Submission to the House of Representatives Standing Committee on Primary Industries and Regional Services Inquiry into Development of High Technology Industries in Regional Australia Based on Bioprospecting

Executive Summary

Bioprospecting is the search for new products with a commercial use, from biological resources. Foods, fibres and drugs have always been derived from nature, but new and developing technologies have increased interest in biological resources as a source of new products. Australians have become more aware of the abundance of Australia's biological resources and increasingly interested both in their conservation and their economic value.

AFFA considers that there is clear potential for industries based on bioprospecting in Australia. However, the potential for these industries to develop in regional Australia is not so clear, as a number of factors will affect the location of any new industry. These include access to inputs (such as natural produce), processing requirements and access to markets.

The present inquiry covers four terms of reference:

1. *The contribution towards the development of high technology knowledge industries based on bioprospecting, bioprocessing and related biotechnologies*

A good deal of sophisticated work is already going on in the area of bioprospecting and related industries, including searching the marine environment for substances to use as drugs. To date, the agriculture and food industries have seen the most products reach the market, for example "bushfoods". There are a number of "success stories" in this area and a number of missed opportunities. Some industries have been established in the regions.

2. *Impediments to growth of these new industries*

Bioprospecting involves many different stages and it is not clear where the main impediments to industry growth might lie. Claims are made that access to the natural environment to search for and collect suitable material to assay is problematic, and that lack of clear title to the natural resources involved contributes to uncertainty and is a disincentive to undertaking bioprospecting activities. However, their potential impact is largely untested in the overall understanding of the broad range of factors affecting bioprospecting in Australia.

In some areas – for example in drug development – Australian companies may generally lack the large financial resources necessary. Australia may be better placed in less expensive areas of research and development, such as the development of "bushfoods".

The general problem of the commercialisation of research and development remains a challenge. Much attention has been paid to this issue, especially in the recent Government statement on innovation ("Backing Australia's Ability"). Particularly important is the issue of bridging the gap between research and development and the early stages of commercialisation. The Government initiatives in this area are important for research-based industries such as those likely to be based on bioprospecting.

AFFA is closely involved in this area through managing the Government's matching dollar for dollar arrangements for the rural Research and Development Corporation program. Last year, the Government contributed over $150m to rural-related R&D. Other programs for which AFFA has responsibility are the New Industries Development Program and the Agriculture - Advancing Australia Farm Innovation Program.

Whether industries based on bioprospecting can grow in rural and regional Australia will depend to a large extent on downstream processing requirements. Some products discovered by bioprospecting will be able to be synthesised rather than sourced from nature. Even if they must be sourced from living organisms, there is the possibility that the organisms can be grown in places remote from where they were first found, or even outside Australia.

While a continuing need to access the natural biological resource is one factor affecting the location of a developing industry, it is not the only one. For example, many food industries that are based on a natural resource are not located near that resource but are sited close to the markets. Considerations regarding market access, transport, availability of a workforce, and costs of different sites will all come into play when decisions about where to locate a new industry are made.

3. The capacity to maximise benefit through intellectual property rights and other mechanisms to support development of these industries in Australia

The Commonwealth has in place well-developed intellectual property laws. In the case of plant variety protection, AFFA is responsible for administering the legislation on plant breeder's rights.

It is sometimes suggested that Australian industry tends to lack expertise in using intellectual property rights to best advantage. Improved expertise in handling intellectual property (IP) should support greater returns to the Australian economy. However, patenting and plant variety rights are only part of the IP question when considering industries based on bioprospecting. Effective management and commercialisation of R&D outcomes including through application for IP rights is also important. To this end, the Commonwealth, in conjunction with the Grains Research and Development Corporation (GRDC) and the Australian National University, is establishing the Australian centre for Intellectual Property in Agriculture.

4. The impacts on and benefits to the environment

Bioprospecting and the industries arising from it could have adverse effects if they are not carried out with due sensitivity to the environment. It is also important that the promise of bioprospecting does not distract from the broad environmental problems that Australia faces, such as salinity.

