9th Biennial Noxious Weeds Conference

IMPROVING WEED MANAGEMENT FOR THE 21ST CENTURY

DUBBO RSL CLUB
DUBBO

16 - 18 SEPTEMBER 1997

Volume 1

Conference Papers

NSW Agriculture

9th Biennial Noxious Weeds Conference

Volume 1 Conference Papers

Dubbo RSL Club
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EDITOR'S NOTE

Conference papers may be used by delegates to help with note taking and to clarify points presented by speakers. Speakers may use conference papers during their talk - they may, for example, refer to a table that may not fit on an overhead projector, but fits on a printed page. In writing a conference paper the speaker may outline their topic in more detail than their presented talk, allowing delegates to gain a more thorough understanding of the topic after the conference.

Speakers at this conference were invited to prepare their papers to meet these purposes.

Conferences normally present the progress of continuing work, as distinct from final reports. Alternatively, conferences may be used to present completed work that has previously been reported in a "final report" format or in a paper in a scientific journal. Please read the papers within these contexts. Authors are responsible for their own work.

In cases where authors could not provide a full paper, an abstract has been accepted. The full conference paper will be published in Volume 2 - Conference Proceedings. In these instances, I have invited speakers to use both their presentation and their abstract as "an invitation to delegates" to seek out further information.

Events that occur at the conference will be appropriately reported in Volume 2 - Conference Proceedings.

I thank speakers for their help in preparing papers and abstracts.

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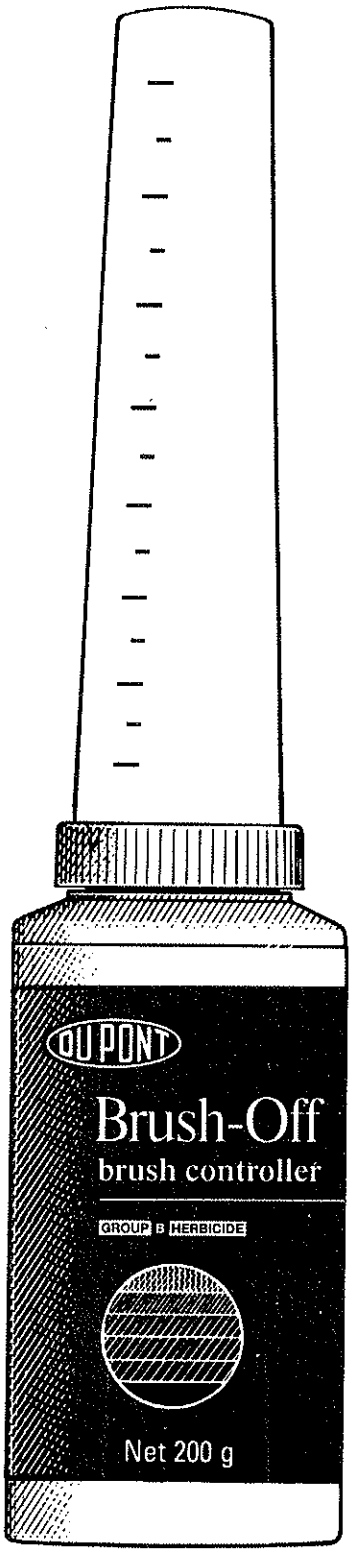

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9th Biennial Noxious Weeds Conference

DAY 1 - Tuesday, 16th September 1997

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1.30	Weed Excursion - "Weed problems in a unique situation - the Western Plains Zoo".	Marshall: Brian Bywater, Dubbo City Council	
5.10	Approximate time of return.		
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WEED MANAGEMENT - GENERALISATIONS FOR THE NEXT DECADE

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INTRODUCTION

In this contribution I wish to highlight some generalisations for weed management that I believe will become more important in the next decade. I come to these generalisations from a background in research on the ecology and control of certain major crop and pasture weeds. More recently, and within the CRC for Weed Management Systems, I have been responsible for initiating a research program on those weeds of natural ecosystems that we call 'environmental weeds'. In what follows I shall draw examples from all three categories of weeds as they occur in southern Australia and use New South Wales examples wherever possible.

I shall consider firstly the results of a recently completed study of weed incursions to Australia over the period 1971-1995. Weeds impact on the southern Australian community in various ways - they may cause losses in crop or animal production or they may interfere in some way with landscape values or human health, etc. Weeds may also 'threaten' the survival of certain rare or endangered species and thereby be associated with loss of native plant and animal biodiversity. In the second part of this contribution I shall present some examples of these different impacts of weeds. Thirdly, I shall consider control methods applicable to different categories of weeds and how they may have to change so that weed management will be more effective towards the end of the next decade.

RECENT INCURSIONS OF WEEDS 1971-1995

In 1996, the CRC for Weed Management Systems secured a contract from the Australian Quarantine Review Committee to report for the first time ever on weed incursions to Australia as a whole over the last 25 years (1971-1995). At the same time, other successful tenderers were doing a similar exercise for plant diseases, insects and forest diseases. Whilst Hosking & Groves (these Proceedings) report specifically on the results relevant to some potential new weeds in New South Wales, I wish to present some results and the generalisations that follow from the synthesis of the data the group were able to gather in the limited time available. Before doing so, however, I wish to stress that the data refer not to number of plant introductions (because that information is not available) but to the number of plant taxa recorded in herbaria as naturalised species, i.e. invasive species that have become established and are reproducing naturally in the wild.

The most significant result is that of the 296 plant taxa recorded as naturalised over the last 25 years the rate of naturalisation increased between 1981 and 1995 compared with the 10-year period between 1971 and 1981. When the same exercise was done previously for four individual States the relationship between the number of species and date of first record was linear for the last 100 years (Specht 1981). There is now some evidence to indicate a more-than-linear increase, both nationally (Groves *et al.* 1996) and for Victoria (Carr 1993).

Two other significant results that I wish to highlight from this recent report are:

1. The majority of recently naturalised taxa were introduced deliberately and legally. Sixty five per cent of the total were introduced as ornamental plants for horticulture (see also Dellow, these Proceedings). Whilst the number of seed contaminants was very low (2%), they were often of species known to be major weeds outside Australia.

2. Very little information was available for the direct costs of these taxa and then only for a few species likely to be weeds of cropping or pasture land. The majority of the species naturalised are likely to be weeds of natural ecosystems, the environmental costs of which are unknown and little studied.

From these results I conclude that the number of weedy plant species to be controlled will continue to rise inexorably. Early identification of their presence is an important first step in the control of this increasing number of plants entering and establishing in Australian ecosystems.

WEED IMPACT

The usual way that weed impact is assessed is in terms of lost crop or animal production. In fact, it has now become obligatory to submit a weed to some cost/benefit ratio for its control before money for research will be made available by some funding agencies. It is more difficult to assess the impact of a weed such as Pellitory (*Parietaria judaiaca*), which can cause asthma to inhabitants of Sydney suburbs, or such as Parthenium (*P. hysterophorus*) that can cause dermatitis to adult males in New South Wales and Queensland.

Both are examples of weeds impacting on human health and it is difficult in these cases to determine real costs in dollar terms. Even more difficult is the case of a weed such as Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) on the coast of New South Wales at, say, Eurobodalla National Park, near Moruya. How much do such weeds cost the community and how do we calculate such costs?

We usually know how much is spent on herbicides and their application. These are the direct costs of weed control. In the case of Serrated tussock (*Nassella trichotoma*), economists may also be able to assess the cost of lost production, for instance, by sheep having to graze invaded pastures on the tablelands (see, e.g. Vere *et al.* 1993). The total cost of Serrated tussock is thus some estimate of both direct and indirect costs.

Using such methodologies for a range of crop and pasture weeds, the total cost of such weeds to the Australian economy was assessed in 1987 to be about $2750 million (Combellack 1987); ten years later it is probably about $3500 million - a very substantial impact.

The above estimate of the total cost of weeds to the Australian economy did not take into account the cost of environmental weeds, however. That situation arises because of the difficulty of arriving at a dollar estimate for the impact of invasive plants on the biodiversity of native fauna and flora. Any economic analysis of the cost of weeds must consider benefits as well as costs; for instance, a benefit of Bitou bush is that it successfully reduces wind erosion of beach sand, a benefit which was recognised early in the history of its (accidental) introduction from South Africa to the New South Wales coast near Newcastle.

A direct cost of Bitou bush is the price of 2 g/L of glyphosate applied aerially at 2-yearly intervals from a helicopter to many coastal areas, including National Park areas such as at Eurobodalla.

A further direct cost of Bitou bush is the contribution made by the NSW National Parks & Wildlife Service over the last 7 years to the total cost of the ANZECC research program (based in Cape Town, South Africa and at two centres in south-eastern Australia, viz. Frankston, Victoria and at Tamworth) on biological control of both Bitou bush and Boneseed by insects and fungi.

What native plant species are at risk from Bitou bush and how do we value them? As environmental weeds become increasingly recognised in the overall impact of weeds, we shall need to know more about their effects on native species and even, I suggest, what the indirect economic costs of these effects may be. I am assured by some resource economists that this is not an impossible task. Certainly, within the CRC for Weed Management Systems we have recently begun such a project. We cannot ignore the subject any longer!

In this contribution I wish to comment on three aspects of the biological impact of environmental weeds, aspects of weed impact also not very well known or researched. Environmental weeds can affect species numbers, species abundance and/or ecosystem function. From a recent analysis of data on rare and threatened plant species in Australia (Leigh & Briggs 1992), we know that 4 of the 83 plants that are presumed extinct have become so primarily because of the impact from weeds over the last 200 years. Of the past threats to native plant species numbers, weed impact is thought to have endangered a further 12 native plant species. And of the present and future threats to native plant biodiversity, weed impact is one of the major ones for a further 57 species. For this reason alone, weed impact becomes a subject worthy of increased research attention.

For an example of the abundance of a native plant being directly influenced by a weed I choose a South Australian example. It concerns Bridal creeper (*Asparagus asparagoides*) and numbers of an orchid *Pterostylis arenicola*. In a Nature Reserve south of Tailem Bend, which was set aside to conserve a limited population of the orchid species, Bridal creeper cover was decreased by weeding. Orchid numbers went up as a result of removing the weed impact (Sorenson & Jusaitis 1995). Both the weed and orchid have the same seasonal pattern of development in that both have perennial underground reserves from which, in autumn, new shoots arise. In the case of the orchid, the leaves remain as a rosette at the ground surface whilst the shoot of Bridal creeper is more vigorous and climbs up whatever it can - in this case mainly shoots of Murray Pine (*Callitris* sp.) - and thereby shades the orchid. Both species flower in spring and then die back. Probably because of this similar growth rhythm the Bridal creeper shoot and tuber outcompete the orchid rosette and tuber; hence numbers of the orchid are reduced over time and the species is thereby endangered. Rarely, I suspect, is the relationship between weed and abundance of a native plant species so direct. My example shows one mechanism by which abundance of a native plant species is specifically impacted by weed competition.

A third way in which weeds impact native plant and animal biodiversity is by the weed modifying ecosystem function in some way. For instance, the nitrogen-fixing leguminous shrub Broom (*Cytisus scoparius*) is in such high numbers in parts of Barrington Tops National Park that soil nitrate levels must be higher, at least seasonally, than the same soil under Poa tussock grass and the occasional *Acacia* plant. Whilst the eucalypt forest at

Barrington Tops may not be burnt very frequently, at other sites where Broom is in similarly high numbers, such as the Central Highlands of Victoria and the Adelaide Hills, a more frequent fire regime coupled with raised soil nitrogen levels may mean an increased potential for introduced annual grasses to replace perennial shrubs in the understorey and thus for long-term floristic change to occur.

In summary, economic analyses of the impact of agricultural and pastoral weeds are increasing in number and degree of refinement, but similar instances for analyses of the indirect costs of many environmental weeds are almost non-existent, despite some evidence for this group of weeds having an impact on native species biodiversity. In the next decade, this situation must change if we are to better manage Australia's natural ecosystems, as well as its cropping and pastoral lands.

WEED MANAGEMENT

Traditional systems for reducing weed impact have relied on cultivation of crop lands and rotations for pasture-cropping land. The former system of continuous cultivation was disastrous for crop weeds such as Skeleton weed (*Chondrilla juncea*). Weeds such as the Silver grasses (*Vulpia* spp.) have increased dramatically in response to a change in cultivation methods as in minimum tillage systems. Changes in cultivation systems can induce changes in the weed flora and be both positive or negative, depending on the particlar weed species. In this section I shall discuss management of Skeleton weed populations in crops further.

Incorporation of a pasture phase in the cropping cycle reduced the impact of Skeleton weed in regions such as the Riverina, and especially if the pasture phase was dominated by Subterranean clover (*Trifolium subterraneum*) for a period as long as 4 years (Moore & Robertson 1964). In cropping regions such as the Mallee with lower annual rainfall and alkaline soils, this management system was less feasible and the weed problem remained. The development of modern herbicides has greatly helped control of many crop weeds but chemical control was of little use in reducing numbers of Skeleton weed, though it did enable grain harvesting. More or less as a last resort, biological control of Skeleton weed was initiated in the late 60s. Whilst the effects of the Skeleton weed rust (*Puccinia chondrillina*) has been successful in controlling the previously widespread genotype of the weed, the other two genotypes have subsequently spread and become a problem in some areas. Releases of two other strains of the same rust against one of the other genotypes of Skeleton weed may help to further limit weed impact, but so far we have been unable to find any natural enemies in Mediterranean Europe effective against the third genotype of the weed.

I have chosen the example of skeleton weed in crops because it shows that integration of a pasture phase with cropping reduced weed impact and the effectiveness of a biological agent was increased, at least in the short term, in this system. The interaction between herbicide application and effectiveness of the biological control agent was never explored, but certainly strategic use of herbicides was part of the overall management system. My example of Skeleton weed provides some evidence for greater effectiveness of weed control when the different control methods were integrated in a system. The development by some weeds, and especially by annual grasses, of resistance to certain herbicides used in cropping, has also highlighted the need to develop integrated systems using all available methods of control but in this case with less reliance on a particular group of herbicides.

In the next decade, more instances of herbicide resistance will undoubtedly arise in other groups of weeds and management systems for a diversity of crops, not just cereals, will have to take account of this comparatively recent development. Whether the incorporation of herbicide resistant genes into the genome of certain crop plants will alleviate this increasingly serious situation remains to be seen, even if permission is granted for their field release. My personal belief is that such genetic modification will at best provide only a panacea in the short term but that it may create agronomic and ecological problems in the longer term I hope I can be proved wrong!

In this section I have concentrated so far on cropping systems and the evolution of a more-or-less integrated system of management for Skeleton weed. But my theme is also applicable I believe to weeds of pasture and to environmental weeds, as well. In the case of pasture weeds such as the thistles, we know that herbicides have a role to play in control, as does pasture management, especially in the critical late autumn-early winter period. The success to date of some natural enemies in reducing seeding of some thistle species also provides a basis for optimism for long-term control of some thistles. But if perennial grasses cannot be established and managed more effectively, especially over the late summer-early autumn period of thistle seedling establishment, thistle seeds will remain dormant in the soil and thistles in pasture will never be fully controlled. Resowing of thistle-invaded land by perennial grasses together with careful management for vegetative cover over the autumn are key aspects of an overall management system for thistles.

The theme of integrated control of weeds and a greater role for revegetation using perennial species in pasture systems has its analogy in natural ecosystems in the deliberate promotion of native species at the same time as control of environmental weeds begins to happen, by whatever means. As part of an ANZECC-funded project, the biological control of Bitou bush in New South Wales, and particularly on the north coast, is beginning to happen. We know something of the controlling effects of glyphosate application to Bitou bush in coastal vegetation (Toth *et al.* 1996). But until we know more about the biology of the dominant native herbs, shrubs and trees and apply that knowledge to enhance their competitiveness in the community, control of Bitou bush may well lead to enhanced weediness of Milkwort (*Polygala myrtifolia*) or some other environmental weed. To avoid such a situation developing, we in the CRC for Weed Management Systems have begun a project at Eurobodalla National Park wherin we investigate the effects, after herbicide application, of fire, hand-pulling, the Bitou tip moth (*Comostolopsis germana*) and the deliberate re-seeding of some dominant native species. Application of results of such investigations should prevent either re-invasion of coastal vegetation by Bitou bush or the invasion by other equally-undesirable environmental weeds; such weeds include Milkwort or even the native species *Pittosporum undulatum* which is not indigenous to the coastal plant communities in which Bitou bush now occurs.

'TAKE-HOME' MESSAGES

1. New species of plants are becoming naturalised in Australia and possibly at an increasing rate. Some of these species have the potential to become weeds in crops, pastures and/or natural ecosystems. Most recent incursions are still only locally established.

If you see a 'new' plant in your area, collect it, press it and send it to a herbarium or an expert for identification. Don't wait until the species has spread widely because that oversight may rule out the chance for eradication - either locally or nationally. The direct

cost of eradication at this early stage may be trivial compared with later direct and indirect costs of control on a regional or national scale.

2. Weed impact consists of direct costs to land managers in reduced prices for plant and animal products. Indirect costs of weeds are more difficult to determine. One such indirect impact of weeds, especially of so-called environmental weeds, is that on native plant and animal biodiversity. A cost/benefit analysis of weed impact is becoming more common before a control program will be funded.

Be sympathetic to the need for an economic approach to weed impact but also realise that for control of environmental weeds the indirect 'costs' of weed impact on biodiversity will become increasingly important in the next decade. Such a shift in research thinking may require you to change the way you have come to regard the effects of weeds.

3. Increasingly, weeds in crops are being managed as part of an overall weed management system. The further development of herbicide resistance in some weeds will accelerate adoption of an integrated approach, not just to control of crop weeds, but also to major weeds of pasture and natural ecosystems.

Do not rely solely on herbicide application or biological control or even, in the next decade, the development of herbicide-resistant crop and pasture plants to manage weeds in your region or ecosystem. Long-term management of populations of major weeds will depend increasingly on the integration of all available methods of control, including revegetation, into weed management systems. You will be managing the total plant community and not just populations of individual weeds.

ACKNOWLEDGMENTS

I wish to thank Richard Carter, NSW Agriculture, Orange, for his kind invitation to present this talk and to John Hosking, NSW Agriculture, Tamworth, for his continued help on the subject of recent weed incursions and for coments on an earlier draft of this paper.

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THE IMPORTANCE OF NOXIOUS WEED CONTROL PROGRAMS FOR AGRICULTURAL INDUSTRIES

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PREFACE

Weeds are a huge environmental and economic burden on New South Wales costing $600million a year in control and lost production. Few sectors of agriculture are not affected by weeds.

Some examples of the impact of weeds are easy to see. Blackberry and gorse encroach on grazing and forestry lands. Others are costly but often go unnoticed. Trace amounts of toxic plants like heliotrope, inadvertently harvested with in grain, reduce growth rates and over time, kill intensive livestock such as poultry and pigs. Seed-heads of spiny burr grass increase the shive fault of wool, penetrate of skin causing health problems for livestock, and may double the cost of shearing. Alligator weed and water hyacinth block waterways, increase water loss from storages and increase the cost of water for agriculture.

The impact of weeds includes secondary effects such as the use of atrazine which can find its way into the watertable, and cultivation which leads to breakdown of soil structure and increased erosion.

Some new impacts of weeds are even less obvious. For instance under quality assurance programs, producers must declare when they use agricultural chemicals in production. Industries such as viticulture now have a well developed system of quality control and are moving to non-chemical management especially when marketing wines to Europe. Buyers of quality assured products do not differentiate between metsulfuron, dieldrin and chlorpyrifos - they are all chemicals.

