management agencies and Australian Aboriginal people: rationale, problems and some lessons. In D.A. Saunders, J.L. Craig and E.M. Mttiske, eds. Nature Conservation 4: the role of networks, pp. 88–106. Surrey Beatty & Sons, Sydney.

Walsh, Fiona and Mitchell, P., eds. 2002. Planning for Country: Cross-cultural approaches to decision-making on Aboriginal lands. IAD Press, Alice Springs.

Warburton, Cindy L., James, Elizabeth A., Fripp, Yvonne J., Truemand, S. J. and Wallace, Helen M. 2000. Clonality and sexual reproductive failure in remnant populations of Santalum lanceolatum (Santalaceae). Biological Conservation 96(1): 45–54.

Warren, Rosemary and Ryder, M. 2003. Soil Biological Constraints and Benefits to Quandong and Other Native Food Production. RIRDC Web Publication No 03/138. Rural Industries Research and Development Corporation, Canberra.

Webb, G.J.W. 1995. The links between wildlife conservation and use. Keynote address. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 15–20. Centre for Conservation Biology, University of Queensland.

Wells, Kathryn. 1996. The cosmic irony of intellectual property. Cultural Property. A journal of the Australian Key Centre for Cultural and Media Policy 7(3): 45–68.

Whitehead, P. 2003. Indigenous products from Indigenous people: linking enterprise, wildlife use and conservation. Paper presented to the 'Seizing our Economic Future Forum', Alice Springs, 6–7 March 2003.

Whitehead, P., Gorman, J., Griffith, A., Wightman, G., Massarella, H. and Altman, J., eds. 2002. Small Scale Commercial Native Plant Harvests by Indigenous Communities. Final report to the JVAP, RIRDC, the Forest and Wood Products Research and Development Corporation and NHT. Key Centre for Tropical Wildlife Management and RIRDC, Darwin.

Wightman, G.M., Dixon, D., Williams, L.L.V. and Dalywaters, I. 1992a. Mudburra ethnobotany: Aboriginal plant use from Kulumindi (Elliot), northern Australia. Northern Territory Botanical Bulletin 14. Conservation Commission of the NT, Darwin.

Wightman, G.M., Jackson, D.M. and Williams, L.L.V. 1991. Alawa ethnobotany: Aboriginal plant use from Minyerri, northern Australia. Northern Territory Botanical Bulletin 11. Conservation Commission of the NT, Darwin.

Wightman, G.M., Kalabidi, G.J, Dodd, Topsy N.N., Frith, Roslyn N.D., Jiwijiwij, Mildred N., Oscar, Josephine N.N., Wavehill, Ronnie J.W., Holt, S., Limbunya, J.J. and Wadrill, Violet, N. 1994. Gurindji ethnobotany: Aboriginal plant use from Dagaragu, northern Australia. Northern Territory Botanical Bulletin 18. Conservation Commission of the NT, Darwin.

Wightman, G.M., Roberts, J.G. and Williams, L.L.V. 1992b. Mangarrayi ethnobotany: Aboriginal plant use from the Elsey area, northern Australia. Northern Territory Botanical Bulletin 15. Conservation Commission of the NT, Darwin.

Wightman, G.M. and Smith, N.M. 1989. Ethnobotany vegetation and floristics of Millingimbi, northern Australia. Northern Territory Botanical Bulletin 6. Conservation Commission of the NT, Darwin.

Williams, Nancy M. 1998. Intellectual Property and Aboriginal Environmental Knowledge. CINCRM Discussion paper No 1. Centre for Indigenous Natural and Cultural Resource Management, Northern Territory University, Darwin.

Williams, S.E. 1995. Measuring and monitoring wildlife communities: the problem of bias. In G. Grigg, P. Hale and D. Lunney, eds. Conservation through Sustainable Use of Wildlife, pp. 140–4. Centre for Conservation Biology, University of Queensland.

Wilson, G., McNee, A. and Platts, P. 1992. Wild Animal Resources: their use by Aboriginal communities; a study commissioned by ATSIC. Australian Government Publishing Service, Canberra.

Wilson, P.G. 1980. A revision of the Australian species of Salicornieae Chenopodiaceae. Nuytsia 3(1): 3–154.

Yaniv, Z, Dafni, A., Friedmand, J. and Palevitch, D. 1987. Plants used for the treatment of diabetes in Israel. Journal of Ethnopharmacology 19(2): 145–52.

Young, Elspeth. 1988a. Aboriginal Cattle stations in the East Kimberley: communities or enterprises? EKIAP, Working Paper No 21. CRES, ANU, Canberra.

Young, Elspeth. 1988b. Land use and resources: a black and white dichotomy. In R. Heathcote and J. Mabbut, eds. Land, Water and People: geographical essays in Australia resource management. Allen and Unwin, Sydney.

Young, Elspeth. 1995. Third World in the First: development and Indigenous peoples. Routledge, London and New York.

Young, Elspeth, Ross, Helen, Johnston, Judy and Kesteven, J., 1991. Caring for Country: Aborigines and land management. Australian National Parks and Wildlife Service (now Environment Australia), Canberra.

Young, Elspeth and Ross, Helen. 1994. Using the Aboriginal rangelands: ‘insider’ and ‘outsider’ perspectives. The Rangelands Journal 16(2): 184–97.

Zorzetto, A. and Chudleigh, P. 1999. Commercial Prospects for Low Rainfall Agroforestry. RIRDC Publication No 99/152. Joint Venture Agroforestry Program, Rural Industries Research and Development Corporation, Canberra.