On the other hand, bioprospecting could benefit the environment in two ways. The first is through the extra economic value that is credited to an environment if it is perceived to be an actual or potential source of useful chemicals and products. This economic value will tend to encourage its preservation. The second is that the results of bioprospecting could be useful in remediating damaged environments or permitting ecologically sustainable use of difficult or marginal environments, of which there are many in Australia.

Introduction

On 2 November 2000 the Secretary of the House of Representatives Standing Committee on Primary Industries and Regional Services wrote to the Department of Agriculture, Fisheries and Forestry requesting input to the "Inquiry into Development of High Technology Industries in Regional Australia Based on Bioprospecting".

The terms of reference were as follows:

To "inquire into and report on the following areas, with particular emphasis on the opportunities in rural and regional Australia:

- the contribution towards the development of high technology knowledge industries based on bioprospecting, bioprocessing and related biotechnologies;

- impediments to growth of these new industries;

- the capacity to maximise benefit through intellectual property rights and other mechanisms to support development of these industries in Australia; and

- the impacts on and benefits to the environment."

As well as this submission's portfolio-specific analysis and views on bioprospecting, we understand that submissions are planned by Environment Australia (EA), CSIRO and Biotechnology Australia (incorporating broad perspectives on bioprospecting on behalf of Industry, Science and Resources; AFFA; Environment Australia; Employment, Training and Youth Affairs; and Health and Aged Care). The Committee should find these submissions complementary to the AFFA submission.

Bioprospecting is exploring for and examining biological resources in search of new products that will have some commercial use. The pharmaceutical and fine chemical industries already have substantial investment in this area as they are expanding efforts to collect and isolate substances, including enzymes and genetic material, from natural ecosystems. Bioprospecting may provide leads to new commercial products in industries manufacturing pharmaceuticals, nutraceuticals and agrochemicals. Other potential applications include paints, building materials, industrial enzymes, cosmetics, sunscreens, novel foods and flavourings.

One quarter of all prescription pharmaceuticals contain at least one plant-derived ingredient (Missouri Botanical Garden 2001). These include aspirin, from meadowsweet; taxol, used for treating ovarian cancer and found in the Pacific yew; digitalis, used for treating cardiac arrhythmias and found in foxglove; quinine, from cinchone and used for treating malaria; tubocurarine, used as a muscle relaxant and derived from curare (Conservation International 2001a); ipecac, used as a purgative and found in the plant Cephaelia ipecacuanha; morphine and theobane, painkillers from the opium poppy; and vinblastine from the Madagascar periwinkle flower, used to treat cancer (Healtheon/WebMD 2001). Of the estimated 250,000 known plant species in the world, perhaps 5,000 have been screened for their medicinal potential (Conservation International 2001b). While some compounds are harvested from wild

plants, for example taxol, others are produced synthetically in laboratories, for example aspirin, and others are extracted from commercial crops of the plant, for example morphine.

While screening for natural compounds has traditionally concentrated on plants and microorganisms, other groups of organisms are also being assessed for their potential to provide new commercial chemicals (Healtheon/WebMD 2001, McGhee 2001). Substances obtained from vertebrates, including cane toads, frogs, snakes and bats, are also being investigated for a range of possible uses. Briostatin and didemnin B are compounds found in molluscs and shown to have strong anti-tumour activity. Shark and tunicate alkaloids are also currently undergoing intensive investigations.

Bioprospecting may involve sampling directly from the environment or sampling from earlier collections. These collections are often maintained by governments or government agencies; e.g. State herbaria and museums, CSIRO collections and universities; but they may also be privately maintained. The Australian Museum alone houses collections of more than 4 million insects and 500,000 fishes (McGrouther and Paxton 2001). The Australian National Herbarium has over 1.3 million specimens, dating back to 1770.