This places new challenges on weed control authorities. When planning weed control programs, we must be aware that we could damage the industry we are trying to protect by imposing policies without consultation with industry.

Government recognises weeds as a major issue. The New South Wales Weeds Strategy released by the Minister for Agriculture in August, provides the frame work for coordination of the effort on weeds. Currently 114 weeds are declared in NSW and the State provides $6 million in grants for noxious weed control. Over 300 weed officers are employed by local control authorities to coordinate weed control and carry out weed control on council lands and roads. The skills of weeds officers are the key to success. The Biennial Noxious Weeds Conference is one way the State supports local control authorities.

STRATEGIES AND PLANNING FOR WEED CONTROL

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INTRODUCTION

Noxious weed control programs have a long history in Australia. The success of noxious weed programs are difficult to demonstrate, yet they do have popular support. Although no studies report on this in NSW, In a survey in Western Australia, the Agricultural Protection Board was well regarded by 80% of farmers. In dollar terms Western Australian farmers were willing to pay about $1500 per year for the service APB 1988). The NSW noxious weeds program cost about $220 per farm , including about $100 per farm provided by the State government through grants to local control authorities.

The aim of this paper is to convince you that to provide effective weed control programs we must take a strategic approach, plan our activities and demonstrate our successes.

The 8th Biennial Noxious Weeds Conference at Goulburn in 1995 included several papers on the strategic approach to weed control. What is new and different two years later?

- We have a weed strategy for NSW, with extra funding (20% increase)
- We have a national weeds strategy.
- NSW agriculture appointed me to coordinate the delivery of weed control.
- We have a process in place to address new weeds nationally
- We have a new scheme for restricting entry of potential new weed
- We have implementing a planning process in conjunction with all changes to the proclamation of noxious weeds
- We have initiated the RWAP program based on project plans with funding on a competitive basis.

Despite all this we still have some problems. We cannot demonstrate successful noxious weed control. Most expenditure is on widespread weeds, and I am not sure that we have in place a mechanism to find new weeds.

Table 1 shows the expenditure on noxious weeds by local control authorities. The contribution in NSW by local and State governments is comparable to that of other Australian states (See table 2).

Table 1. Expenditure on noxious weeds in NSW by local control authoritics.

Noxious Weed	Annual Average Expenditure by local control authorities 1990-1996
blackberry	748575
Serrated tussock John's wort	742781
African boxthorn	403193
Bathurst burr	383187
johnson grass	289519
galvanised burr	258932
Paterson's curse etc	238535
giant Parramatta grass	216223
horehound	172429
spiny burr grass	169472
water hyacinth	161391
noogoora burr	157011
parthenium	42506
dodder	42172
horsetail	46
bitou bush	14857
ludwigia	1097

Table 2. Expenditure by State and local government on noxious weed control - comparisou between States - and with gross value of agricultural production.

State	Expenditure on Noxious Weeds (local and state) $Million	Gross Value of Agricultural Production $Million	Expenditure as percentage of resource value
NSW	14	7000	0.2
SA	4 *	2000	0.2
WA	16 *	2700	0.6
QLD	13 *	4600	0.3

*includes other pests excludes control on roads

In NSW we have a long history of coordinated weed control. In the past few years we have seen some changes. The infrastructure was established over a long time. The responsibilities were generally established in 1919 by the Local Government Act. The local council was responsible for noxious weed control on roads and council land, and landowners were made responsible on privately owed land. Noxious Weeds Act 1993 continues this framework. The establishment of weed control county councils and employment of specialist weed officers has ensured we have the infrastructure to coordinate control.

During that time we have shifted from and emphasis on weeds of grazing land reflecting the dominant land use at the time. As land use shifted to cropping weeds that affect crops were included. We now have weeds of urban areas and the natural environment included. During that time however programs have been reactive rather then proactive. For instance Nodding thistle was first found in 1950 yet is was only declared in 1964. It took a further 20 years before it was proclaimed over most of its potential range in NSW, by which time it was already widespread (Medd, 1987).

Systems Approach

The system has unfortunately developed so that the emphasis is on enforced control. This approach fails to recognise some key features about plant communities. A one off treatment such as herbicide spray is rarely successful. Legislative approaches cannot define a complicated management change, where timing of each part of the process is critical.

Figure 1 demonstrates why we need a systems approach. If we start off with a weed affected system , we do control work, we end up with a system with less of the weed. The next stage may be a second weed moves in and we have a less desirable system, or we may move to an improved system, or we may need further inputs to reach an improved system (eg pasture seed; fertiliser; revegetation).

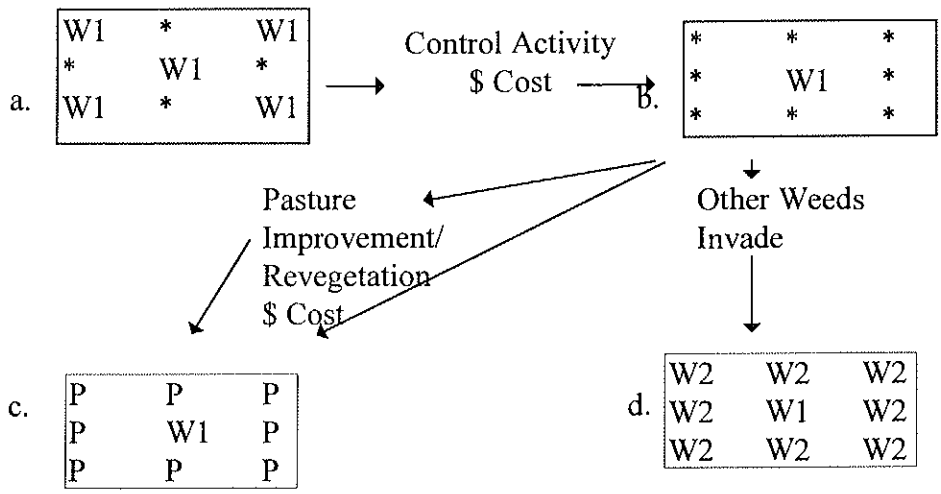

Figure 1

To overcome an initial weed problem (a) a control activity initially reduces the weed population (b). The final result of weed control activities (c or d) depends on the presence of suitable species (P) to replace the weed controlled (W1) . If suitable replacement pasture or other species are not introduced other weed species (W2) may result in worse weed problems (d) (Figure adapted from one by El Bruzeze pers Comm 1997)

The structure in place is *ad hoc*, it fails to identify new weeds early and does not address the problem of more weed control programs without more resources. The system is audited in a financial basis but is not audited on a State benefit basis.

The strategic approach allows us to target resources to highest priority areas; and demonstrate results not just in financial terms, but on effect of programs on weed spread. It also ensures we target the right weeds.

We have introduced two initiatives to assist local control authorities to use a strategic approach. The Regional Weed Action Program and Weed Control Plans.

Regional Weed Aetion Program

The Regional Weed Action Program is a new initiative to ensure that we can demonstrate to the Government that our programs are effective. The initiative initially funded by a $0.5 million grant, is for projects developed by local control authorities and regional committees that address regional, State or National priorities.

Projects funded under the program must be innovative, and are allocated on a competitive basis. To ensure regional priorities are addressed regional advisory committees, where they exist, have the opportunity to set priorities for projects from the region.

To obtain funding under the program projects must have clear achievable milestones. The milestones need to be objective, realistic and time bound.

Weed Control Plans

Weed Control Plans are under development for most weeds which are considered a major priority for the State. Local plans are currently under development by many local control authorities. In some cases the only local plans developed are when a change to the noxious weed list is sought. In some cases regional plans are under development. For example Serrated tussock in the Southern Tablelands, and alligator weed in the Hawkesbury Nepean Catchment.

These plans include contributions from local control authorities and the State. We expect that, over time, a plan will exist for any weed control program implemented under the Noxious Weeds Act.

An integral part of the weed plans is the action plan. The action plan is comprehensive. A local control authority may implement most of an action plan without reference to the Act. For instance extension programs and coordination of control work .are easily implemented. Many plans do require a provision of the Noxious weeds Act. For instance in the parthenium weed plan, a major barrier to achieving of the aim of eradication of all infestations within 5 years of discovery is the need to retreat infested areas prior to seed set. Obviously the lca needs the power to inspect the property and to require the landowner to treat any plant found..

The budget part of a weed plan needs to include all costs and benefits. For instance if we use enforcement provisions of the Act we must include the cost to the landowners who would not chose to control the weed if the provision was not in force, as well as the obvious costs of administering the provisions and control work on council land and roads.

Noxious weed declaration does not indicate a level of priority for a weed control program. A declaration is no more than a method of meeting a plans aim.

Table 3 shows some plans the are underdevelopment in New South Wales.

Table 3. NSW Agriculture weed management plans.

Plan level	Initiated by	Benefits	Example
National	NSW Ag; AWC; other		Siam weed; Striga spp.
State plans	NSW Ag	National/state	parthenium weed; alligator weed.
Regional plans	NSW Ag, regional advisory committee	Regional/State	Southern Tablelands serrated tussock management plan
Local plans.	Local control authorities	Local/Regional	blackberry; wandering dew

Which Program Should We Fund?

Ultimately a decision is needed as to which programs the government should fund. If traditional economic approaches are taken, the emphasis will go to programs which are low cost and have a major effect. Programs to protect agriculture will tend to have priority due to the relative ease of establishing the economic impact of a weed on a farming system. Valuation is much more difficult when we consider weeds of natural ecosystems.

Dane Panetta (1996) summarised the stages of weed invasion and suggested appropriate action and constrains (see table 4). For weeds of natural ecosystems the manager must consider the trade-off between the conservation value of the land and the effort needed to conserve it. For areas which are degraded and of lower conservation value it may not be worth protecting from invasion by noxious weeds. By contrast where an area has a high conservation value it may warrant protection activity at a greater level than is expected of other land.

Other Reasons To Support a Strategic Approach

To ensure that we can maintain restrictions of imports of weedy plants and produce, machinery etc that may contain weeds we must take a strategic approach. Under the PSS agreement under the Uruguay round of GATT we must demonstrate that we have programs in place to look for weeds etc before we can impose restrictions on imports. The system in place currently does not allow us to demonstrate that we are surveying and checking within Australia to the same level that we are imposing on our trading partners.

We also have international obligations. Extracts from the International Convention on Biological Diversity include a requirement for Australia to:

Develop national strategies, plans or programs for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programs which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting party concerned; and

Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programs and policies (Article 6).

Prevent the introduction of , control or eradicate those alien species which threaten ecosystems, habitats or species; (Article 8)
Integrate consideration of the conservation and sustainable use of biological resources into national decision-making (Article 10)

All Australian states and the Commonwealth have agreed to the International Convention on Biological Diversity. This obliges NSW to develop plans control or eradicate alien species which threaten ecosystems or species.

Table 4. Stages of weed invasion, appropriate actions and management constrains.

Invasion milestone	Management action	Constraints
Colonisation	Reduction of invasibility	Effectiveness of "community management"
	Management of dispersal vectors	Nature of vector
	Maintenance of buffer zones	Cooperation of neighbours
	Eradication	Detection
Reproductive maturity	Eradication	Detection Duration of juvenile period
Seed bank development	Eradication	Rate of seed bank decline
Structural change (direct or indirect)	Targeted weed control	Off target damage
	Assisted recruitment/revegetation	Attributes of indigenous spp.
	Controlled disturbance regimes	Regeneration requirements of indigenous species

F.D Panetta and D W Lane (1996)

CONCLUSIONS

One of the outcomes from the planning process is that we will be able to fund the most beneficial programs, irrespective of the method. Weed officers will need to look beyond the Act. They will need to develop their extension skills, and planning skills. They will establish field demonstrations; hold training days for council field staff; they will identify new weed problems.

Local control authorities who are not happy with their adjoining council's activities will develop joint plans and seek funding from NWAC based on those plans. Councils will submit proposals to remove the enforced control requirements from most weeds and suggest innovative proposals for new proclamations.

We need to answer further questions:

1. Which weeds warrant inclusion on the noxious weeds list?

2. What criteria are used in that allocation of resources and imposition of restrictions under the Noxious Weeds Act.

3. How do we link between funding and results of weed control activities.

TAKE HOME MESSAGE

Government funding for weed control will continue provided we demonstrate success. To demonstrate success we need to increase our strategic approach to weed control including noxious weed control. In a competitive environment programs which use a strategic approach, are well planned and incorporate a balance of methods are most likely to obtain government assistance.

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Example Action Plan- Parthenium

Objective: Detect all new incursions of parthenium weed		
Barrier: Farming community and public do not recognise parthenium weed		
Action	Who	Milestone
Develop TV ad and show on prime time during summer in target area	NSW Agriculture	1. Ad completed by Dec 1996 2. Ad shown for 3 weeks over summer 1996-97
Develop caravan display and tour rural shows in target area	NSW Agriculture to develop display Regional advisory committee to arrange schedule LCAs to attend display in local area	1. Display developed 2. Display exhibited at 12 shows and 2 field days
Barrier: Landowners do not notify local control authority when a plant is suspected		
Action	Who	Milestone
Publicity program	NSWAg	1.Publicity covered by radio and rural print media in target area by November 1996
Visits to farm properties, machinery dealers, seed and grain merchants, machinery field day sites and parking bays in target area to draw attention to the problem and conduct survey	LCA weed officers	1. 20% of farms who have not reported parthenium weed in target area visited once during period January to May. 2. 100% of agricultural machinery dealer yards, seed and grain merchants, machinery field day sites and parking bays inspected during period January to May.
Require landowners to notify local control authority when parthenium weed is found (**Section 15**)	NSWAg	1.Declaration requiring notification in place by Jan 1997
Barrier: New outbreaks often occur on public lands and roads		
Action	Who	Milestone
All highways and shire roads inspected once in period April to May	LCA Weed officer	All Roads inspected by May

Contingencies:	Action
Large outbreak found, over several properties	Apply to treasury for extra funds to allow for initial treatment Amend Act to allow for local quarantine of affected properties
Local control authorities fail to report new outbreaks or fail to follow-up old records	Withhold grant funds from LCA's

AN APPRAISAL SYSTEM FOR LOCAL CONTROL AUTHORITIES
Expectations for LCAs and NSW Agriculture

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ABSTRACT

The New South Wales Government has provided $6 million to local and county councils (Local Control Authorities) as grants to help with noxious weed management. An outcome of the recent development of the NSW Noxious Weeds Strategy was the need to make some sort of appraisal of activities of Local Control Authorities (LCAs) to ensure whether these grants are well spent, and whether LCAs are performing functions and responsibilities under the Noxious Weeds Act. Such an appraisal would also establish a basis to help improve the operations of LCAs.

A formal appraisal system has been developed by weed management staff of NSW Agriculture. The appraisal is in the form of a desk top audit where LCA staff involved in noxious weed management operations (officers and their supervisors), and possibly the chairman of your weeds committee, discuss a series of questions with two staff from NSW Agriculture. Two, out of a pilot run of six, Local Control Authorities have completed appraisals.

For Local Control Authorities outcomes will include a report on how your Local Control Authority compares to others. This, of course, will demonstrate where you lead with weed management, where you have taken an alternative approach, or perhaps where you need to improve. In situations where a number of LCAs need to improve on an issue, NSW Agriculture may be able to develop programs to address any problems strategically.

Most councils are now familiar with appraisal systems, benchmarking and audits. Our appraisal system for LCAs is initially being developed for analysis of your work processes. In time, appraisals could be reviewing how you compare to set benchmarks and whether you have reached particular weed management goals.

The results of the pilot appraisals will be reviewed in November and any required changes to the system will be made. After this, all LCAs will be examined sequentially.

Noxious Weeds staff of NSW Agriculture and the Noxious Weeds Advisory Committee are committed to the appraisal process. We see that such a formal appraisal need not be seen to be intimidating to LCAs, but more be considered as part of their own assessment and development process. We look forward to your support with this.

ACKNOWLEDGMENTS

Many thanks for Michael Michelmore and Richard Carter for constructive comments on earlier drafts of this abstract.

PARTHENIUM WEED UPDATE

A Review of Parthenium Weed Outbreaks in New South Wales

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TAMWORTH

BACKGROUND

Parthenium Weed was probably first introduced to Australia during World War II by contaminated military equipment imported from the USA. The infestation was discovered in 1955, ten years after the end of the war, at Toogoolawah in the Brisbane Valley on the site of a wartime American airfield. This infestation was subsequently determined to be a different bio-type to the later introduction in Central Queensland (Navie et. al., 1996) and did not spread widely from the outbreak site.

A second introduction of Parthenium Weed occurred in 1958 in contaminated Buffel Grass seed imported from Texas in the USA (Haseler, 1976). The outbreak occurred in Central Queensland between Clermont and Belyando Crossing. However the outbreak was not discovered until 1964 and not appreciated as a significant threat until Spring 1973 when large numbers of plants emerged along roadsides in the area following good rains (Parsons and Cuthbertson, 1992). It is believed that widespread clearing in Central Queensland, promoted by the Brigalow Scheme, and in particular the unregulated movement of heavy machinery exacerbated the alarming rate of spread of Parthenium Weed during and after this period.

Parthenium Weed was first detected in New South Wales on 1st April 1982. The outbreak consisted of one plant growing on the roadside of the Newell Highway approximately 37 km north of Narrabri and was discovered by Mr Ron Baker, the Chief Weeds Officer of Narrabri Shire. Two weeks later a single plant was found growing beside the Newell Highway 75 km north of Moree. A number of other plants were found that season on both roadsides and private agricultural land, including an outbreak of 250 plants growing along Swifts Road, a boundary between Moree Plains Shire and Yallaroi Shire (North West Weeds County Council). The Swifts Road outbreak was adjacent to Oaklea, a property in Moree Plains Shire, approximately 85 km north east of Moree. In July 1983 approximately 1000 Hectares of Oaklea and Karuah, an adjoining property under the same ownership were found to be infested by scattered plants of Parthenium, with 3 Hectares around a machinery shed heavily infested. This outbreak fully demonstrated the threat to New South Wales posed by Parthenium Weed.

Nature of Outbreaks

An outbreak may range from a single plant growing on a roadside through to a very large number of plants growing on farming land which were reasonably presumed to have been introduced by the same source and which may require many years of surveillance and control to eradicate. To date there have been 442 reported outbreaks of Parthenium Weed in NSW. This number may in fact be smaller as it is impossible to know whether plants found along a stretch of main road over a period of weeks stem from the same cause or not.

A breakdown of the NSW outbreaks may be shown in the following table.

Location of Outbreak	Number of Outbreaks	Percentage of Total
Privately Owned Agricultural Land	39	8.8%
Feedmills and Silos	3	0.67%
Feedlots	3	0.67%
Machinery Yards	4	0.9%
Newell Highway Roadside	180	40.7%
All Other Roadsides	213	48%
Total	**442**	**100%**

The outbreaks on privately owned agricultural land were of a far more serious nature than those on roadsides. The majority of roadside outbreaks consisted of not more than 5 plants. This may be contrasted with two major outbreaks on private property. At Mundry, west of Gunnedah, more than 5788 plants were found over a five year period. This outbreak was notified and was caused by contaminated Purple Pigeon Grass seed. At Oaklea, plants are still being found 14 years after the outbreak was discovered. The initial introduction of Parthenium seed may have taken place 5 years before that discovery. Seed at Oaklea was also buried by cultivation. It has since been estimated that the half life of buried Parthenium Weed seed is at least six years, (S. Navie pers. comm., 1997).

This means that buried seed may continue to emerge for up to fifteen years.

Source of Outbreaks

The source of most roadside outbreaks of Parthenium Weed is open to speculation but was most probably a combination of factors including seed blown from vehicles which had come from Qld including headers, contaminated soil falling from earthmoving machinery from Qld and contaminated grain from Qld spilling from trucks.

The source of most outbreaks on privately owned land was much better known. The majority of outbreaks on all private land in NSW has been attributed to header harvesters, (27 known outbreaks). Contaminated sunflower hulls from Gwydir Valley Oilseeds were also major source, (8 outbreaks). Gwydir Valley Oilseeds has since changed hands and this problem no longer occurs. Other sources have included contaminated pasture seed from Qld (1), sheep (1) and contaminated grain from Qld (3).

Recent Outbreaks

In 1996 there were a relatively small number of roadside outbreaks, mainly occurring in Moree Plains Shire. There were however a number of significant outbreaks on private land. These included two outbreaks in machinery yards at Gilgandra and at Quirindi; five outbreaks on farming land in Moree Plains Shire near Mungindi, which were thought to have been caused by two headers working independently and one outbreak on grazing country near Tenterfield which has been attributed to contaminated sunflower hulls from Gwydir Valley Oilseeds.

In 1997 there has again been a relatively small number of outbreaks, almost all of which have occurred on roadsides, the majority being in Moree Plains Shire. There has also been one roadside outbreak in Bogan Shire and Brewarrina Shire, (Castlereagh-Macquarie County Council). The only private property outbreak to occur in 1997 was in Moree Plains Shire. The location was a small property of about 40 Ha approximately 5 km east of Moree adjoining the Gwydir Highway. The outbreak was reported by a tenant of one of the two houses on the property after having seen the Parthenium Weed display at the Moree Agricultural Traders Exhibition.

The outbreak was thought to be at least three years old and has been attributed to header harvesters. The owner of the property had been a harvesting contractor. However he sold his equipment and left the industry three years ago. The tenant said that the headers had been parked in an area where the parthenium plants were found to be most prolific. The number of plants associated with the outbreak has been estimated at 1000.

In June 1997 a major outbreak was discovered south of Gatton in southern Queensland. The outbreak covered 160 Ha of steep basalt country that was also heavily infested in parts with lantana. Three adjoining holdings were affected. The outbreak was thought to be five years old and the introduction has been attributed to a bulldozer. The Queensland Dept of Natural Resources has taken significant steps to contain the outbreak however they have not committed any funds, beyond supervision costs, to the control of the infestation despite the limited financial means of the affected landholders.

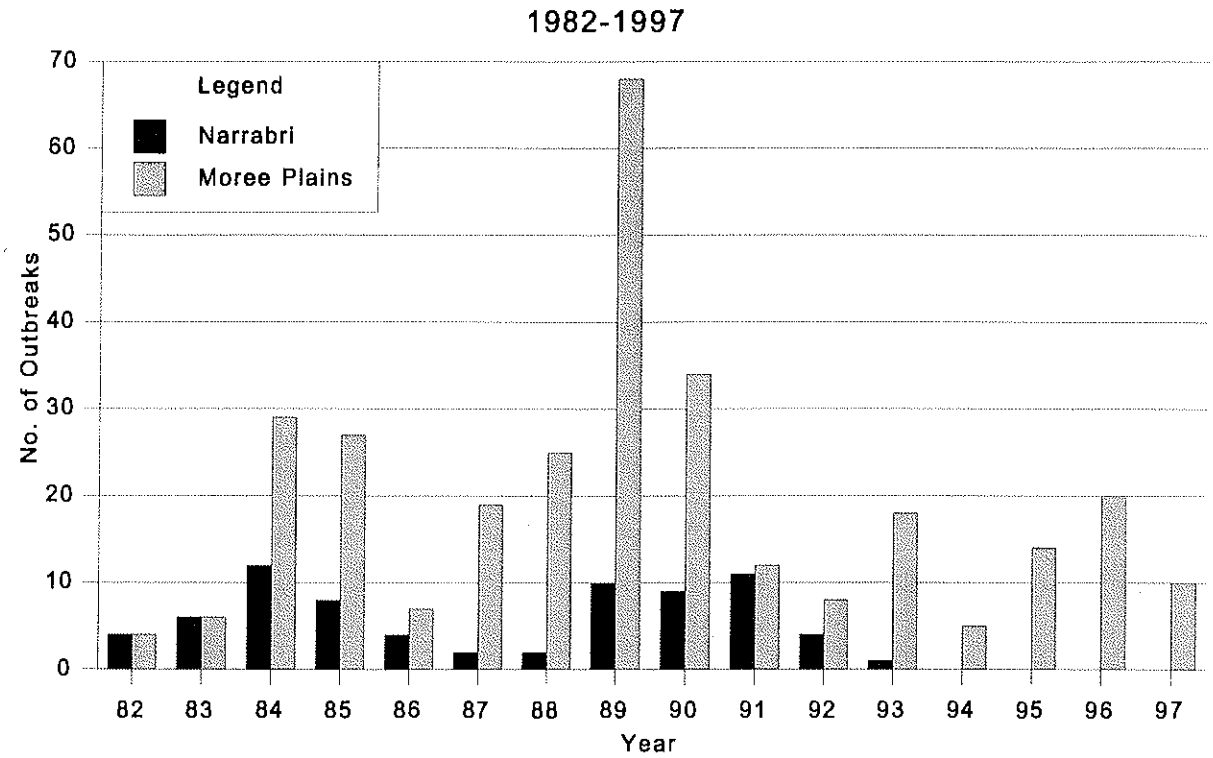
NSW can successfully fight the Parthenium Weed invasion as long as southern Queensland remains relatively free from infestation. However it is anticipated that Parthenium Weed may become endemic to southern Queensland within twenty years but it is hoped that the biological control program will have reduced the vigour of the species by that time (R. McFadyen, pers. comm.. 1997). The Gatton outbreak is not in itself an immediate threat to NSW. However should Parthenium Weed be permitted to become endemic to southern Queensland before the bio-control program has been demonstrated to be successful, the threat to NSW may be dire.

Trends

To determine any trends of Parthenium Weed incidence in NSW it is useful to examine information from outbreaks in two northern shires, Moree Plains and Narrabri. Both these shires are transected by the Newell Highway. Moree Plains Shire abuts the Queensland border and has recorded the largest number of Parthenium Weed outbreaks of all local government areas in NSW. Narrabri Shire adjoins the southern border of Moree Plains Shire.

The number of outbreaks in these two shires may be demonstrated by the following chart.

Parthenium Weed Outbreaks

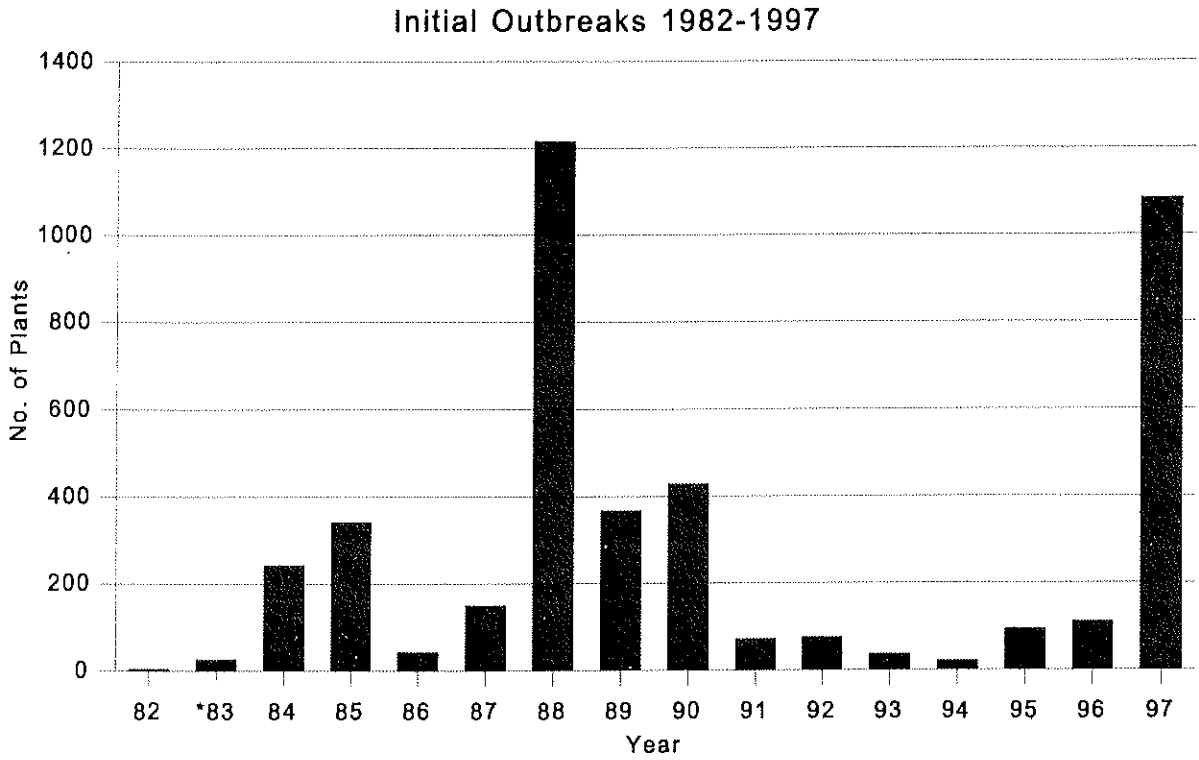


It is apparent that the number of outbreaks has been declining since 1990. This could be due to enhanced border crossing procedures for harvesting machinery and the imposition of new procedures for the handling of sunflower seed and hulls from central Queensland at Gwydir Valley Oilseeds, Moree. However it should be noted that the large number of outbreaks in 1989 coincided with the most recent period of wet summer conditions and the consequent bumper sorghum crop in central Queensland.

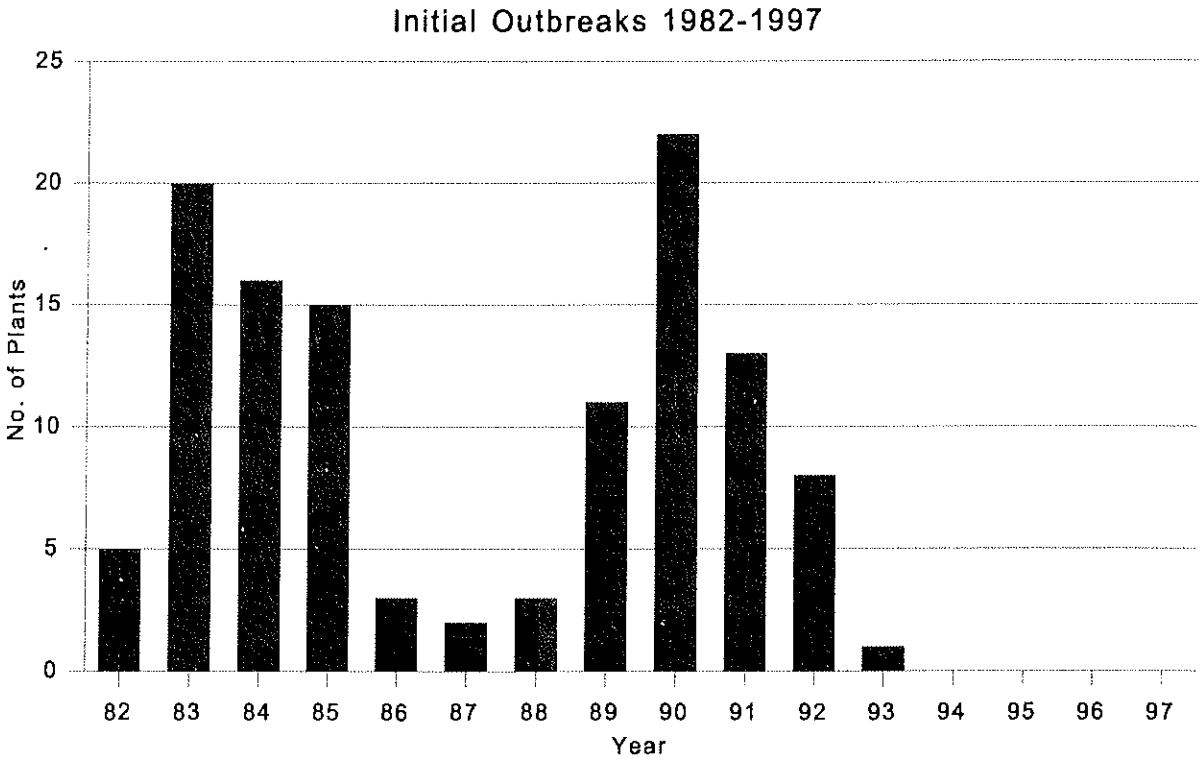
The following two charts show the number of plants of Parthenium Weed which were associated with outbreaks in Moree Plains Shire and Narrabri Shire from 1982 to 1997.

- Note that the Moree Plains chart does **not** include the outbreak at Oaklea in 1983 which may have contained more than 10 000 plants.

Parthenium Plants - Moree Plains



Parthenium Plants - Narrabri Shire



The above two figures leave little doubt as to the source of Parthenium Weed outbreaks in NSW. The figures also demonstrate the apparent decline in the amount of Parthenium Weed seed being introduced to NSW from Qld since 1990 and also the consequences of a failure to detect an outbreak for a number of years.

There has been some debate in NSW as to whether the majority of roadside outbreaks have been caused by Parthenium seed spilling from grain trucks or by seed falling from headers. This dispute cannot be decided until the next major sorghum harvest in central Queensland with the consequent significant movement of grain, which may be contaminated with Parthenium Weed seed, from Qld to NSW.

SUMMARY AND TAKE HOME MESSAGES

- Parthenium Weed continues to be one of the most significant weed threats to agriculture and human health in NSW. Ensure your Council is fully aware of the threat posed by Parthenium Weed.
- The number of outbreaks is currently in decline but the reasons for this remain unclear.
- Viable Parthenium Weed seed may continue to emerge for up to 15 years after being buried. Prevent seed from being buried as far as is possible. Use appropriate wording in Section 18 Notices and advise engineering staff.
- Maintain good community awareness of Parthenium Weed. If you find a roadside plant, run a field day. Use the Parthenium caravan at Shows etc. Keep the local press informed.
- Small outbreaks are much easier to eradicate than large ones. Encourage notification of outbreaks by landholders. Consider use of penalty notices for failure to notify. Train outdoor staff in Parthenium Weed identification. Thoroughly treat all outbreaks.
- Promote the practice of good farm quarantine to all landholders. Encourage grain growers to use reputable harvesting contractors and to insist on a border inspection certificate if the headers have been in Qld. Discourage the purchase of grain and hay from anyone with an 07 79XX XXXX telephone number.
- Maintain a thorough inspection program, particularly around feedmills, machinery yards and feedlots.
- Maintain complete inspection records. You wont be around forever!
- Report all outbreaks to Weeds Branch, NSW Agriculture.

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PARTHENIUM STUDY TOUR - APRIL 1997

Bryson Rees
Senior Weeds Officer
Wellington Shire Council, Wellington

After a round trip of approximately 4,200 kilometres into Queensland we all returned home much the wiser on Parthenium and having seen plenty of plants at all stages of growth. Forty two people from Councils, County Councils, Rural Land Boards and sponsor DuPont, whom we thank for their support, attended the tour.

Having completed a day and a half on the bus, the first sightings of Parthenium came to our attention on the Bauhinia Downs District Tuesday afternoon and there was plenty to see. Before any sightings, staff of Moree Plains Shire Council gave us a presentation on their fight to keep the weed out of NSW. From the Shire adjoining the Queensland Border this talk was very informative and had everyone thinking about what was ahead of us over the next few days.

After travelling through the Bauhinia Downs we arrived in Rolleston to pick up the Project Officer of the Parthenium Action Group Inc., Scott Dearden. Scott spent the next two days and nights with us. This proved a very beneficial move as Scott was there to answer many questions and guide us through the tour. Having picked up Scott we drove some 200 metres from the centre of Rolleston to a truck-stop for our first introduction to Parthenium and there was plenty about.

Being an incorporated body, all had to sign the visitor's book, including the bus drivers who both mixed well and learnt with the rest of us. Scott handed out his written information and then introduced us to Parthenium and gave us a short talk followed by many questions from us. We spent over an hour on site before making our way to Springsure.

Wednesday was a full day in the field with the morning made up of guest speakers talking to us on many aspects of Parthenium and the problems. We visited "Mount Pleasant" with Manager Ross Griesson talking on the problems on their property.

The next speaker was Scott Day, Noxious Weeds Officer Calliope Shire Council. This Council is on the coast and with very little Parthenium they have adopted a heavy handed approach, ie "clean it up now or we will do it and charge you".

Jim Wilmont, Lands Protection Officer from Central Region, then spoke. He covers the area that has the most Parthenium infected areas and they tackle each infestation as they come across it.

The final speaker was Alan Tomley from the Department of Natural Resources, Allan Fletcher's Research Station and he spoke on Biological Control Agents. There are six Bio-Control Agents but the two most successful are Zygogramma bicolorata (leaf eating beetle) and the Partheniicola (Parthenium Rust). All speakers along with some ten landholders from the Local Landcare Group remained with us for lunch answering many more questions as well as joining us in the field during the rest of the day which proved an added bonus to all.

We then visited "Mount Panorama" to look at field evaluation of the effectiveness of the Biological Control Agents. Scott Dearden explained to us the field site and what results have been achieved. There certainly was no shortage of Parthenium either effected by Bio-Control Agents or unaffected and this was the case for the full field part of the tour. Leaving "Mount Panorama" we headed for Fred Ivan's block to check out his chemical control site.

Three main methods of chemical control are to use Atrazine and 2-4-D Amine 500 g/l or 2-4-D Amine and Brush-off or straight Brush-off. As was continually being told to us the Parthenium loves no competition. The general idea now is to use 2-4-D Amine and Brush-off mix or just Brush-off. This way the grasses survive.

Now having left all three properties we were instructed by Scott Dearden to take the bus to the Rolleston Parthenium wash down bay. The bus was cleaned inside and out. We returned to Springsure following the bus wash down for the thankyou speeches and some small presentations of thanks.

Thursday saw us head back to the Bauhinia Downs district for more field site inspections with the main visit to Robin Sparke's property, "Wirranda", where we observed grazing and pasture management to combat Parthenium. Robin's program has been so successful that we had to go to his boundary fence to see the difference between his management program and the next door neighbour who has flogged his country bare and now has a good coverage of Parthenium.

As I said earlier, the inspection of "Wirranda" proved, as did "Mount Pleasant", that good management of grazing and pasture can beat Parthenium on a property. The timing of the study tour was good as the seasonal conditions had Parthenium growing well and we saw plants from seedlings up to mature plants ready to drop thousands of seeds.

At the completion of the field trips I spoke to Moree Plains Council staff and asked them how do they feel now about the situation with his reply being that we can beat it by keeping up our program that we have in place, knowing now that Queensland are working and winning with their programs.

With five long days of the tour, two in the field with Scott Dearden and some 250 minutes of video to be edited by NSW Agriculture, we are now in a better position not only to identify Parthenium but have the confidence to talk about the problems that can be caused by this noxious weed of both States.

Upon leaving Isla Gorge the Project Officer had plenty of second hand boots to dispose of left behind by the touring party. A tour well worth the effort!

TAKE HOME MESSAGE

In general the landholders of Queensland do not consider Parthenium a major problem and the truth of the matter is they are working hard on Parthenium which is different to what we were led to believe before the study tour. This is no reason for us to relax by any means and I can say that anyone that went on the tour is well aware of the problem that could develop if we become complacent.