Bioprospecting can also involve studying collections of data about organisms rather than collections of organisms. This is “bioinformatics”, in which genetic data stored in databases is “mined” for information that can be used to aid in drug discovery, protein engineering and designing new molecules. Much of this genetic data is stored in databases that are publicly available and accessible through the Internet. For example, the European Bioinformatics Institute, GenBank (USA) and the DNA Database of Japan (DDBJ) all collect a portion of the total sequence data reported worldwide and all new and updated database entries are exchanged between the groups on a daily basis (Baker et al 2000). The amount of information in the databases (nucleotide and protein sequences) is increasingly rapidly, with the European database tripling in size from October 1999 to October 2000 (EMBL 2001).

First term of reference: the contribution towards the development of high technology knowledge industries based on bioprospecting, bioprocessing and related biotechnologies (with particular emphasis on the opportunities in rural and regional Australia)

There are two major industries that have profited from biological resources. The pharmaceutical industry has benefited through drugs developed from natural compounds, often from resources accessed in the wild. The agricultural sector utilises biological resources for conventional plant breeding techniques as well as through modern biotechnology. The introduction of molecular markers to characterise genetic variance, together with the possibility of introducing genetic material from other species and genera to improve crop yields and concentration of nutrients, as well as resistance to disease or environmental conditions, are increasing the potential value of biological resources for agriculture.

Australia is a ‘mega-biodiverse’ country and is therefore considered to have a strong potential for bioprospecting. For example, Australia has over 15,000 vascular plants

described. This diversity in plants has not been fully explored, and new species are still being identified. Arthropods and microorganisms are even less well known than the vertebrates and plants. Studies of the ecology of many of the unique Australian ecosystems are also lacking.

The potential for industry development based on these biological resources has already been demonstrated, although past developments have not always been domestically based. As Ramsay (1994) noted:

- the largest producer of (and the first nation to domesticate) the Australian native nut, the macadamia, is the United States
- the world's largest producer of eucalypt oil is Portugal
- the world's largest producer of woodlot eucalypt timber is Brazil, followed by China
- the first nation to take out a worldwide patent on the waratah was New Zealand. It was named the "Kiwi Rose"
- the world's largest producers of Australian native wildflowers (kangaroo paw and boronia) are Holland and Israel
- the first nation to farm the barramundi and mud crab was Thailand, which is still the largest producer.

In recent years, more of this potential has been exploited domestically. "Bushfoods" are the focus of a program of the Rural Industries Research & Development Corporation (RIRDC):

http://www.rirdc.gov.au/pub/bush5yr.htm

At Attachment 1 is a case study of a successful business based on bioprospecting (principally through harvesting of wild plant foods): Cherikoff Pty Ltd, formerly known as Bush Tucker Supply Australia.

A good example of research on the commercial development of a promising new cut flower from Western Australia, yellow bells (*Geleznowia verrucosa*), is found in a RIRDC-sponsored study (Plummer et al., 2001). An example of a "success story" has been the commercial production of the flannel flower, used in the athletes' bouquets at the Sydney Olympics. This native wildflower no longer needs to be harvested from the bush, but can now be grown commercially using tissue culture techniques (Jeffrey 2001).

A further interesting possibility is the use of an indigenous fungus to control the saffron thistle (http://farrer.riv.csu.edu.au/farrer/research/ipm/ipm-p4.html)

Australian plants are being increasingly targeted as sources of drugs and other biochemicals (McGhee 2001). The Centre for Phytochemistry at Southern Cross University, Lismore was established in 1999 to investigate the chemistry and biological activity of Australian native plants. This Centre is developing a comprehensive library of plant chemical extracts derived predominantly from Australian plants. It also undertakes collaborative endeavours with local and international bioprospecting companies. The centre accommodates 16 full-time researchers.

BioDiscovery, an Australian company listed on the Stock Exchange, has a joint venture with CSIRO Entomology Division to screen Australian insects for agrochemical and pharmaceutical purposes. They have agreements with the global pharmaceutical companies Rhone-Poulenc Agro and Glaxo Wellcome and are pursuing other agreements (BioDiscovery 1998).

Bioprospecting provides considerable potential for the development of new marine-based industries. The pharmaceutical and fine chemical industries already have substantial investment in this area. Our highly diverse marine fauna and our research and technological capabilities place Australia in a strong position to develop and capitalise on new marine biotechnology industries.

The Australian Institute of Marine Science (AIMS) in Townsville is a Commonwealth government statutory authority committed to scientific research in Australia's ocean territory. It has undertaken research towards the discovery of new commercial products from Australia's marine resources with the development of substantial scientific infrastructure and expertise and an extensive screening collection of around 10,000 marine invertebrates and plants and 7,000 microorganisms from about 1,500 sites around Australia.

Other major bioprospecting agencies working in this area are: Roche Research Institute of Marine Pharmacology (at Dee Why, Sydney); and the Queensland Museum (Brisbane) in collaboration with the Queensland Pharmaceutical Research Institute (Griffith University, funded by Astra Pharmaceuticals Pty. Ltd).

To date, no commercial product has eventuated from bioprospecting for marine invertebrates in Australia (although several are currently under development). The most immediate applications in marine industries will probably occur in aquaculture. Aquaculture development has the potential to contribute significantly to future development and growth in rural and regional coastal Australia. Many of the bioactive compounds identified cannot be synthesised and their exploitation would involve either large scale harvesting from the wild or the development of culture facilities to produce sufficient numbers of the relevant organism to provide adequate supplies of the active compound.

Second term of reference: impediments to growth of these new industries

The Australian workforce has good skills in areas required for bioprospecting. Australia has a "high quality science base and a highly educated labour pool" (Ernst and Young 1999). However these skills are based in the capital cities of Sydney, Melbourne, Brisbane and Adelaide, and are often geographically centred around universities. Future workforce requirements should largely be met by Australia's high quality education system and relatively well-funded research infrastructure, which supplies an abundant supply of quality graduates. These, and occasional overseas recruitment, are expected to help meet Australia's demand (Ernst and Young 1999). Nevertheless, there are considerable shortages in the global biotechnology workforce and Australian graduates may seek employment overseas, rather than in Australia.

The availability of capital to support the characterisation, testing and commercial production of products may be limiting. Getting a drug to market is an expensive and time-consuming process (Global Biodiversity Institute/International Institute for Tropical Agriculture 2000). The time and expense required mean that Australian developments from bioprospecting for drugs are most likely to be brought to the final stage of commercialisation by global companies. Large international companies provide major research funding opportunities, as well as facilities essential to the development process for pharmaceuticals (e.g. specialised screening, clinical trials). These are not readily available in Australia and are usually sourced offshore.

However, a great deal of attention has been paid recently to the need for improved funding of Australian research and development, including basic research, business R&D, and the commercialisation of research. The Government's recently-announced innovation action plan, "Backing Australia's Ability", contains a variety of initiatives that could promote industries based on bioprospecting, including increased funding at the level of basic research, tax concessions to support new commercial R&D, and funding for the early stages of commercialisation of products, through "pre-seed" funding and venture capital. Specific funding for biotechnology will enable an expansion of the Biotechnology Innovation Fund (BIF) and the establishment of Biotechnology Centre(s) of Excellence.

From AFFA's perspective, of particular significance in the innovation action plan was the Prime Minister's reaffirmation of the Government's matching dollar for dollar arrangements for the rural Research and Development Corporation program. The RDC program is a unique alliance between industry and Government to pursue R&D to advance the interests of industry and the wider public. Last year under this program, the Government contributed over $150m to rural-related R&D. Also announced under the plan was an extension of the New Industries Development Program (NIDP) which will provide $21.7m over five years to encourage our rural and regional agribusiness to develop new products, services and technologies.