THE PARTHENIUM ACTION GROUP'S PROGRAM IN QUEENSLAND

Scott Deardon
Project Officer
Parthenium Action Group

INTRODUCTION

The Parthenium Action Group was formed in 1994 after a workshop held by the Rolleston Landcare group identified parthenium as the number one Landcare concern in the district.

The Action Group has a core committee which includes landholders from the Central Highlands, members from Local Government, and representatives from the Department of Natural Resources and the Department of Primary Industries.

The group also has an association with the Queensland Transport Department and the Department of Environment and works closely with the Allan Fletcher Research Station, Brisbane and the Tropical Weeds Research Station, Townsville.

The group has established a program through which it's aims are to:

- educate landholders of the best management practices of parthenium from landholder's experiences;
- educate the broader community to the potential problems associated with parthenium;
- educate the community in measures to prevent the spread;
- establish research and development in the field;
- contain parthenium within the Central Highlands;
- eradicate parthenium within the Central Highlands.

EDUCATION AND AWARENESS

Through an extensive on going program of education and awareness the community is being kept informed of the problems associated with parthenium. This is being achieved through presentations given at field days, Landcare group meetings, Weed awareness days such as 'National Weed Buster Day', displays arranged at cattle sales and functions such as Beef '97, a premier beef expo held every four years in Rockhampton and Agro 2000, an agricultural exposition held in Emerald, Central Queensland every year. A regular news letter is also published by the Project Officer from the Parthenium Action Group and keeps recipients up-to-date with what's happening on the parthenium scene.

The Parthenium Action Group has purchased ten perspex display boxes for use by Landcare Groups situated on the periphery areas of the infestations to display live parthenium plants and biological control agents. These boxes are shifted around various business houses in order to target a large cross section of the community. The boxes are designed to contain any seed which may develop on these display plants.

The erection of ten awareness signs on roads leading into the Central Highlands indicating, "PARTHENIUM WEED AREA, BE AWARE", was the first bold contact with the general public. These signs have well and truly caught the attention of both the travelling public as

well as locals. A number of follow-up projects have been undertaken to show the travelling public what this weed looks like and why people should be aware. Posters have been printed and are being displayed in service stations, rest areas, tourist information centres and various other locations. With finding provided by the Natural Heritage Trust, identification cars with a magnetic strip have been printed and are now available at these locations. Numerous A4 leaflets have been published and are constantly handed out at various venues. Some of these are specific to gold and gem fossicers coming to the area and who then travel far and wide.

Being involved in the education of the policy makers of the future is something that we are proud of. For two years Natural Resource students from the Gatton College campus of the Queensland University have visited Rolleston on their annual tour to gain first hand knowledge on the problems, management options and controls of parthenium. By showing these students the problems associated with parthenium may help alleviate a similar problem from occurring in the future.

With the assistance of the local Landcare co-ordinator Merredith Barrett, the local primary school students have been taught first hand the problems associated with parthenium and land degradation matters.

Education and awareness is one of the most important aspects of our program in Queensland. It is not only targeted at school children, but landholders, government departments, service industries, councils and the general and travelling public. Everyone need to be made aware of the various ways that weed seeds can be spread further afield. Just because those pretty white flowers bear a resemblance to 'babies breath', people should not assume that it is one and the same. Staff at the Carnarvon National Park are horrified when they see bunches of these flowers on travellers dash-boards. To this end we are consistently producing awareness literature to target these people. Identification is important.

Recently an Endeavour car rally was rerouted to avoid travelling through large infestations of parthenium. A Clermont grazier was so concerned that he contacted the organizers of this event and without hesitation the organizers altered the route to avoid this area. The concerns that parthenium is causing in our community is reflected in the understanding that is shown by organization such as this.

Recently a tour was organized for New South Wales extension staff to view the parthenium problem first hand and to see that Queensland is actively working towards correcting the existing problem.

The Parthenium Action Group now has an internet mail web site that can be accessed by pags@bigpond.com

LANDHOLDER COMMUNICATION

The Parthenium Action Group has published a 'Best Management Practices' Booklet written from landholders experiences. This booklet was written to give landholders options on the best management practices for controlling parthenium. It was written with the assistance of first hand experiences that landholders have encountered since the 1970's in controlling the weed on their properties, and also with the help of staff from DNR, Lands Protection Branch and QDPI. This booklet has been well received with all 4000 copies having already been

distributed to landholders and relevant people. Funding is being sought to re-write an up-dated version of this booklet.

ON GROUND ACTIVITIES

DLP funding was granted to the Parthenium Action Group to purchase ten quick-spray units. These units have been placed around the Central Highlands and are made available to landholders and the general community for a minimal fee. They have proved very successful in controlling isolated outbreaks of parthenium in relatively clean areas.

A number of nursery sites have been established around the Central Highlands to help establish the various biological control agents. These sites have community ownership and landholders and interested parties are continually shifting biological control agents to these nurseries for future harvesting. The collection of the various biological control agents from the Rolleston district is an on-going commitment that has been undertaken by the various landcare groups and landholders in the infested areas. By giving these sites community ownership it has helped to educate Landcare groups and landholders in the unique problems that are associated in establishing biological control agents in the field. There are various aspects of establishing these agents, for example, elevation, soil types and variations in weather conditions to name but a few.

There are some nursery sites that are more successful that others, these are of particular interest to research staff and they are searching the reasons for this.

All the biological control agents used in the fight against parthenium have had to be brought from the Central America's. With our variable weather conditions, for example, long periods of drought and temperature variations, it has been hard for us to establish these agents in certain areas. This will be a long on-going process as is the case with many biological control agents.

Wash down facilities have proved successful in controlling the spread of parthenium. The construction of more of these facilities on the periphery areas is on the Queensland Governments agenda. The prohibiting factor in getting them sooner is a requirement to have a waste oil and grease skimming facility incorporated. One of the first pads constructed was in Rolleston by Siepem whilst constructing the Roma to Gladstone gas pipeline. It cost approximately $5 000 and is constantly in use. The Emerald Shire Council recently built one at a cost of $90 000, and funding has been sought for another facility at a cost of $150 000. The Parthenium Action Group feel that ten $9 000 facilities would be more practical than one $90 000 facility.

BIOLOGICAL CONTROL AGENTS

Individual landholders and community groups such as Landcare groups eagerly await each year the availability of the various biological control agents. Zygogramma bicolorata, is one agent that is readily sought after. The reason for this is the Zygogramma bicolorata is a defoliating beetle who's larve are veracious feeders. With the defoliation comes increased light and heat to the soil, this helps in the establishment of exotic and native grasses.

There are five other biological control agents already established in the field. Epiblemma strenuana is wide spread and established throughout the parthenium infestation and has spread as far south as New South Wales. Epiblemma strenuana is a stem galling moth and has been

successful in reducing the height and the vigour of parthenium. Listronotus setrosipennis is a stem boring weevil. After a recent survey funded by the MRC, it was determined that this weevil was present in the Upper Belyando, Isaccs/Connor and Suttor River systems. Although this weevil was found to be present, it's density varied greatly.

Smicronyx lutulentus is well established in the Rolleston district. Smicronyx lutulentus is a seed feeding weevil that pupates in the flower heads.

Bucculatrix parthenica is a leaf mining moth that is established throughout the infested areas.

The winter rust, Puccinia abrupta has managed to establish on the western side of the Great Dividing Range and it's establishment is looking good on the eastern side ofthe range in the Central Highlands.

Community involvement in the collection of biological control agents for distribution to other nursery sites and landholders properties is an ongoing commitment. Landcare groups and individual landholders have a well worn path to the infestations around Rolleston where all the biological control agents are presently established in the field. This involvement will spread biological control agents far and wide for establishment in other areas of the infestation. The establishment of all biological control agents is a long process and our success will be measured in the years to come.

CONCLUSION

The Parthenium Action Group is constantly being requested for representation with Landcare groups and landholders in relation to perceived problems that may come about through the erection of high voltage transmission lines, gas pipelines, mineral and gas exploration and other service industries in and on the periphery areas of the parthenium infestation.

Much concern has been shown by community groups and individual landholders for the potential of weed invasion in the construction stage of such projects. In alleviating much of the anxiety about weed infestations it is becoming a standard for companies to do a weeds survey with their initial centre line surveys. This establishes where weeds are and aren't.

The main concerns landholders have are:

- where construction machinery comes from;
- do maintenance contractors work in contaminated areas as well;
- the sighting of access tracks in and out of job sites;
- the use of washdown facilities.

We are all working to formulate and obtain commitment for an industry standard to be established.

The Parthenium Action Group has been invited to participate in Landcare group meetings to explain the potential problems associated with parthenium infestations. By taking live plant specimens and displaying them at such meetings has proved successful in identifying isolated outbreaks.

"If a picture is worth a thousand words then a live plant is worth a thousand pictures".

KEY LEARNINGS

- Find a project which the community see as a priority.
- Give ownership by creating awareness.
- Keep people informed.
- Keep committees small.
- Access all stakeholders.
- Have positive on ground activities early.

NSW AGRICULTURE'S NOXIOUS WEED MANAGEMENT COMPUTER PROGRAMS

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ABSTRACT

NSW Agriculture is currently developing computerised database management systems to aid in weed control. Most of these databases will be linked, some time in the future, to the departments homepage on the World Wide Web. The homepage, http://www.agric.nsw.gov.au is still being trailed and modified to meet the needs of all NSW Agriculture clients. An email account has been setup by NSW Agriculture to service clients within the weed control industry. The address is weeds@agric.nsw.gov.au

This paper will discuss the various information available on the web site and the best ways to access it. The computerisation of the noxious weed grant application form and the ability to receive and lodge the grant application via email will also be discussed.

WEED MAPPING USING GPS, GIS AND REMOTE SENSING

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INTRODUCTION

Why Map Weeds?

Information on the distribution and abundance of weeds is essential to assess the importance of the weed and its spread over time. Such information is also essential to properly estimate costs of lost production and to formulate management and research strategies. Without the information, it is difficult to properly evaluate the cost and effectiveness of control strategies and to obtain funding for control programs.

However, accurate information is rare. Most is in the form of presence or absence data without any information on weed density or abundance. Accurate data on abundance of weeds is very difficult to obtain, as is information on change in infestation levels over time.

How Are Weeds Usually Mapped?

Conventional methods for weed survey are questionnaires, the use of herbarium records, and field surveys. Field surveys may be carried out by air or by ground, and in recent years Global Positioning Systems (GPS) integrated with Geographic Information System software have been used (Auld, 1971, 1978, 1984, 1995; Hyde-Wyatt, 1979; Pitt and Miller, 1988).

While remote sensing systems have been predicted for a number of years to be of use for weed mapping, particularly on a large scale, they have been little used for this purpose.

GLOBAL POSITIONING SYSTEMS

Global Positioning Systems (GPS) have great potential for weed mapping work. However, it is important to understand their proper use and limitations.

Most GPS receivers use the American satellite network for positioning, while a smaller number can access the Russian satellite network (GLONASS).

A range of GPS receivers can now be purchased, with the cheaper models surprisingly inexpensive. However, the cheaper units often have a poorer accuracy and other major limitations.

Problems Of Accuracy Of Position Fix

Position fixes using the American system suffer from a systematic error programmed into the satellites, which degrades the signal. This is called 'Selective Availability'.

This error means that when a position fix is taken, 95% of the time it will be within 100 m of the actual position. 99% of the time, the fix will be within 300 m of the actual position, and 1% of the time it will be outside these limits.

Selective availability causes constant variation in the signal, which means your position fix will change, even if you are not moving. It is the result of induced clock errors and an orbit error in the navigation message.

Other errors occur due to degradation of the signal by the atmosphere, the position and 'health' of the satellites you are using, the number of satellites you are using and the accuracy of the clock in your GPS (McElroy, 1992).

Errors due to satellite position in the sky can also occur. For example, if all the satellites are well spread around the sky, the potential error is less. On the better GPS units, this is reported by providing GDOP readings (Geometric Dilution of Position), which provide information on the accuracy of the position fix. There are a number of 'DOP' readings, but many GPS units only report some DOP readings, and the cheaper units provide any information on DOP. The reading most commonly provided is PDOP (3D position) (McElroy, 1992). A higher DOP reading means a much poorer accuracy of position fix.

Use Of Single Position Fixes For Weed Mapping

Single position fixes using GPS are useful for telling you approximately where you are, or where an infestation of a certain weed is. You may be able to use the figure to report the centre point of an infestation and then record an estimate of the area infested to use with the GPS position fix.

However, the variation in the signal means that basic GPS position fixing cannot easily be used for mapping the extent of an infestation - that is, not if you want it mapped accurately. For large infestations, this may not be a problem, as plus or minus 100 - 300 m per fix when mapping the boundaries may be good enough. However, for accurate mapping of infestations this presents a problem.

Improving The Accuracy Of Position Fixes

The accuracy of GPS position fixes can be improved by a range of methods.

A common means is by the use of point averaging. Here the GPS is programmed to average a certain number of fixes while you are stationary. If about 300 fixes are averaged, this usually provides a reading of within about 50 m of your actual position (assuming a good spread of satellites and a reasonable GPS unit). However, this is time consuming, even when the GPS is capable of taking one reading per second.

There are other more accurate ways to overcome 'selective availability' signal degradation problems. Advanced GPS units can be connected to differential correction units, which provide real-time signal corrections. When such units are used with a reasonable GPS, position fixes accurate to within 1 - 5 metres can be obtained.

A number of correction services are available. The cheapest is AUSNAV, which broadcasts corrections over the 2JJJ FM and some other FM station wavelengths. A range of signal accuracies can be purchased - Premium (1-3 m accuracy), Intermediate (5 m) and Basic (10 m). Unfortunately, the service is only currently available for about one third of NSW, mainly over the eastern portion. The range from the broadcasting station for the premium service is also less than for the basic, and there is a risk of being in signal 'black spots' as FM

transmission is line-of-sight. However, the cost of the service is relatively low. A receiver costs about $600 - 900 ex tax, and the service costs start at $1300 per year for the premium rate, $350 for intermediate, and $180 for basic.

The more advanced services are satellite broadcast, and cover all of Australia. They require a receiver worth between about $6,000 and $12,000. The cost of the signal charges is also expensive, up to about $60/hour, although the receiver only needs to be turned on for a minute or so for a fix. The signal charges are on a sliding scale and decrease with amount of use. They can be purchased on a yearly, monthly, weekly or hourly rate depending on the service required. Rental of the receivers is also available. Two of the services available at present are Fugro Omnistar and Racal Landstar.

The advantage of these systems are that the GPS can be connected to a computer running mapping or GIS (Geographic Information System) software and that a real-time digital map of infestations can be produced as you drive around its boundaries.

A Common Trap With Using GPS

Another difficulty with GPS is that most receivers default to using the World Geodetic System (WGS 84) as the map datum. However, in NSW the Australian Metric Grid Reference (AMG) coordinates on our paper maps are based on the Australian Geodetic Datum (AGD). The datum in your GPS needs to be changed from WGS84 to AGD84 or AGD66 for you to be able to compare the GPS coordinates to those on a map. To make things even more confusing, a new Australian Geodetic Datum is planned for introduction in the year 2000.

How Accurately Can You Map Weeds Without GPS?

It is difficult to accurately map location and the extent of a weed infestation, using standard topographic maps, even in relatively open terrain. Mapping of weed infestations in rugged terrain is extremely difficult. A study done in the USA compared the accuracy of weed mapping using conventional survey and a differentially corrected GPS in rugged terrain. The results showed that the terrain confused the workers, as they overestimated the size, position and shape of weed infestations on topographic maps. The conventional survey overestimated weed infestations by 85% in comparison to the GPS survey (Lass and Callihan, 1993).

One of the problems in estimating the extent of weed infestations is the definition of an infestation. What is a light, moderate, or dense infestation of a certain weed? Does this change with location in the State? Is a 10% infestation considered light? Is it one plant per hectare, or is it one plant per paddock? Is it a small dense infestation in one section of a paddock? Is it a scattered infestation across a paddock? Is it the degree of infestation where agricultural production begins to suffer?

Weed infestations are easily overestimated. One study in 1988 found that in NSW, only 20 weeds had their area of infestation assessed. Of these, only eight had their infestations divided into different densities. The definition of density of infestation varied between the weeds, and the accuracy of the assessment was much poorer for the lighter infestations. In fact, the total amount of light infestations of the eight weeds exceeded the total area of the State (Campbell, 1991).

In order to accurately map serrated tussock infestations in Tasmania differentially corrected GPS has successfully been used. This was only possible due to the limited area infested with serrated tussock in this State.

REMOTE SENSING FOR WEED MAPPING

Due to time and labour constraints, it is obvious that GPS is not the complete answer to weed mapping. In some situations, it can be extremely useful, as in Tasmania where all serrated tussock infestations were mapped using differential GPS. Obviously, it will be very time consuming to drive around the infestation boundaries of all noxious weeds with GPS. In some cases, steep terrain may also make this impossible.

Conventional air and ground visual surveys for the monitoring of weed infestations are expensive, especially in inaccessible areas.

Alternatively, remote sensing offers the possibility of a low cost, objective, repeatable means of mapping weeds and monitoring their change over time especially over large and/or inaccessible areas (Curtis, 1978). It can be cost effective for large areas, as it requires less manpower per unit area than conventional surveys (Pitt and Miller, 1988).

However, for remote sensing to be successful, research is essential to determine differences between the target weeds and other vegetation. The sensor used must be able to determine the difference between the target weed and other vegetation with a minimum of error, and in a repeatable fashion. This is not always possible (Fitzpatrick *et al*, 1990).

Remote sensing has been little used in Australia for weed monitoring, but has been effectively used for the monitoring of other land cover types and their condition.

What Is Remote Sensing?

Remote sensing includes any system that collects information about the surface of the earth without being in contact with it. Such systems normally use or sense electromagnetic energy as their means of collecting such information (Campbell, 1987). Commonly used systems include photography, multispectral scanners and in recent years, radar and hyperspectral scanners. The platform for such systems can be hand held, aerial or satellite.

Aerial Photography

Photography has been used for vegetation mapping for over a century. It has the advantage of very good detail although it is limited to the visible and near infrared sections of the electromagnetic spectrum. In addition, using aerial photography over large areas can be a problem.

Much of the original remote sensing weed mapping work was based on aerial photography. Most of the work was conducted overseas on woody plants, although one study was conducted on identification of and density of nodding thistle (*Carduus nutans*) (Martinko, 1982). In Australia, successful studies were conducted on identification of a range of weeds. These included the amount of barnyard grass in rice across the MIA, and capeweed in pastures across the south west of Western Australia. Preliminary identification of *Mimosa* in the Northern Territory was also conducted (Barrett and Leggett, 1979; Arnold *et al*, 1985; Pitt and

Miller, 1988). Most of the work was based around the identification of the weeds at flowering.

Aerial photography is still used for weed mapping in specialised circumstances.

Satellite Systems

Most remote sensing for vegetation is now carried out using multispectral scanners. Of the satellite scanners, the two most often used for agricultural studies are the Landsat Thematic Mapper (TM) and SPOT High-Resolution Visible (HRV) instruments. Landsat has six bands covering the visible and near to mid infrared part of the spectrum (blue, green red, near infrared, mid infrared and mid-far infrared) as well as one thermal infrared channel. SPOT has three bands covering the green, red and near infrared parts of the spectrum. The ground resolution or pixel (picture element) size of these sensors is 30 x 30m for Landsat (120 x 120m for the thermal band) and 20 x 20 m for SPOT. These scanners measure the amount of light reflected back from the earth's surface in these wavebands (or the energy emitted by the target, in the case of the Landsat thermal channel).