It should also be recognised that in last year's Budget, the Government introduced the Agriculture - Advancing Australia Farm Innovation Program which compliments the recently announced initiatives. This Program provides grants to encourage businesses in the farming, food, fisheries and forestry sectors to adopt already researched innovative practices, process and products. This $18.2m initiative is running as a pilot in the 2000-2001 and 2001-2002 financial years.

There are also areas in which relatively small sums of money can achieve results, for example in the domestication and cultivation of Australian native plants (Reid, 1999). New plant varieties can be bred relatively cheaply and brought into commercialisation in a few years. But the returns are not as high as from new drugs.

The aquaculture industry is still very much focussed on production issues, such as feeds, and there is currently limited industry support for investment to address other areas. Also, one of the key questions in the marine environment is whether the existing management regimes can accommodate bioprospecting. The regulation of marine bioprospecting in the wild varies considerably among the States and Commonwealth. Some issue Ministerial Permits, whilst others issue Research Permits. Where there are research collection permits, they frequently require

additional approval or liaison with Management Advisory Committees and various Government agencies.

A few challenges in the development of industries based on bioprospecting in the fisheries and aquaculture area may be:

- the availability of water of sufficient quality and actual space (area of water) for sites
- the need for "reseeding" of some sedentary species such as abalone to enhance production from depleted reefs, which raises issues of possible genetic contamination in terms of sub-populations and compatibility;
- the need for an ecologically sustainable balance between the economic and social benefits of aquaculture development and environmental protection.

Third term of reference: the capacity to maximise benefit through intellectual property rights and other mechanisms to support development of these industries in Australia

The capacity to maximise benefits through intellectual property rights is increased through users having the right skills to harness opportunities. To promote such skills development, the Commonwealth Government, in conjunction with the Grains Research and Development Corporation (GRDC) and the Australian National University, is currently establishing the Australian Centre for Intellectual Property in Agriculture (ACIPA).

ACIPA is intended to provide a focal point for training, education, research and policy support in intellectual property for agriculture. The Centre will also seek to develop expertise in the strategic use and management of intellectual property, that will:

- enhance the tools necessary for industry and research partners to evaluate the effect of IP on research and commercialisation
- assist in merging intellectual asset management and business strategy
- provide education, training and policy development in IP, assets and associated strategies.

The Commonwealth also has in place intellectual property laws. AFFA is responsible for administering the legislation on plant breeder's rights.

<u>Patents and plant breeder's rights</u>

Australia has a well-developed system for IP protection, based around patents. The Australian patent system is well suited for protection of biotechnology inventions because the Australian Patents Act does not include any definition of what constitutes a patentable invention (Ernst and Young 1999). A wide range of material, including nucleic acids, proteins and polypeptides; and living organisms ranging from viruses and bacteria to higher plants and non-human animals; can be patented in Australia if an inventive step can be demonstrated, as can processes for preparing, isolating and using biological products and processes (Ernst and Young 1999). However Australian

discoveries may need global protection. In some cases, this can be done using multiple patents. Alternatively, a mixture of patents and commercial contracts may be necessary, given the difficulties in some countries in patenting inventions involving living things.

In Australia, plant variety protection is available under both the *Plant Breeder's Rights Act 1994* (PBRA) and the *Patents Act 1990*. Both schemes grant intellectual property rights. In the case of PBR, the rights are of a limited and prescribed nature and do not extend to genes or processes for manipulating them. Both schemes allow for the granting of rights to varieties and dual protection is available. The schemes can operate in parallel.

The PBRA is modelled on the *International Convention for the Protection of New Plant Varieties 1991* and is administered through the PBR scheme. The Act was introduced to support the competitiveness and sustainability of Australian primary industries by encouraging investment in plant breeding; facilitating access to elite varieties, including from overseas; and speeding technology transfer. Only new varieties are eligible for protection under the PBRA. Eligibility criteria set out in sections 42 and 43 stipulate, *inter alia*, that the variety has a breeder; is distinct, uniform and stable; and has not been exploited for longer than the prescribed periods. It is important however, that improvements planned for the *Plant Breeder's Rights Act 1994* proceed. These improvements seek to ensure that a potential misinterpretation does not allow protected varieties to pass through the commercialisation chain or be exported without the breeder having an opportunity to exercise their rights.

The PBR scheme has been specifically designed for plant varieties and falls within the bounds of the World Trade Organisation TRIPs (Trade Related Aspects of Intellectual Property) Agreement. Currently there are 46 members of the International Union for the Protection of New Varieties of Plants (UPOV) including EU, USA, Canada, Japan, New Zealand, China and the Russian Federation. Administration of all PBR schemes is similar, allowing a high degree of reciprocity. For example, protection can be applied for in other UPOV member states for varieties developed in Australia.

The PBRA provides the plant breeder with an opportunity to exercise an exclusive right to prevent others from undertaking particular activities in relation to a registered plant variety: production, reproduction, conditioning, sale, import, export and stocking. The PBRA includes an equitable balance of private and public interest considerations. Under public interest provisions, access to plant varieties is enabled through non-infringing activities, including the use of a variety for private, non-commercial or research and breeding purposes.

Currently PBR is most frequently used to register new plants derived through conventional breeding. PBR protection is potentially available to varieties in all plant species (including Australian native species) as well as fungi and algae (but excluding bacteria, bacteroids, mycoplasmas, viruses, viroids and bacteriophages).

PBR has encouraged local breeders to produce new plant varieties for local and foreign markets (over 20 new major export crop varieties are registered each year). Growth in PBR registrations since the introduction of the foundation legislation in 1987 has been impressive (more than 3000 applications received). Currently an

average of one new variety is registered each day. The scheme is recognised as being cost effective. Around 100 new breeders enter the scheme each year. Registration of a variety costs $2,000 with an annual renewal fee of $300.

While naturally occurring varieties that are found by bioprospecting will not satisfy the criteria for PBR protection, they can readily be used as the building blocks for new varieties. Approximately 12% of all PBR applications are for new varieties of Australian native species. There is increasing interest in native plant breeds (Attachment 2).

Fourth term of reference: the impacts on and benefits to the environment

Promoting ecologically sustainable development is important to Australia, in order to maintain the productivity of the natural resource base that underpins our rural industries and to demonstrate the environmental performance of these industries to the markets where they sell their products. Moving to implement ecologically sustainable production systems requires the development of systems that take into account the impact of chemical use, provide new commercial opportunities for salt affected lands, use new plant and pasture varieties to intercept rain leaking into groundwater, are attuned to natural processes, and maintain the functions of ecosystems and conserve biodiversity. Bioprospecting may play some part in developing these systems, but it should not be emphasised to the point that it becomes an end in itself, distracting effort away from activities that provide greater environmental and economic benefits in the long term. Also, bioprospecting may itself pose some risks to the environment. Surveys of natural environments to collect samples, with the introduction of people and their vehicles, could damage environments, especially the least explored and least disturbed environments with unknown potential. Damage may be direct, or occur through the introduction of weeds, pests and diseases novel to that environment.

The amount of material that can be taken from a particular environment without causing damage is a primary concern in the conservation of biological resources. Depending on a given compound's yield, preclinical trials of proposed drugs - to evaluate toxic side-effects and effectiveness in animals - may require large amounts (tonnes) of dried plant material. The survival of some species has been threatened in the past by drug researchers over-harvesting from the wild. The exploitation of pilocarpine, for example, threatened the survival of *Pilocarpus pignatifolios, P. microfilla*, and *P. jaborandi* species in South America. In another case, clinical trials with taxol threatened the survival of the Pacific yew tree, *Taxus brevifolia*, in its natural habitat (Fraser 2000).