The next generation of satellite systems (planned for launch from next year onwards) will include sensors with many more bands at a similar ground resolution to current systems, or similar bands with a much better ground resolution.

Airborne Systems

Airborne scanners have extremely good ground resolution, and have dramatically increased in use over the last few years. They offer the additional advantage of quick turn around time for between capture of the imagery and its availability. Current systems include analogue and digital airborne video (3 - 20 bands), airborne thematic mapper (10 - 12 bands) and recently hyperspectral scanners (up to 250 very narrow bands).

Weed Mapping By Multispectral Remote Sensing

The major problem with the use of multispectral remote sensing systems to map weeds is in the sensor's ability to discriminate the weed from other vegetation. Most bands of multispectral sensors measure the amount of light reflected back from the target to the sensor. If the target weed does not reflect significantly different levels of light from the surrounding vegetation, the chances are that it cannot be recognised. The density of infestation is also important, particularly if the sensor has a reasonably coarse pixel size. Therefore, current satellite systems may only be able to measure moderate to dense weed infestations in pastures and rangeland environments. Accurate assessment of light or scattered infestations is unlikely, although maps of likely areas of infestation may be able to be produced. Consequently, satellite systems are of very limited use for determining new areas of weed infestation until these become reasonably well established.

However, current and new airborne systems and the next generation of satellite systems should provide an improved capacity to map down to light infestation levels.

Satellite systems have been used in Australia to map change in woody weed cover in the Western Division of NSW. These studies monitored the distribution, density and changes in woody cover, with a recent study monitoring changes over a 10 & 20 year period (Cofinas *et*

al, 1992; Gardiner, 1994, 1996; Gardiner *et al*, 1996; Weir *et al*, 1992). While accurate in mapping woody vegetation in a dry grass understorey, problems occurred during flushes of understorey growth and in bluebush and saltbush communities.

Overseas, satellite systems have been investigated for the mapping of a range of weeds, again mainly for woody weeds. However, this has mainly been on a limited scale. One of the few large scale projects mapped bracken (*Pteridium esculentum*) over Scotland. This study used a combination of the older Landsat Multispectral Scanner (MSS) imagery (approximately 80 m x 80 m pixel size) and GIS (Geographic Information Systems) procedures to map the bracken. The GIS was used to determine the environments where bracken did not grow, and then the satellite imagery was processed for the remaining areas. The study was successful in identifying moderate - dense bracken infestations, but could not map light infestations (Miller *et al*, 1990).

Preliminary studies in Australia have also indicated the possibility of the use of satellite remote sensing systems for mapping Paterson's curse at flowering. This was investigated as a means of assessing the effectiveness of the bio-control program on this weed (Ullah *et al*, 1989b), and this project is being re-evaluated at present in Victoria.

Other studies have concentrated on the use of high ground resolution airborne imagery. Most of the work has been conducted in the USA, on a range of woody vegetation. Most of the studies have proven the potential for mapping such vegetation at a property level. However, the mapping was most successful where the weeds were greatly different from surrounding vegetation (for example, at flowering) (Everitt and Escobar, 1992; Everitt *et al* 1992, 1993, 1996).

There have also been preliminary studies in Australia to assess the use of airborne imagery for weed mapping. One study identified the potential for airborne thematic mapper imagery for mapping Blackberry (*Rubus* sp.), and was tested as a means of assessing the effectiveness of the blackberry rust (Ullah *et al*, 1989a). Another study found that airborne video imagery could successfully be used to discriminate Bitou bush (*Chrysanthemoides monilifera*) from other dune vegetation. It also found that Landsat TM imagery, captured before and after Bitou Bush spraying, could be used to assess the area of Bitou Bush controlled (Brandsema, 1996).

I have recently commenced work on a study to assess the potential for satellite and airborne systems to map serrated tussock *(Nassella trichotoma)* and Scotch thistle (*Onopordum* spp.) at a range of infestation levels. The preliminary results for both plants are promising.

In particular, dense to moderate infestations of Scotch thistle appear to be mapped relatively well. The reason for this appears to be in part the dense white hairs on the leaf, which reflect about 20% more visible light than a range of other thistles and pasture plants.

Weed Mapping In Crops

Charles Sturt University, in cooperation with the Cooperative Research Centre for Weed Management Systems have begun an investigation into the potential of airborne sensors for weed detection in cereal crops (Lamb, 1995). If successful, the technique will assist in identifying which areas of the paddock have dense enough areas of weeds to warrant spraying. This will reduce weed spraying costs.

It is difficult to use the technique on weeds where the optimum spraying time is early in plant development (eg. the 2 - 5 leaf stage). Even with a pixel (picture element) size of 1 x 1m, the sensor will not be able to differentiate plants at this stage. However, the results look promising for the detection of broadleaf weeds (such as Wild Radish, *Raphanus raphanistrum*) later in the growing season, where application of hormone chemicals can take place between late tillering and booting of the crop. Grass weeds such as wild oats (*Avena* spp) can be identified late in the growth cycle, after they mature. This can provide information on areas of the paddock that will need application of pre-sowing or early post-emergent chemicals the following year, if the paddock is to be cropped again.

Such information can be used for precision farming, and is currently being used for this purpose in the USA.

USE OF GIS FOR WEED MAPPING OF GIS FOR WEED MAPPING

The main use for GIS in weed mapping is in the storage of weed maps (from remote sensing or conventional surveys), for manipulation of the data and for integration with other data sets.

One advantage of storage of weed data in a GIS is that it allows accurate calculation of area infested, and can be compared with other survey data collected at some stage in the future. This allows change in area infested over time to be calculated, as well as showing where the changes have occurred.

In a GIS, weed maps can be integrated with, for example, road and topography data. This could be used to locate and estimate areas of infestation that could be controlled by long hoses from roads. It could be used provide an estimate of the area of infestations that could be controlled by ground or those that would require aerial control (Prather and Callihan, 1993).

Introduction of other data such as the location of horticultural crops would allow identification of areas of weed infestation where aerial control could cause potential crop damage from spray drift.

The combination of known infestations in a GIS with a range of data sets (including topographic, soils and climatic data) has additional advantages. Such information can be used to provide an understanding of the ecology of the weed, and to predict areas at risk from infestation.

GIS data sets can also be incorporated with remotely sensed data to improve capability for weed mapping . The benefit of combining remote sensing and GIS for more reliable analysis, mapping and monitoring of weeds has been demonstrated by a number of weed studies (Everitt *et al*, 1993, 1996; Fitzpatrick *et al*, 1990; Gardiner *et al*, 1996). One of the most important was the bracken mapping study in Scotland.

Here GIS was used to map areas of soils, topography and climate that were unsuitable for bracken. These areas were then excluded from the analysis of Landsat imagery, to make the process of mapping more manageable (Miller *et al*, 1990).

TAKE HOME MESSAGES

Weed mapping is essential to determine whether weed infestations are increasing over time, are decreasing or are stable. Such information is important for research into weed control, biological control programs, government funding and for development of strategies to control the weeds.

Most conventional forms of weed mapping give reasonably accurate ideas of the location of weeds, but accurate information on the actual area infested and degree of infestation is difficult to obtain.

In mapping weeds, the use of normal GPS allows reasonably accurate location of the position of the operator, and the centre of a weed infestation. It will not be suitable for mapping the boundaries of an infestation due to programmed error fluctuations in the signal ('selective availability').

The only alternative is the use of differential GPS, which corrects for this signal degradation. The GPS can then be linked to a notebook or sub-notebook PC running mapping and GIS software, and the extent of infestations automatically logged into the computer.
Remote sensing offers another means of objectively mapping and monitoring weeds, especially in inaccessible areas. The resolution of current satellites is such that it may be possible to measure dense and moderate infestations of certain weeds. Experience overseas suggests that flowering woody species are the easiest to measure, although there is sufficient evidence that some pasture weeds can also be mapped.

Light to moderate infestations of pasture weeds, some woody weeds and some crop weeds can also be mapped by use of airborne sensors. New satellites with high resolution sensors are planned for launch over the next six months to five years, and may allow more effective mapping of weeds (down to light scattered infestations).

The efficiency and use of weed mapping will be improved by incorporating the data into GIS. This allows the manipulation of the maps with other data to provide information on control strategies, potential weed spread, and to compare infestation changes over time. The integration of remote sensing and GIS for weed mapping will improve the accuracy and usefulness of the data.

ACKNOWLEDGEMENTS

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AERIAL INSPECTIONS USING GLOBAL POSITIONING SYSTEM AND COMPUTER SOFTWARE

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Weeds Officer
Gunnedah Shire

INTRODUCTION

As most of us would agree the physical inspection of private property for Noxious weeds is a time consuming and expensive operation. With private inspections often coinciding with seasonal spray programs, we find ourselves constantly juggling time and resources to ensure our own roads and reserves are kept clean as well as maintaining a constant level of private property inspections. The window of opportunity available to us to effectively carry out our duties in these two important areas, is usually fairly narrow, requiring any options saving time and resources to be closely examined.

With the development of Global Positioning System (GPS) and realtime mapping software the application of aerial inspections as an integral part of our overall Inspection Program has become a viable option. After close consultation with Peter Terrett of Global Star Melbourne and the National Parks and Wildlife, GPS/Automated Realtime Mapping Software (ARMS) was identified as the most obvious step in the quest to streamline our Inspection Program. Consequently an Aerial Survey using GPS also ARMS Software was conducted covering the entire Gunnedah Shire, producing our first accurate record of Noxious Weed types and their distribution.

ADVANTAGES

Time - A comprehensive survey was carried out in March this year and took 53 hours to complete over a two week period. Within the time frame the total Shire area was flown by Helicopter in a North/South Grid pattern one (1) kilometre in width. This allowed the major percentage of Noxious Weed Infestations, both Perennial and Annual to be recorded in one operation and provided us with extra time in which we could undertake Noxious Weed Control on our Council Roads and Reserves.

Cost - This survey not only enabled a thorough Noxious Weeds Audit of our Shire but returned effective cost savings to Council. An area of $5000k^2$ was covered by the survey at a cost of around $26,500.00. A total of 1,115 rural holdings were inspected returning an average cost per property of $23.80. This represents an 80% reduction in the cost per property compared to ground inspections carried out the previous year.

Efficiency - Subsequent ground inspections of problem areas are able to be carried out aided by co-ordinates obtained whilst in the air. Time lost to the inspection of relatively "clean" areas can be minimised, allowing us to concentrate on properties not complying with the Act.

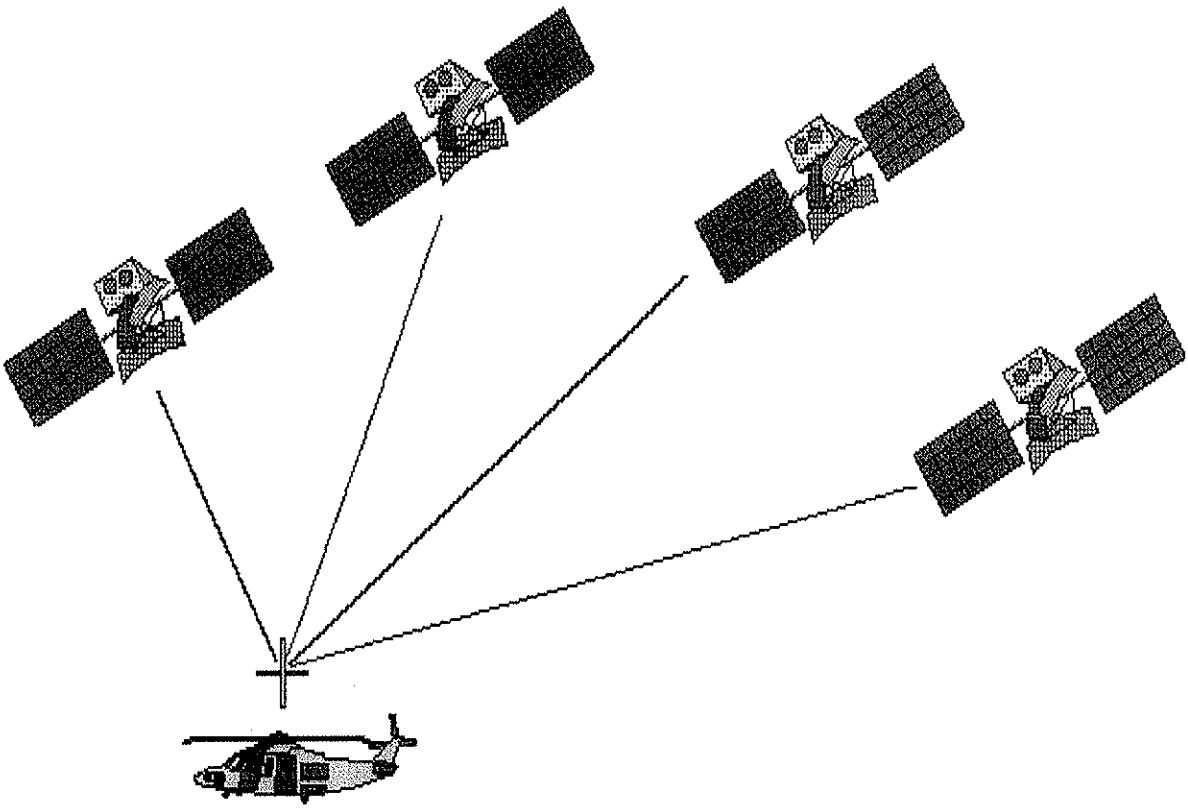
Consistency - We feel the ability to assess the Noxious Weed problem across the board not only pinpoints areas of *real* concern but also addresses the contentious issues of consistency and fairness while enforcing the Noxious weeds Act. The survey has received encouraging

support from Landowners and the Community in general, with the issues of consistency and fairness ranking high in positive comments.

THE SYSTEM - A BRIEF OVERVIEW

What is GPS? GPS is a Satellite Navigation System Developed by the US Defence Department. It utilises 24 Satellite orbiting the earth's surface at a range of around 20,000 kilometres travelling at 14,000k/hr.

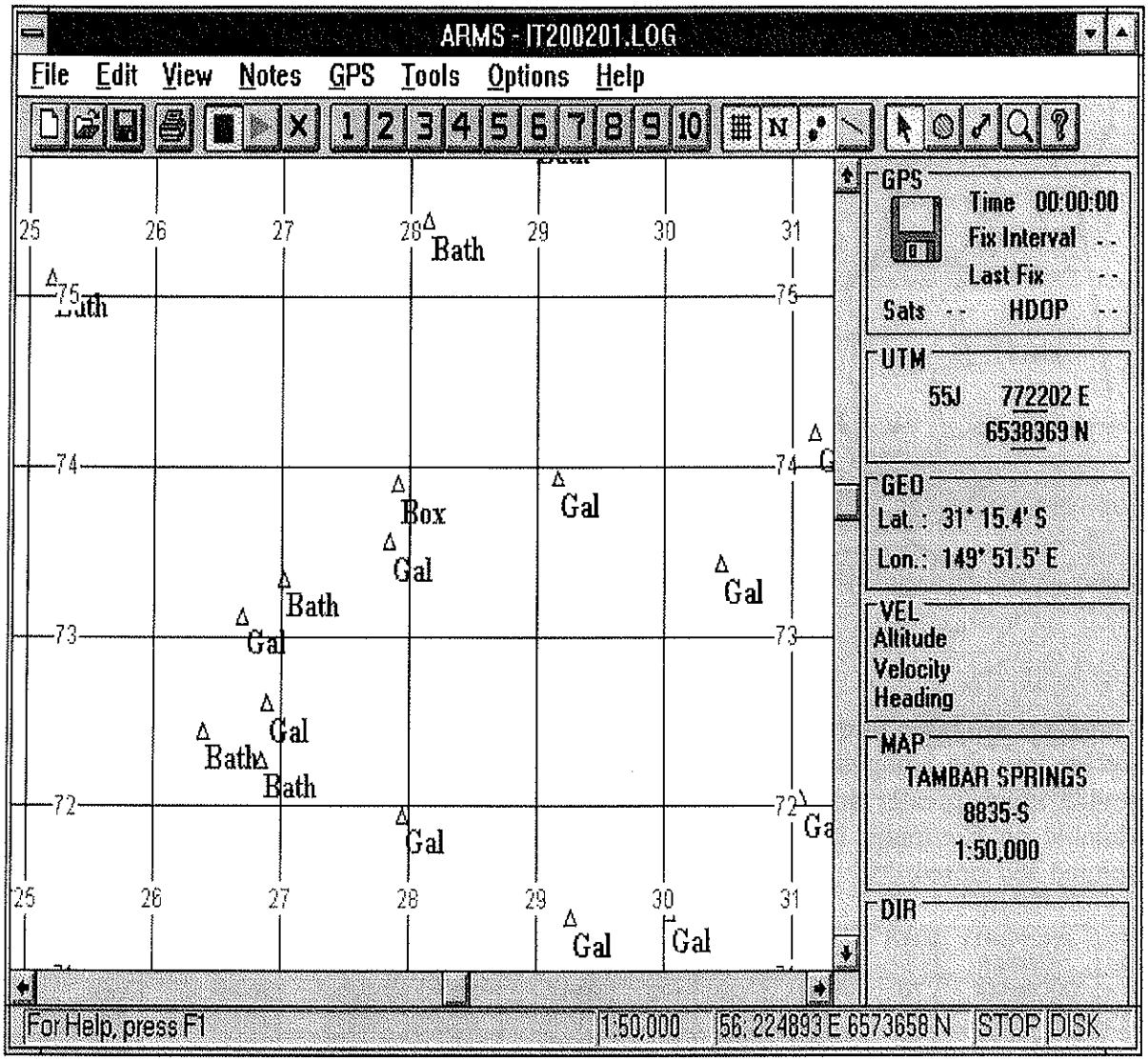
How Does it Work? GPS is able to pinpoint locations on the earth's surface by measuring the distance from several of these satellites to a ground based receiver.



Once the distance has been determined from 4 satellites a position fix can be established and expressed in Geographical co-ordinates of either Latitude/Longitude or Australian Metric Grid (AMG), the latter adopted for our use because of its simplicity and ability to match our current LEP Map at a Scale of 1:100,000. GPS also enables us to relocate any position fix taken during aerial surveys.