The protection of biological resources (genetic, species and habitat) is a major global issue. There is also a need for *ex situ* protection in herbaria or marine "farms". In the case of rare, endemic or newly-discovered species, knowledge of the reproductive biology of the plant or animal species is essential to ensure survival and needs to be addressed before any large scale collecting is permitted. Innovative ways to address the ecological sustainability of products with commercial potential include tissue culture of rainforest and tropical plants and learning how to farm marine animals (aquaculture).

Bioprospecting may benefit environmental conservation by placing an economic value on biological resources. There may be an incentive to preserve ecological resources in order to charge access fees for specific bioprospecting projects (Sternlof 2000). The impending commercialisation of the recently discovered Wollemi Pine has placed a commercial value on the preservation of an Australian species once thought to be extinct.

Australian marine ecosystems, especially tropical reef systems, are very rich in species and inventories obtained from marine biological surveys, such as those derived from bioprospecting, can enhance our understanding of the components of these marine systems, and serve to help protect and conserve these resources. Bioprospecting can be an effective means to obtain inventories of Australia's marine biological resources, which may have some commercial benefit in the longer term. For example, bioprospecting has not only tripled the previous estimates of the Australian sponge fauna but also confirmed that, like terrestrial fauna, the marine fauna is mega-biodiverse. In some families of sponges, Australian species comprise about 33% of the worldwide fauna (now estimated at 15,000 species): although even this figure may grossly underestimate the small, cryptic communities. Under traditional sources of funding, these discoveries would not have been made so readily. Moreover, technological advances permitting studies using much smaller quantities of live samples provide an opportunity to escalate the rate of discovery of new species.

Bioprospecting may also lead to the identification of plants with a range of characteristics suitable for environmental purposes e.g. salinity control, erosion control, nutrient management and bioremediation. The world's largest desert revegetation programs using Australian native arid-adapted plants are in Israel and South Africa and the main breeding programs for these plants are in Israel, the US, China and South Africa (Ramsey 1994). These facts should serve as a reminder of the potential for bioprospecting and the need for Australia to be at the forefront of its commercialisation.

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ATTACHMENT 2

PBR applications for new varieties of Australian native species (13/12/00)

GENUS	TOTAL APPLICATIONS
Chamelaucium	50
Bracteantha	35
Brachyscome	23
Anigozanthos	21
Grevillea	19
Syzygium	17
Leptospermum	17
Eucalyptus & Corymbia	15
Telopea	11
Hardenbergia	9
Boronia	9
Scaevola	8
Acacia	8
Agonis	7
Ozothamnus	6
Cupressus	6
Microlaena	5
Lomandra	5
Ceratopetalum	5
Lechenaultia	5
Bothriochloa	4
Banksia	4
Microcitrus	4
Macadamia	3
Santalum	3
Danthonia	3
Melaleuca	2
Clematis	2
Helipterum	2
Cyathea	2
Asplenium	2
Sporobolus	2
Murraya	2
Themeda	2

Nephrolepis	2
Ptilotus	2
Stenocarpus	2
Poa	2
Astrebla	2
Actinotus	2
Acmena	2
Panicum	2
Isotoma	2
Chamelaucium x verticordia	1
Acalypha	1
Cynodon (native & naturalised)	1
Codiaeum	1
Adenanthos	1
Allocasuarina	1
Anopterus	1
Apium	1
Caustis	1
Austromyrtus	1
Callistemon	1
Backhousia	1
Angophora	1
Olearia	1
Wahlenbergia	1
Verticordia	1
Toona	1
Thryptomene	1
Stenanthemum	1
Scholtzia	1
Sapium	1
Rhodanthe	1
Regelia	1
Pogonatherum	1
Pittosporum	1
Pimelea	1
Philotheca	1
Isopogon	1
Kunzea	1
Duranta	1

Eragrostis	1
Eremocitrus	1
Glycine	1
Hymenosporum	1
Xanthostemon	1
Pandorea	1
Lophostemon	1
Melia	1
Mentha	1
Mimusops	1
Dodonae	1
Koeleria	1