Automated Realtime Mapping System (ARMS) - This simple but highly efficient software program was developed by Global Star of Melbourne. It has the ability to receive and

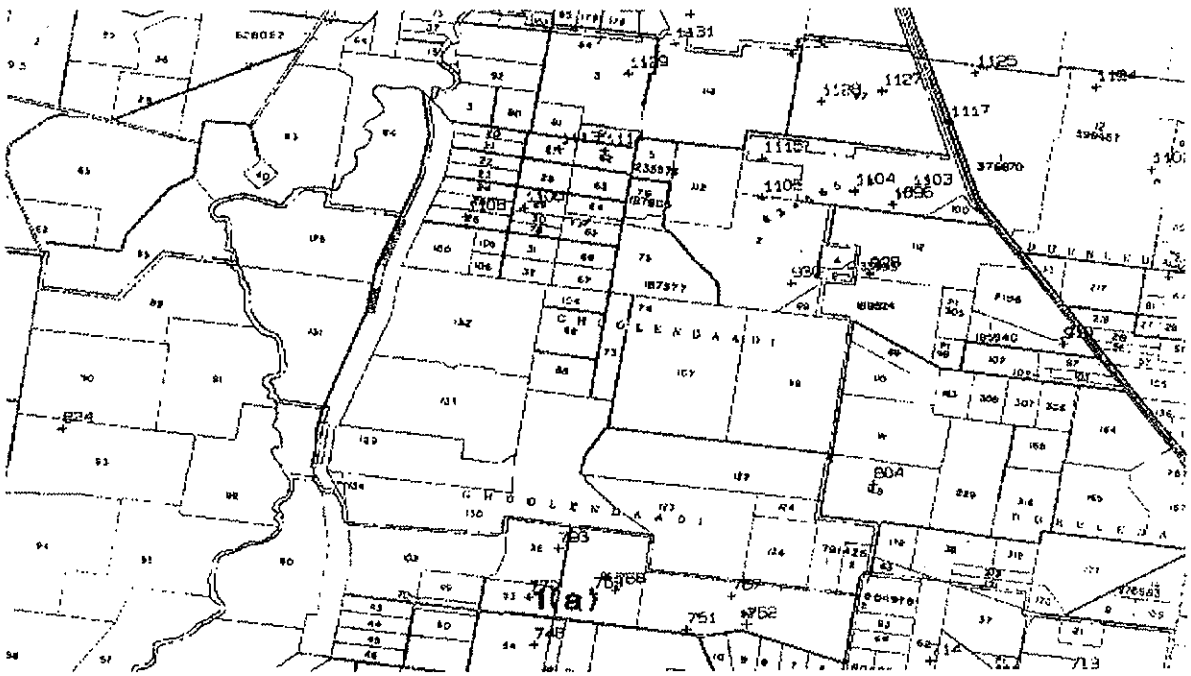
decipher information from a GPS Receiver. To avoid a lengthy explanation of how this information is processed into a recognisable format the illustration below demonstrates the information produced by the ARMS Software which is visible on a computer screen whilst in the air.



This screen provides us with important information including constant geographic co-ordinates and weed locations previously recorded. An icon representing the aircraft is also visible at all times and assists our pilot in maintaining the required flight path.

All points recorded by the computer via pre-tabed keys are saved on the computers hard drive. This information can then be printed in any scale desired or transferred to our Computer

Aided Design Program, and printed on transparent film at 1:100,000. This enables the Data obtained to be overlayed on our LEP Map to establish actual properties on which Noxious Weed Infestations were recorded. The CivilCad Program operated by our Engineering Services provides the added bonus of being able to produce a printout of each individual weed type allowing much easier matching of particular weed types to rural holdings.



A program available from Global Star later this year will enable our Shire Maps to be loaded directly into the computer. Weed locations will be loaded onto these maps, which will provide much greater accuracy than map overlaying. Topographical Maps are currently available on Computer Disk which again widens the scope for further information to be captured and stored.

NOT NO.	PROPERTY OWNER	LOT	D.P. NO.	PAR	U.P.N.	PARISH	POINT NOS.	EASTING	NORTHING	WEED
94	XXXXXXXX	70	755471	120	475	Bando	952	775597	6546130	Box
171	XXXXXXXX	70	755471	120	475	Bando	951	775638	6546364	Gal
	XXXXXXXX	34	755471	120	502	Bando	887	778166	6554914	Bathurst Burr
	XXXXXXXX	50	755471	120	509	Bando	820	782708	6553547	Noogoora Burr
152	XXXXXXXX	143	755471	120	1743	Bando	811	780526	6553881	Gal
	XXXXXXXX	143	755471	120	1743	Bando	125	781053	6553856	Batthurst Burr

Record Keeping - All properties in the Gunnedah Shire have a Unique Parcel Number (UPN) for each Parcel of Land. Once Noxious Weed Infestations have been identified on a property that property's UPN number is used to access Noxious Weeds details under Property Rates Information on Council's Computer Main Frame. This forms the basis for accurate record keeping and will expedite the identification process in future surveys.

Accuracy - Although the GPS System is extremely accurate, there are some factors which have a slight affect on final position fixes. These variations include:

- Selective Availability - A random error instigated by the US Defence Department for security purposes.
- Dilution of Precision (DOP) - A variance caused by atmospheric and Ionospheric conditions and physical impedence of satellite signals caused by topographical conditions.

Although these variances can be corrected by a second Land Based Receiver used in conjunction with a Differential GPS (DGPS) we have found accuracy produced by our current equipment to be more than adequate for Noxious Weed Survey on Rural Properties.

SUMMARY

This year has been quite an experience for all involved in our Inspection Program. With new computer software being developed constantly, improvement in this type of technology is happening daily. Of course, the way in which annual inspections may be used will vary from Council to Council nonetheless, I am sure that this type of equipment has an important role to play in our future operations.

PEST MANAGEMENT INFORMATION SYSTEM (SA)

Sue Southcott
Anadata
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The Pest Management Information System or PMIS as it has become known, has been in use in South Australia since late 1990. The earlier DOS version was written for one of the Adelaide Hills Animal and Plant Control Boards and then gradually adopted as the standard for boards around the state.

Prior to 1990, the recording systems used by boards were mostly manual, although some boards had partially computerised their record-keeping. The records were generally based on a property card, with a card being established for each property dealt with by each officer. There was, however, little consistency between boards over the type and amount of detail recorded, especially in relation to proclaimed plants.

The primary aim of PMIS was to enable pest management at a level above that of the individual properties, that is, the summarisation, selection and presentation of data at board level, which was inherently difficult in any manual systems. PMIS has allowed board officers to keep track of pest plants and animals in their board areas and to build a historical data source for the future.

The new windows version of PMIS called PestWin© is currently in development and will be distributed to selected boards for testing by mid July 1997. The new system will encapsulate some of the characteristics of the older version, and also include many more features that users have requested in recent times. Some of the attributes of the new system are:

1) Recording of property information and ownerships.
2) Recording of infestations against properties.
3) Activities performed against each infestation.
4) Program Management for infestations.
5) Selected GPS support.
6) Transfer of parcels of land and pests, etc, to other landholders.
7) Standard reports and letters.
8) Graphs of infestation deviations from historical data.
9) Link to MS Access for ad-hoc reporting purposes.

Through the use of GPS, linking infestation data to mapping systems is much easier. PestWin© will store GPS coordinates, enabling officers to record locations of pests directly into the Pestwin© database. A mapping system can then use the historical data from Pestwin© to give more accurate variances in infestations over time.

Pestwin© will be on display at the 9th Biennial Noxious Weeds Conference, Dubbo in September.

TRAINING AND COMPETENCIES FOR WEEDS OFFICERS.

Hugh Milvain
Noxious Plants Advisory Officer
NSW Agriculture,Yanco

INTRODUCTION

Todays role of a weeds officer is no longer a person who is issued with a hoe, knapsackand a pair of stout walking boots. Weeds officers today must be a walking switched on computor because of the sophisicated work place in which they work, it is no longerhoe it out or spray it out.

Weed control todayhas to fit into a total intergrated management package and to be able to achive this end,weeds officers need a more comprehensive level of knowledge than those of a decade ago.

Todays society is demanding that all operations be seen to be compatible with the environment and a number of agricultural industries are starting to go down this path of quality management incoporating environmental issues as this is what the customer is starting to demand.

This creates the need to establish a code of practice or standard with a uniform set of competencies applying to all officers regardless of their location in the state.
Recently at the national level, a set of competencies for Vertebrate Pest Management was established with six work levels and training requirements to be achived.

To achive any level of competency there is a need for training in each relavent field of operation,and once the competency has been achived there is a continual need of updating through training.

I have spoken with a number of weed officers who have given me what they consider to be a base set of competencies or standard that is required to operate in the position of noxious weeds officer.

BASE COMPETENCIES

- Understanding of Quality management systems including Environmental management
- Management programing
  the environment
  alternative methods
  chemicals selection
  safe use
- Communication with the staff
  with the public
- Writing - Reading delivery of reports
  read chemical labels
- First Aid

DISCUSSION

The above base competencies would apply to all Weeds officers from Chief weeds officer to weeds officer,and the Chief weeds officer would possibly need leadership skills.

Regardless of the level for the weeds officer,management skills of being able to develop an operational program based on an intergrated management package that takes into consideration alternative methods of control,selection and safe use of chemicals so not to affect but maintain a sustainable environment is important in todays climate of quality management. Communication and the ability to read and write are essential skills needed because without them any program would not function effectively. Being unable to read will make the selection and safe use of chemicals difficult and is likely to cause problems in all areas of control and could have some impact on the environment.

A good writing ability is essential for reporting and communicating to both the public and other staff members.

First aid knowledge is needed to be able to treat effectively a person who may have been accidently poisonedby the product being used or a blown hose spraying over the operator.

ADDITONAL TRAINING

Some officers have been requesting training in plant identification,herbicide modes of action,and legal training.

Plant identification :Suggested areas of training is in the recognition of seedling plants both the target and non-target species so to be more efficent and ecomonical in control practices. In most situations the target plant is well advanced in growth which means that additional herbicide has to be used to achive control. This additional use of herbicide inturn places extra pressure on the environment. Since the transfer of prickly pear to the Noxious Weed Act requests for training in the identification of the Noxious Pear has been sought.

Herbicide Modes of Action :This could look at the function of the herbicide when applied to the target plant,is it a knockdown,systemic, translocated or residual, and are they selective or non-selective. An area that needs to be covered in this subject area is the environmental factors which will have a bearing onselection and timing of application of any herbicide.

Legal training ;This area is important for the effective application of the Noxious Weeds Act, carly training was carried out when the Act became operationaland since then admendments have been made and staff changes occurred necessitating a refresher/update in training.

An other area of training that should be considered is OH&S particularly as Work Cover is developing a code of practice which will impact on how we all apply and store pesticides in the near future, this draft code has been on public display for comment. It has a requirement for continuing training for the correct use of personal protective equipment which must be documented.

PROPOSED NATIVE VEGETATION CONSERVATION ACT

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BACKGROUND

State Environmental Planning Policy (SEPP) 46, The Protection and Management of Native Vegetation, was introduced to provide a greater level of protection to the State's native vegetation. It was not a ban on land clearing, but required land clearing proposals to be assessed for their environmental impact and their economic, social and environmental benefits to the State.

From the day of its introduction, an evaluation and review process has been underway which has come to the point of the Government having received submissions and having decided to replace SEPP 46 with a Native Vegetation Conservation (NVC) Act.

Proposal

A discussion paper introducing the proposals for the new Act is now available for public comment in preparation of developing the Act. It is proposed that the Act will replace SEPP 46 along with the native vegetation provisions in other Acts such as the Western Lands Act, Soil Conservation Act and Forestry Act, giving the NVC Act more complete coverage across rural NSW with a single piece of legislation relating to native vegetation conservation and management.

It is proposed that the Act will include the following major changes from the original SEPP 46:

- Regional Vegetation Management Plans (RVMP) may be developed on a local government area, catchment or other regional basis and, when approved by the Minister for Land and Water Conservation, will allow activities in the region that are specified in the Plan (including land clearing) to be undertaken without the need to apply for separate approval.

- Property Agreements may be made between a landholder and the Minister, specifying native vegetation management and, if desired by the landholder, attaching management outcomes to the title of the land. This will enable that landholder to undertake the activities specified in the Agreement.

- A Nature Vegetation Management Fund will be available to assist landholders to achieve the public benefits of managing native vegetation under Property Agreements.

- A Native Vegetation Advisory Council will be established, including NSW Agriculture representation, to advise the Minister for Land and Water Conservation on relevant issues, and importantly to provide a forum for government and non-government interests in native vegetation to share and resolve issues of concern.

- It is proposed that the list of exemptions from the provisions of the Act will be basically the same as those under SEPP 46. The process of application and approval to clear more

vegetation, if not covered by the arrangements under RVMP's and Property Agreements, will be simplified by the Act.

- The Department of Land and Water Conservation (DLWC) will be the lead agency for the Act and will reorganise its resources currently involved in native vegetation management and regulation to service the regional planning, assessment, monitoring and prosecution roles.

Implications

The concept of RVMPs and Property Agreements will provide greater scope for agriculture and related activities to gain security of operation in relation to native vegetation management. There will also be greater clarity of regulation as all native vegetation provisions will reside with one Act.

It is significant however, that it is proposed that the RVMPs will be developed in accordance with the process of developing a Regional Environmental Plan (REP) specified in the Environmental Planning and Assessment Act. They will then be classed as REPs. The process is managed locally by a regional vegetation management committee involving appropriate stakeholders and includes a period of public, technical and government review with final approval by the Minister for Land and Water Conservation. This level of rigour will require significant input from State and local Government agencies and other industry and community interest groups to ensure that the Plan is comprehensive and mutually acceptable. It is therefore very important that the interests of weed managers are also included in the development of the Plans to ensure that future activities relating to weed control in native vegetation areas is considered on a sound basis and with a regional perspective.

Opportunities will be available for comment and input to plans throughout their development. A RVMP is already being developed for the Lachlan Valley as a pilot for other inland catchments.

The monitoring role of DLWC will be managed by remote sensing (satellite imagery and air photos) along with ground observation and reporting. That role will eventually provide better information on areas of preserved, cleared and regenerated tree cover to enable more strategic remediation measures for the natural resources of the State.

TAKE HOME MESSAGES

- It is important to embrace the new legislation as a more strategic and consultative approach to native vegetation management.

- All sectors of the community have opportunities to contribute by way of comment to the development and implementation of the Act. You are in a position as a whole group and as local organisations to ensure that the interests of better weed management are built in to the processes.

WEED INTRODUCTIONS THROUGH NURSERIES

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INTRODUCTION

Sixty-five percent of recent weed invasion in Australia in the last 25 years are of ornamental origins. (R. Groves, personal communication.)

Since the commencement of European settlement in Australia in 1788 there has been a steady introduction of weed. Currently, about 10% of Australia's total of 20,000 plant species are introduced plants (Groves 1987).

Plant introductions have been rapid. In 1804, 29 species of introduced plants were collected at Sydney (Groves 1987). These plants included plantain (*Plantago major*) and winter grass (*Poa annua*). Plants which have become weeds have been introduced both accidentally, such as skeleton weed or deliberately introduced and propagated and spread such as blackberry, prickly pear, Paterson's curse and gorse. The intentional spread by the then European nostalgia and ignorance is being continued today.

Since 1788 the number of introduced species which have naturalized has increased at a constant rate of approximately 4 to 6 species per year (Fig. 1).

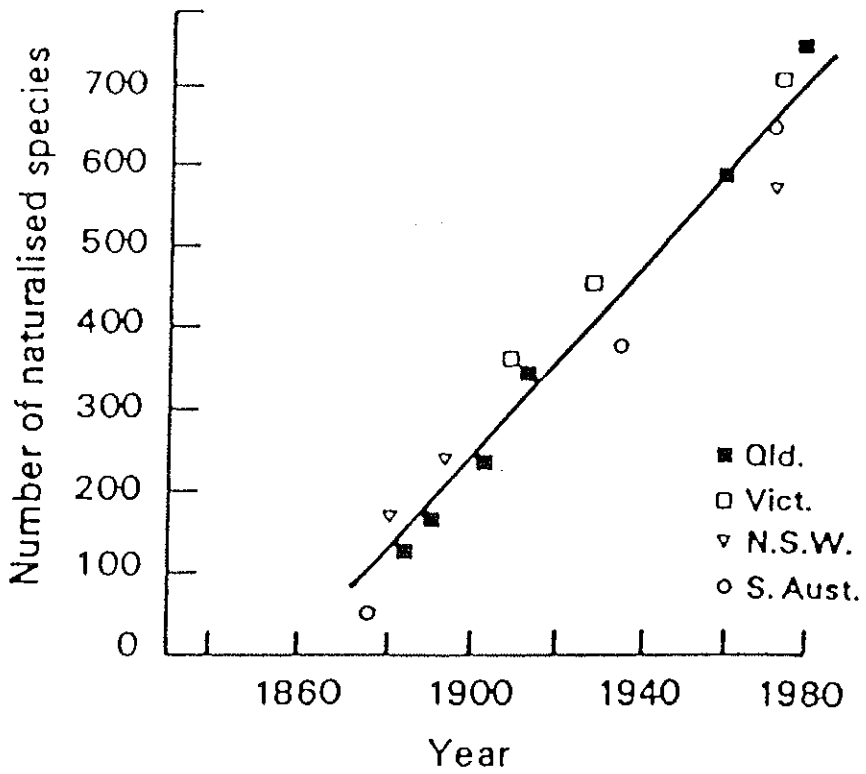

Figure 1: Number of naturalised plant species in the four Australian States of Queensland, Victoria, New South Wales and South Australia 1870–1980 *(Figure 14 of Specht 1981)*

Groves (1987) indicates that for every 100 species introduced, approximately 10 successfully colonise to the new environment, with only 5 species eventually being naturalized. Not all naturalized species become weedy; perhaps only one species will eventually become a weed.

WHAT MAKES A PLANT WEEDY?

The Plant Family - Certain taxonomic groups of plants have proven to be more 'weedy' than others.

In southern Australia the majority of noxious plants are derived from the Asteraceae (Daisy) family. It appears that species of certain taxonomic groupings are more likely to be weedy. Groves (1987) considers the Asteraceae, Brassicaceae and Amaranthaceae families to be the most invasive in the temperate zones.

Climate - Plants from similar climatic zones are better able to establish and colonise. For instance, many weeds of South Africa's Cape Province have become major weeds in similar climatic zones in southern Australia. Capeweed, spiny emex, bitou bush and boneseed are excellent examples.

Matching of climatic zones not only explains the success with which plants become so well established but is an important indicator of potential weed problems. Again in South Africa, there is a high incidence of native prickly *Acacia* species. Matching of climatic zones would indicate that many of these *Acacia* species, such as *Acacia karoo*, could be expected to establish very well in the arid zones of southern Australia, quickly becoming major weeds.

Mesquite, a woody shrub of the Fabaceae family from southern USA has, in fact, matched a similar climatic zone in the arid rangelands of Australia and is now a major weed threatening arid rangelands in Western Australia, Queensland and western New South Wales.

Other attributes which enhance a plant's weediness include the aspects of whether the plant is a "coloniser", its methods of dispersal, seed dormancy and methods of reproduction.

WEED VIA HORTICULTURAL INTRODUCTIONS

Plants introduced deliberately as agricultural or horticultural plants which have consequently become weedy have been occurring since early colonisation. The most striking example is the deliberate introduction of prickly pear (*Opuntia* spp.) with the First Fleet in 1788.

There has always been a desire to introduce new and exotic horticultural plants. It appears this desire is becoming more demanding with little attention paid to the possible weediness of some of these species. As stated earlier, 65% of current weedy plants originate from ornamental/horticultural species.

Early horticultural catalogues demonstrate this strong desire to introduce "exotic" plants. Sir William Macarthur's extensive nursery at Camden Park catalogues of 1843, 1845, 1850 and 1857 list in excess of 1500 plant species. In his 1857 "Catalogue of Plants Cultivated at Camden Park" (Anon. 1857) such species as sweet briar, *Opuntia* spp. (2), Paterson's curse, *Oxalis* spp. (18) and *Ipomea* spp. (Morning glory). The Macarthur nursery was the largest in the colony and was responsible for introducing many desirable plant species - both crop, fruit trees (200 species listed in 1857 catalogue) and ornamentals. Native species were also

propagated. As a matter-of-fact, the basis of the Royal Botanic Gardens, Sydney originated from Sir William Macarthur's collection.

CURRENT OBSERVATIONS

The author has observed in the Orange area (Central Tablelands NSW) alone, horticultural nurseries are propagating the following plants which are either considered weedy or are "declared noxious plants" (Noxious Weeds Act 1993).

St John's wort (*Hypericum perforatum*)
Long-style feather grass (*Pennisetum villosum*) Noxious
Black knapweed (*Centaurea nigra*) Noxious Vic
Brown knapweed (*Centaurea jacea*)
Artichoke thistle (*Cynara cardunculus*)

Plants such as perennial cornflower (*Centaurea montana*) are often grown ornamentals sold through nurseries. This plant is considered a serious weed of both Spain and turkey (Holm *et al.* 1979). Climate matching it would be easy to conclude the weedy potential of perennial cornflower for the Mediterranean zones of southern Australia; Victoria, South Australia and Western Australia.

The genus *Centaurea* has featured highly in an Orange district nursery. Not included in the beforementioned list are three species of *Centaurea* which are unknown in Australia. Correct identification required the forwarding of specimens to Kew Gardens, London. The genus *Centaurea* originates chiefly from the Mediterranean region. Worldwide, there are about 500 species; many of these species are considered major weeds while some are considered desirable horticultural species - eg cornflower (*Centaurea cyanus*). "Hortus Third, A Concise Dictionary of Plants Cultivated in the United States and Canada" (Bailey and Bailey 1978) lists 43 *Centaurea* species considered horticultural plants. In New South Wales there are 6 *Centaurea* species listed. Of these, three are noxious weeds; St Barnaby's thistle, star thistle and brown knapweed (Victoria). "Hortus Third" lists *C. nigra*, *C. jacea* and *C. montana* as horticultural species.

There are many other examples of horticultural plants becoming weedy in Australia. The example of *Acacia karoo* in New South Wales, Western Australia and Victoria is an obvious example where climate matching would clearly indicate the plant's weedy potential.

Kochia (*Kochia scoparia*) is an excellent example where a major weed of the mid west USA was deliberately introduced to Western Australia for salt reclamation work by a large seed and nursery company. Kochia is known worldwide as a major agricultural weed but through lack of a proper screening process and ignorance was allowed to be introduced and established.

CONCLUSION

This brief paper poses the question but does not attempt to provide the solution.

Persons in authority should be aware and concerned at the very real danger that "weedy" horticultural plants pose to the environment and agriculture.

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RECENT NATURALISATIONS OF SPECIES IN AUSTRALIA – SOME SPECIES WHICH COULD BECOME A PROBLEM IN NEW SOUTH WALES

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INTRODUCTION

The Co-operative Research Centre (CRC) for Weed Management Systems was commissioned by the Bureau of Resource Sciences to document the establishment of exotic species in Australia from 1971 to 1995. The report was also to identify the means of introduction (where possible) and the costs of these introductions in lost production and control. The report was prepared with the help of herbarium staff and herbarium records from around Australia. Details for Victoria also included records compiled over many years by Geoff Carr.

According to Hnatiuk (1990) the number of introduced species in Australia is about 2,000 but using various State floras and lists of naturalised plants present in various States the number would now appear to be over 2,500 (Hosking unpublished data). There have been many problems with identification of weed species in Australia and different States often use different names for the same species (Hosking *et al.* 1996). This makes it difficult to accurately determine which species are present in Australia and when they first established. Weed species are also often not collected and are often poorly represented in herbaria. This also results in difficulty in determining when a weed species first establishes. The date of establishment listed in the report is based on the earliest herbarium record, or accurately determined specimen, of a naturalised species. In some cases this date is many years after establishment, for example for specimens collected from adult trees.

FINDINGS OF THE REPORT

A summary of the findings listed in the report (Groves *et al.* 1996) follows (the term taxa is used to denote any taxonomic category e.g. species, variety or subspecies):

1) A total of 296 plant taxa were recorded as naturalising between 1971 and 1995.
2) The recorded rate of naturalisation increased between 1981 and 1995 compared with 1971 to 1981.
3) Taxa naturalising between 1971 and 1995 originated equally from Africa, the Americas and Europe.
4) Most recent naturalisations are still only locally established.
5) The majority of recently introduced taxa were introduced deliberately and legally.
6) The direct costs of these taxa are only known in a few cases.
7) The environmental costs of these introductions are unknown and little studied.

Of taxa that naturalised between 1971 and 1995 the majority (65%) were likely to have been introduced as ornamentals.

Some species listed as naturalising between 1971 and 1995 and of potential importance to New South Wales.

The following species are recorded as naturalised after 1971 and are potentially of importance to New South Wales. The entire list of species that are recorded as naturalised after this date can be found in the report of Groves *et al.* 1996. A number of species listed in the report and not included below may also prove to be important weeds in the future. Comments on the species below are in note form and are based on information in the report which was largely extracted from a weed book being written by G. Sainty, S. Jacobs, J. Dellow, I. Miller, J Hosking and G. Carr. Known distribution (**Distrib:**) of the species in Australia is based on Hnatiuk (1990) and State floras except for Western Australia where the regions are the IBRA regions used by the Australian Nature Conservation Agency (and also used by Western Australian Herbarium (PERTH)).

Cabomba caroliniana CABOMBA (family Cabombaceae). Native to America. This species was first recorded as naturalised in New South Wales in 1981 (based on a specimen at the National Herbarium of New South Wales (NSW)) and in Victoria in 1989 (based on a specimen at the National Herbarium of Victoria (MEL)). The earliest record for the species in Queensland is for 1967 (Mackey and Swarbrick in press) but the species was not considered naturalised in Queensland until 1989. This species was introduced as an aquarium plant. **Notes:** A serious aquatic weed elsewhere in the world (Jacobs 1990). It will continue to grow free floating. Spread by stem or root pieces. Seed production has not been reported in Australia. Thrives in nutrient rich water and is now well established in New South Wales and coastal Queensland. Spread should be prevented. See Parsons and Cuthbertson (1992) for more information on this species. **#Noxious** in Qld. **Distrib:** Spreading in rivers. Qld (coast and Atherton), NSW (North Coast Central Coast), Vic (MT).

Chromolaena odorata CHROMOLAENA, SIAM WEED (family Asteraceae). Native of West Indies, tropical South America and Mexico. This species was not recorded in Australia until 1994 when it was found along the Tully River in North Queensland (B. Waterhouse pers. comm.). The species appears to have been present since the early 1970s. This species is likely to have been brought in as a pasture seed contaminant and first planted on Tully River Station. **Notes:** *C. odorata* is a major weed in the tropics. Spread by seed. Toxic to stock. Potential to invade disturbed land is high. To date $460,000 has been spent in an attempt to eradicate this weed (Queensland Department of Natural Resources records). It is uncertain whether this species would be a problem in New South Wales as it is mainly a tropical species. The species may be a problem on the North Coast of New South Wales if it reached this area. A second form of *C. odorata* was found on Tully River Station but this form only appears to be spreading slowly. See Parsons and Cuthbertson (1992) for more information on this species. **#Noxious** in Qld (whole State), NSW. **Distrib:** Localised - many hectares along Tully River. Qld (Cook).

Cyperus aromaticus NAVUA SEDGE (family Cyperaceae). Native of tropical Africa. This species was first recorded as naturalised in the Cairns area in 1979 (based on a specimen at the Queensland Herbarium (BRI)). The species was also recorded from Kuranda in the same year (Queensland Research Station, Atherton specimen). The means of introduction of this species is unknown. **Notes:** Prolific seeder and this is the main method of spread. Also transported by

root pieces. Aggressive in high rainfall areas. Can quickly form extensive colonies. Considered one of the worst weeds in Fiji and now a very common weed of roadsides in moister areas from Cape Tribulation south towards Innisfail, and near Kuranda as you approach the Atherton Tablelands (B. Waterhouse pers. comm.). It is uncertain whether this species would be a problem in New South Wales as it is mainly a tropical species. The species may be a problem on the north coast of New South Wales if it reached this area. See Parsons and Cuthbertson (1992) for more information on this species. **#Noxious** in Qld. **Distrib:** Increasing problem. Qld (Cook- centred on Babinda).

Diplachne uninervia [*Leptochloa uninervia*] (family Poaceae). Native of America. This species was first recorded as naturalised in New South Wales in 1992 (NSW specimen). Subsequent to the Groves *et al.* (1996) report an Australian revision of *Diplachne* has shown that *D. uninervia* has been present in Australia for some time but has been misidentified as the native species *Diplachne fusca* (N. Snow pers. comm.). The means of introduction of this species is unknown. **Notes:** The only known location for this species in New South Wales is Homebush Bay where plants were growing in saline waterlogged land. This area is now a construction site for the year 2000 Olympics. On the basis of corrected identifications *D. uninervia* has been recorded from five locations in WA and also from South Australia and the Northern Territory. *D. uninervia* is a major weed of irrigated crops in California, and potentially a major weed of rice in Australia. **Distrib:** Localised. Qld (North Kennedy), NSW (Central Coast), SA (Southern Lofty), WA (many locations), NT (Palm Valley).

Equisetum arvense HORSETAIL (family Equisetaceae). Native of South Africa, Europe, Asia and North America. First definite record of naturalisation appears to be November 1989 (NSW specimen) at Belrose, Sydney (first NSW specimen is for 1927 at the Barrington Tops without any additional information - possibly only a pot plant at this time). This species is likely to have been introduced as an ornamental. **Notes:** A garden escape that is extremely difficult to eradicate, especially in rocky soils. In Sydney it dies back in winter. Has potential to be a serious weed in Australia. Poisonous to livestock; contains equisetine, a toxic alkaloid that causes equisetosis. Introduced to New Zealand c. 1910, where there are now localised colonies of up to 200 ha. Major weed in northern hemisphere and recorded by Holm *et al.* (1977) as one of the worlds worst weeds. Spread is mostly vegetative, by growth of rhizomes and and movement of rhizomes and tubers to new areas, with minor spread due to spores. To date $10 000 has been spent by NSW agriculture on control of this fern (R. Trounce pers. comm.). Occasionally sold as an ornamental. Detected for first time in Queensland at the Mt. Coot-tha Botanic Gardens (Brisbane) on 20 June 1996 (by Warwick Wright). Origin of the Mt Coot-tha plants is unknown as yet (may have been imported as a garden ornamental, either from overseas or interstate sources). The Botanic gardens have been requested to remove the plant. It is suspected that *Equisetum* species are used as 'medicinal herbs' and other introductions may have been made for this purpose (S. Csurhes pers. comm.). See Parsons and Cuthbertson (1992) for more information on this species. **#Noxious** in Qld, NSW, Tas and SA. **Distrib:** Localised. Qld (Moreton), NSW (Central Coast - naturalised in Sydney).

Hydrocleys nymphoides WATER POPPY (family Limnocharitaceae). Native of tropical America. This species was grown in the Botanic Gardens in Sydney in 1899 (NSW specimen). The species was first recorded as naturalised in Vic in 1979 (specimen collected from Maffra, refers to the species being planted upstream of the collection area 10-15 years earlier; specimen from Castlemaine, collected in the same year, refers to few plants being present in 1973 and that the species was grown prior to this). The species was introduced as an ornamental. **Notes:** Reproducees by plantlets during autumn; also spread by pieces.

Attractive horticultural plant that has naturalised in isolated patches. Thrives in nutrient-rich stationary or flowing water to 1 m deep. An ornamental that has the potential to become a weed in eutrophic water. Naturalised in the Benalla, Yarra Glen and Valencia Creek (near Maffra) areas, where recorded mainly from farm dams and slow-moving rivers (Walsh and Entwisle 1994). Cultivated and now naturalised on the NSW North Coast and in Cabramatta Creek, Sydney. **Distrib:** Localised. NSW (North Coast, Central Coast), Vic (NRSW).

Juncus fontanesii subsp. *fontanesii* (family Juncaceae). Native of Southern Europe, Turkey and northern Africa. The species was first collected in Victoria in 1979 (Walsh and Entwisle 1994). The means of introduction of this species is unknown. **Notes:** The species is now locally common around Princetown, Victoria. Similar to *Juncus articulatus* and possibly overlooked for this reason. **Distrib:** Localised. Vic (K).

Kochia scoparia [*Bassia scoparia*] KOCHIA (family Chenopodiaceae). Native of Eurasia. The species was first recorded as naturalised in Western Australia in 1990 (Australian Weeds Committee report). The problem form is the one which was introduced for forage in salt affected areas. **Notes:** Forage form and ornamental form. Ornamental form possibly still sold in some localities. Forage form introduced to Western Australia by a seed merchant and planted in salt affected areas in 1990/91 (Australian Weeds Committee report). It spread rapidly to non salt affected areas and roadsides and was considered a threat to agriculture. In 1992 it was proclaimed as a declared plant in Western Australia. May be confused with Roly-Poly, *Salsola kali*, and Amaranths, *Amaranthus* spp. Kochia changes from green to yellowish or brown with age. Dead plants break-off and blow around in the wind spreading seed. Hardy salt tolerant species adapted to arid areas. Contains nitrates - if the plant contains more than 1.5% by dry matter of nitrate it may be toxic. Studies show that wheat yields are reduced c. 20% by a density of 6 Kochia plants per sq. metre. Is an allelopath, i.e. produces substances that suppress the growth of other plants. See WA Agricultural Protection Board Infonote 28/92 for more information. This species has the potential to be an important weed in New South Wales. #**Noxious** in WA. **Distrib:** Localised. Tas (?), WA (AW, ESP).

Ludwigia longifolia (family Onagraceae). Native of South America. This species was first recorded as naturalised in New South Wales in 1991 (NSW specimen). *L. longifolia* was introduced to the botanical gardens in Sydney but removed after it showed potential to spread. **Notes:** Recently naturalised near Sydney. **Distrib:** Localised. NSW (Central Coast).

Ludwigia peruviana PRIMROSE WILLOW (family Onagraceae). Native of North and South America. The species was first recorded as naturalised in New South Wales in 1971 (NSW specimen). This species is likely to have been introduced as an ornamental. **Notes:** In some areas the number of seeds below dense *L. peruviana* are over 500 000 per m^2. Seeds germinate in 4 days in shallow clear water or mud; at least 80% of seed being capable of germinating. Seeds will germinate while floating. Germination appears to be limited by depth of soil, few growing to the surface in sand 1 cm deep. *L. peruviana* may form small floating islands, producing numerous pneumatophores; it is one of few shrubby species to disperse when mature. Maintenance of canopy is mostly by vegetative means. Fallen stems produce new shoots along the stem, eventually taking root. *L. peruviana* thrives in saturated soils or free water. It has the potential to become a major weed. Probably spread by birds, seeds readily adhering to feathers. *L. peruviana* has poor wildlife value, excluding all other vegetation. One infestation in the Botany Wetlands, Sydney, covers c. 30 ha. Identified as a major threat to Australia by Csurhes (1991) in a review of Quarantine Proclamation 86P. For more

information on *L. peruviana* see Parsons and Cuthbertson (1992). **Distrib:** Localised. NSW (Central Coast).

Nassella charruana (family Poaceae). Native of Argentina and Paraguay. The species was first recorded as naturalised in Victoria in 1995 (MEL specimen). The means of introduction for this species is unknown. **Notes:** Spread by seed. Recorded from Thomastown, Victoria and farmland on the northern side of Melbourne. This species has every indication of being an extremely serious agricultural and environmental weed. The species is considered to be a weed in its native range (M. Gardener pers. comm.). This species has the potential to be an important weed in New South Wales. **Distrib:** Localised at a few locations in Victoria. Vic (N).

Pistacia chinensis CHINESE PISTACHIO (family Anacardiaceae). Native from Afghanistan to Kashmir. The species was first recorded as naturalised at Tamworth, New South Wales in 1990 (NSW specimen) but was obviously naturalised many years prior to this date from the size of the trees. Also reported to be naturalised around Armidale (J.M.B. Smith pers. comm.) and around Sydney (P. Dixon pers. comm.). First recorded in Queensland in 1990 (BRI specimen). This species is likely to have been introduced as an ornamental. **Notes:** Often confused with Rhus, *Toxicendrum succedaneam*, and promoted as a replacement for this species. *P. chinensis* is at present only a minor environmental weed in New South Wales. **Distrib:** Localised. Qld (?), NSW (Central Coast, Northern Tablelands, North Western Slopes).

Rotala rotundifolia (family Lythraceae). Native of southern and south eastern Asia. The species was first recorded as naturalised in Queensland in 1974 (BRI specimen) and in New South Wales in 1992 (NSW specimen). This species is likely to have been introduced as an ornamental. **Notes:** Water garden escape. Potential invader of wetlands. Collected from the Brisbane and Cairns districts. **Distrib:** Localised. Qld (Cook, Moreton), NSW (Central Coast).

Salix spp. WILLOWS. (family Salicaceae). A large number of species of willows and willow hybrids have recently been recorded as naturalised in south-eastern Australia. This has been partly due to recent introductions and partly due to increased interest in willow species as weeds. Only one of the species considered to be of importance to New South Wales is covered here.

Salix nigra BLACK WILLOW (family Salicaceae). Native of USA. The species was first recorded as naturalised in Victoria in 1994 (E. Thexton pers. comm.). This species was introduced as an ornamental and for stream bank stabilisation. **Notes:** Recorded from Kiewa River and several other locations in north eastern Victoria (E. Thexton pers. comm.). Common in freshwater tributaries of the Hawkesbury River (G. Sainty pers. comm.). **Distrib:** Localised. NSW (Central Coast), Vic (RVW).

Senecio glastifolius (family Asteraceae). Native of South Africa. The species was first recorded as naturalised in Western Australia in 1986 (PERTH specimen). This species is likely to have been introduced as an ornamental. **Notes:** Spread by seed. On sandy soils. Potentially a serious environmental weed, now spreading in *Banksia* woodlands near Albany, Western Australia. This species has the potential to be an environmental weed in New South Wales. **Distrib:** Localised. WA (WAR JF).

Succowia balaerica (family Brassicaceae). Native of the Mediterranean region. The species was first recorded as naturalised in Western Australia in 1992 (PERTH specimen). This species was introduced by Kings Park and Botanic Garden where it was grown in the Mediterranean garden as an example of a Mediterranean plant (Keighery 1996). **Notes:** Naturalised in bushland near Kings Park, Perth and also found below Reabold Hill in Bold Regional Park, 8 km west of Perth (Keighery 1996). A potentially serious weed to much of the vegetation of the western side of the Swan Coastal Plain and should be eradicated before further spread occurs (Keighery 1996). This species has the potential to be a problem in southern New South Wales. **Distrib:** Localised. WA (SWA).

CONCLUSION

Reports of weedy species which have recently naturalised in Australia, such as the one produced by the CRC for Weed Management Systems, should be compiled and made available to all States. This brings potential weed problems to the notice of those that can implement control should the species enter the State.

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GIANT PARRAMATTA GRASS - AN UPDATE

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If you live on the coast of NSW or a summer rainfall area above 700 mm per annum then the chances of you getting Giant Parramatta grass *Sporobolus indicus var major* (G.P.G.) are very good.

In fact if you look at the distribution of a very close relative, *Sporobolus indicus var capensis* (Small Parramatta grass) which is common across southern Australia then one must speculate that GPG could possibly have a similar distribution potential.

So, if you haven't got it yet, the chances of getting it in most areas of NSW are good, so learn what it looks like if you are not familiar with this plant.

Where Is It Now

Very heavy infestations of GPG are present in the mid north coast of NSW from Grafton to Kempsey. It is spreading north and south with heavy isolated infestation reported in the Manning, lower Hunter and south east Queensland with reports of small outbreaks in the Nowra area, New England Tablelands and Northwest slopes.

How Does It Spread?

GPG is a plant capable of producing massive quantities of seed. The seed is small about the size of a grain of sugar is golden brown in colour and has the ability to stick to surfaces, especially when wet.
Seed is mostly spread by vehicle, equipment, machinery and stock movement. Most new infestations occur along public roads, highways, farm roads, tracks and around stockyards.

Typical spread on coastal pasture country is scattered plants gradually increasing in density to patches of plants which then rapidly increase and take over the pasture as the dominant grass. Depending on the type of pasture, grazing and pasture management the invasion can take as little as 3-4 years to many years.

Why Is It A Problem?

We have no firm figures or what animal production losses are caused by GPG invasion of a pasture. The general consensus from the cattle grazing community is that it does causes losses. Losses in the range of 10% to 80% reduction in carrying capacity have been reported. On the other hand production increases especially during drought have also been reported.

The plant is a tussocky summer growing perennial grass of low grazing quality and capable of growing on a wide range of soil types and environments. Many farmers claim that its tough leaf characteristics wear the teeth of cattle prematurely reducing the animals production life.

GPG invades sporting fields, golf courses, nature strips and lawns where mowing the GPG leaves an uneven, rough surface. It also presents a serious fire hazard in late winter and spring where the dry stem and leaf material is highly combustible.

GPG can have a serious affect on the biodiversity of an area because of its ability to dominate open grasslands which basically ends up as a monoculture.

What Do We Do About It?

The major strategies to date for the control of GPG have revolved around the following:

- Reducing the spread of seed.
- Early detection and control.
- Integrated control strategies.
- Management to improve utilisation of GPG.
- Common approach to GPG control.

Funding for the GPG awareness and control programme commenced in 1990 with an initial grant of $50,000. A committee, NSW North East Noxious Plants Advisory Committee, comprising Local Government and NSW Agriculture administers the funds and has also been successful with raising extra funds from Agribusiness, Local and NSW Government. Currently this committee is reviewing its structure and will most likely involve wider community and government representation.

Reducing The Spread Of Seed

Major strategies have included:

* An awareness campaign through publications combined with early detection and control program targeted at the farming community.

* Employees of Public utilities such as electricity supply, telecommunication organisations and relevant commerce have been encouraged to adopt such practices that reduce the spread of seed. This has been done by meetings, depot discussion sessions, posters and information mail out. A set of protocols to reduce the spread of GPG by these organisations has now been developed and implemented.

* Local government have been active to varying degrees in controlling GPG on roadsides, revegetating new roadworks and have encouraged buffer zones between infested and clean areas, and along roadways, tracks and on private lands with heavy infestations.

Early Detection And Control

The main strategies of this awareness programme have been:

* Identification - distribution of colour identification brochures and posters.
* Production and transmission of TV advertisements.
* Video for use at meetings, etc.
* Purchase and fitting out of mobile display van for use at field days and shows.

* Posters, bumper stickers, Agnotes and other publications.
* Use of field days, meetings, tours and media.
* All of this has been done in close association with Local Government.

Integrated Control Strategies

Research and investigation work has included:

* Herbicides screening trials with the major herbicides Frenock ®, 2,2 DPA and Glyphosate being identified. Work also included time, rates of application and method of application.
* Studies on the Autecology (what makes GPG tick) and Bio control. The studies on the autecology of GPG has greatly improved our understanding of the plants characteristics. To date Bio control has shown little promise.
* Control method trials eg: using cropping programmes.
* Evaluation of competitive pasture species.
* Studies to investigate the feasibility of selectively applying Frenock ® through a Pressurised wick wiper on scattered GPG infestation are giving encouraging results.
* Glyphosate applied with a Pressurised wick wiper. This technique of selectively applying Glyphosate to GPG in early summer is being further developed. If rates of 2.5 to 3 L per ha Glyphosate 360 g/L are applied, a significant kill of G.P.G. can be achieved. Follow up application is necessary.

This technique has been well developed in Queensland for the control of Giant Rats Tail grass *Sporobolus pyramidalis*, a similar plant to GPG.

A technique using Glyphosate at sub lethal rates via a Pressurised wick wiper is showing promise for chemical slashing of GPG (see later). Several shires on the mid north coast have purchased Pressurised wick wipers for hire to their rate payers for GPG control.

A Research Agronomist, Mr David Officer has been recently appointed to Grafton to work on the GPG problem. Highest research priority will be to attempt to assess the production and economic losses caused by GPG. This is basic information which we don't have, and is vital for assessing economics of control and control strategies. Other work will include further development of different control methods and strategies as well further evaluation of competitive pasture species.

Demonstration programme showing different control strategies has been underway for some years throughout the north coast of NSW. The programme has involved Local Government, NSW Agriculture and recently Catchment Management Committees and the Landcare movement.

Some farmers have developed strategies appropriate to their own situation eg: A high nitrogen fertiliser programme with strategic grazing and slashing has worked well on dairy pastures infested with GPG.

Management To Improve The Utilisation Of GPG

Some farmers have observed that during dry spring periods cattle have performed better grazing short GPG than they did on predominantly Carpet grass *Axonopus affinis* which the GPG had replaced.
Feeding and feed quality studies also indicated that short GPG is 10 - 15% better digestibility in spring and provided GPG was kept short, about the same quality as carpet grass in summer.

To prevent GPG becoming rank in late summer a chemical slashing technique is being developed using low rates of Glyphosate applied through a Pressurised wick wiper at early seed head initiation normally in late January and February. Rates as low a 1 L per ha of Glyphosate 360 g/L is sufficient to significantly reduce seeding and prevent the overburden of rank growth in late summer.

This technique is quicker and cheaper than slashing although the GPG must be preconditioned either by burning or slashing in the spring prior to the first application of Glyphosate.

Common Approach To GPG Control

There has been an informal common approach to control of different levels of GPG infestation throughout the Local Government areas of north coast NSW. This has worked to some degree but the need for a better standard approach has been recognised. Currently the NSW North East Noxious Plant Advisory committee is working on protocols to standardise strategies and options for GPG control which hopefully will be implemented by Local Government throughout north coast NSW.

Because we are looking at a complicated biological and economic system these are no universal answers or methods of control for GPG. Situations vary from property to property, even from paddock to paddock, the control method used will vary according to factors such as:

* the level of infestation;
* existing pasture and land use;
* type of production and level of production;
* type of land and soil.

TAKE HOME MESSAGE

- It is highly likely that in time you will get Giant Parramatta grass.
- Learn to identify it.
- It is spread by seed on vehicles, machinery and cattle movement from the North Coast of NSW.
- You will most likely first see it along roads, tracks and around stock yards.
- Early detection and removal/destruction is the best and cheapest control strategy.
- Once established there is no one hit off control strategy for G.P.G., control will involve integrated strategies that can be expensive.
- Raise the level of your agricultural communities awareness of the dangers of Giant Parramatta grass.

WEEDBUSTER WEEK

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INTRODUCTION

Weeds Awareness Week was first introduced in 1986 in NSW to draw people's attention to problems caused by weeds. Organised by the NSW Agriculture and the Noxious Plant Officer''s Association it was again staged in 1990 and 1996. Today it has become a national event, and is now known as Weedbuster Week.

Weedbuster Week will be held throughout Australia from 12 to 19 October 1997, to raise awareness about weeds and the problems they cause.

In New South Wales, the week will be coordinated by NSW Agriculture.

THE AIM OF WEEDBUSTER WEEK

To raise public awareness of noxious weeds and the detrimental effect they have on the environment, at both an economic level and a recreational level.

Weedbuster Week gives land care groups, bush regeneration groups, local government, schools, catchment groups and others the opportunity to promote their weed control activities and raise awareness in their local communities. Projects can be organised by these groups aiming at cleaning up specific weed infested areas.

Type of Activity

The type of activity could be a field day, a potted weed display, a weed control demonstration, seminar, workshop, school activity, (colouring in competition, essay competition), weed clean up at a local creek or park or any other weed control activity.

When holding your weed event, try and choose a site where you can gain maximum visibility. For example, if your are planning a weed display choose a high profile, high traffic area. Shopping centres, malls and main streets are prime examples. It would be more appropriate to set up a weed display in a busy shopping centre on a Saturday morning rather than a local corner shop on a Wednesday evening.

Advertise and Publicise

As Weedbuster Week approaches, advertise and publicise the event with great gusto. Contact your local radio station and newspaper and let them know what's going on. You will be pleasantly surprised at their response.

Posters can be placed around town in places like shopping centres, shop windows, take aways, service stations and the like. Of course, seek permission first.

Involve local schools via colouring in and essay competitions. Children, especially young children, love these types of events and mum and dad will soon be informed about weeds.

Gaining on Past Personal Experience

In 1996, Orange City Council involved the local schools with colouring in competitions in conjunction with the NSW Agriculture competitions. Apart from the prizes presented by NSW Agriculture and their sponsor, Orange City Council also presented awards for all the children who presented the best picture or essay for their age groups in each school. Local business houses happily provided sponsorship to purchase these awards. A bag of goodies was also presented to every infants and primary school child who entered the competition.

Orange City Council, Cabonne Shire Council and Wellington Shire Council also combined to hold a street display in Wellington's main street as well as a major weed display in Orange's newest shopping centre, the Metro Plaza. Both these events were very successful. Employees from the NSW Agriculture also assisted with the display.

The display in the Metro Plaza included potted noxious weeds, posters, Ag notes, balloons and the main attraction, Woody the Weed. The balloons and Woody proved to be extremely popular with the young children.

Networking with neighbouring Councils, (Local Control Authority), proved to be very successful. Various ideas were banded around prior to Weed Awareness Week and the sharing of resources throughout the Week ensured one Council, (Local Control Authority), was not left with all the work.

The same format is planned for Weedbuster Week this year with Orange City Council, Cabonne Shire Council and Wellington Shire Council joining forces once more.

TAKE HOME MESSAGES

Come on everybody - shake, rattle and roll. Make people aware of noxious weeds and their "ugly" effect on our country. Contact the local media, local schools, local business houses and your neighbouring control authorities or environmental groups and get them involved.

Lets....."**BUST THE WEED**".....

"Woody the Weed" - an innovative approach to weed awareness used during Weed Awareness Week 1996.

BIOLOGICAL WEED CONTROL AS A PART OF OVERALL WEED MANAGEMENT

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CSIRO Entomology, Canberra, ACT
JJ Dellow and J Fisher
NSW Agriculture, Orange, NSW

ABSTRACT

The aim of this paper is to put biocontrol of weeds into a framework to help participants of this Conference to develop an understanding of the potentials and limitations of biocontrol in agricultural systems. The talk will be in several parts and aims to look at a range of issues ranging from how biocontrol fits into the Noxious Weeds Act, through release, establishment and assessment phases to integration with other conventional measures of weed control.

Biocontrol and the Noxious Weeds Act - John Fisher

Landholders have a 'duty of care' towards their neighbours, and it is the responsibility of local control authorities (LCAs) to enforce the provisions of the Noxious Weeds Act. It is NWAC policy to encourage the use of biological control in appropriate situations while avoiding the use of it by landholders as an excuse for not carrying out their responsibilities under the Noxious Weeds Act.

The Ecology of Weed Systems - David Briese

To effectively manage weeds it is critical to understand their biology and ecology. This is particular important for biological control, as the life-cycle of the control agent is tightly linked to that of the host weed. Weeds may be annual, biennial or perennial; they may have grassy, herbaceous, shrubby or woody structures; they may reproduce by seed, vegetatively or both; they have different ways of dispersing and some may form large long-lived stores of viable seed in the soil. All of these properties need to be considered when selecting potential biological control agents and will have an influence on how successful an agent might be. Examples of these are given.

A thorough understanding of weed ecology is not only necessary for improving the success of biological control, it is critical for any integration of biological control into weed management strategies. One way to do this is by modelling the weed population dynamics. This can enable the weak links of a weed's life-cycle to be identified (e.g. is it more effective to reduce seed output directly or to target the young or mature rosettes in a broadleaf weed). It can also determine the threshold levels in weed populations needed for control and predict how well agents are likely to achieve these. Such models are also useful tools for studying the impact of other weed control options, such as grazing management and tactical herbicide usage.

A detailed understanding of weed ecology is, therefore, the key to integrating the various options and producing more effective management strategies.

Release and Establishment of Biological Control Agents - Tim Woodburn

Any biological control project has several sequential stages. There is the initial explorative phase, in the target weed's native range, for potential pathogens/arthropods. Studies on basic weed ecology should also be done during at this time. The selected agents are then introduced into quarantine, where they undergo host testing to establish their specificity levels. Once it has been established that neither plants of agricultural or environmental importance are under threat, permission is sought from the Australian Quarantine Inspection Service and Environment Australia for its release.

The release phase can be subdivided into 3 stages of varying duration: years 1-3, the initial releases, usually of a research nature: years 2-4, initial releases made by State collaborators: years 3-6, rapid expansion of redistribution networks.

The monitoring phase of a project commences once the agents become established in the Australian environment. Typically there is assessment of both the spread and impact of the agents on the target weeds. There are usually 3 levels of monitoring undertaken. Detailed assessment by the research team focuses initially on the impact of an agent at a micro level e.g., extended regular sampling of individual weeds or small weed patches. This detailed study is expanded to the plant population level as and when the spread of the biocontrol agent occurs.

The second level of monitoring occurs at the State level by the State collaborators, where a once only measure of spread and impact is assessed at a few selected sites over the range of the weed infestation. The third level of assessment is undertaken at the local level redistribution network level, where the emphasis is more on establishment of the agent.

Realistic Expectations for Agent Impacts - Bill Pettit

There is a great many people with a vested interest in the success of a biological control program against a weed species. A reduction in herbicide usage, mechanical control methods and landholder time and money are expectations that landholders, biocontrol workers and agronomists alike share. Whether such expectations are realistic will depend upon a number of factors. The ecology of the target plant, the potential impact of an introduced agent on that plant as an individual and as a population, the effectiveness of redistribution of that agent through the range of the target weed, and the compatibility of landuse with the agent's lifecycle will all have a strong influence in the realisation of the potential impact of a biological control agent.

With a large number of biological control agents released in Australia now in a redistribution phase biocontrol workers have more of an insight into the potential of these agents to impact on their target weed species. How this potential might be realised in a weed management system for pastures will be the subject of this paper.

Integration of Herbicides and Biocontrol - Jim Dellow

To date biological control of weeds has been used as a stand 'alone concept'. In reality this mentality is putting excessive strain on what is already a delicate balance. To exploit biological control agents (insects and plant pathogens) to their full potential consideration

must be given to a fully integrated approach incorporating grazing livestock, perennial pastures and herbicides.
Already the spray-graze technique is utilised by farmers to capitalise on grazing stock, sublethal herbicide rates and competitive crops or pastures to obtain superior and cheaper control results. The next step is to incorporate biocontrol agents into the system.

The possible harmful affects of herbicides on the efficacy of biocontrol agents must be assessed as well as the timing of strategic grazing of livestock to avoid averse results.

INTEGRATED CONTROL OF BITOU BUSH IN NEW SOUTH WALES

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THE PROBLEM

Bitou bush and boneseed, two subspecies of *Chrysanthemoides monilifera*, are competitive environmental weeds of South African origin. Despite distinct differences between these subspecies (Weiss 1986) the similarities in pest status and habit often mean that they are lumped together. Bitou bush (*C. monilifera* ssp. *rotundata*) is restricted to areas of summer rainfall (Parsons and Cuthbertson 1992) and infests coastal areas of southern Queensland, NSW and Lord Howe Island. There is also an localised infestation at Menindee Lakes, NSW. In NSW it is common in areas north of Sydney and occurs south to the Victorian border (Love 1985). Boneseed (*C. monilifera* ssp. *monilifera*) is restricted to areas of winter rainfall (Parsons and Cuthbertson 1992) occurring extensively throughout southern Australia but is also present in coastal areas of NSW as far north as Sydney. It is a serious problem in many conservation areas in Victoria, South Australia, Western Australia and Tasmania. Boneseed was first recorded as a garden shrub in Sydney in 1852 (Gray 1976). Bitou bush was first recorded as naturalised in Australia from Stockton near Newcastle in 1908 (Weiss 1986) where it appears to have been an accidental introduction in ships ballast.

During the early 1950's bitou bush was used as a sand stabilising plant (Mort & Hewitt 1953) and to revegetate coastal areas mined for mineral sands (Barr 1965). The capacity of bitou bush to invade native vegetation had been recognised by the early 1970's and its recommendation for coastal planting was withdrawn. However, by 1976, Gray (1976) reported that bitou bush was naturalised along much of the NSW coast. Aerial surveys of the NSW coastline were conducted by the NSW National Parks and Wildlife Service in 1981 and 1982. These indicated that bitou bush was distributed along approximately 60% (645 km) of the coast and was the dominant species along 230 km. The range of bitou bush has expanded since these surveys and Love (1985) predicted that it could spread to occupy over 90% of the NSW coastline by 2010 and would dominate the native vegetation along two thirds of the coastal fringe.

Bitou bush is a serious weed of conservation areas (Adair & Scott 1989). In invaded vegetation, plant diversity is reduced and structural alterations occur as native plants are displaced (Dodkin & Gilmore 1985). This displacement has a detrimental effect on native fauna (Dodkin & Gilmore 1985). Bitou bush is largely an environmental weed as it is easily controlled by stock grazing and cultivation. It is primarily restricted to non-agricultural areas such as national parks, forests, coastal dune ecosystems and other recreational land. In the past, physical and chemical control have been used to reduce infestations and limit spread of bitou bush.

Biological Control

A biological control program against bitou bush and boneseed was approved by Standing Committee On Agriculture in 1987. Surveys in South Africa indicated that there are more than

100 species of phytophagous insects associated with the *Chrysanthemoides* species complex (Scott & Adair 1990). To date, seven species of insects have been imported from South Africa into Australia for host specificity testing. Host specificity testing for bitou bush and boneseed insects is being conducted at Keith Turnbull Research Institute, Victoria. Insects imported are bitou tip moth (*Comostolopsis germana*); five species of leaf feeding beetle: black boneseed beetle (*Chrysolina* sp. 1), blotched boneseed beetle (*Chrysolina picturata*), painted boneseed beetle (*Chrysolina* sp. 2), *Ageniosa electoralis* and bitou tortoise beetle (*Cassida* sp.); and bitou seed fly (*Mesoclanis polana*). A leaf feeding moth (*Tortrix* sp.) and the lacy-winged bitou seed fly (*Mesoclanis magnipalpis*) are currently undergoing quarantine host specificity testing in Australia. Six species have been released, bitou tip moth, black boneseed beetle, blotched boneseed beetle, painted boneseed beetle, bitou tortoise beetle and bitou seed fly. *A. electoralis* was able to develop on a number of plant species and has been rejected as a possible biological control agent. Additional insects and a rust fungus are now under investigation in South Africa.

Of the six insects currently released in Australia, bitou tip moth has been the most successful. This species only develops on *Chrysanthemoides* spp. (Adair and Scott 1989). It has now been released at 68 sites in NSW and has established at, or is colonising, many of these. At many of these sites it has now spread several kilometres from the original release point. At some sites, numbers in excess of 400 larvae/m^2 have been found and are significantly reducing flowering and seed production of bitou bush. Black boneseed beetle has been released at five sites in NSW. Its current status is unclear but it does not appear to have established at any site. The larvae of this beetle appear to be particularly prone to predation by ants and spiders (R. Adair pers. comm.) and this may limit their potential as biological control agents. Blotched boneseed beetle will not be released in NSW as it is specific to boneseed and prefers winter rainfall areas found in Victoria and South Australia. Painted boneseed beetle has been released at six sites in NSW but like black boneseed beetle it does not appear to have established at any of these sites. Bitou tortoise beetle has been released at six sites in NSW and is persisting and reproducing at these sites but it is too early to say whether it has established or it's likely impact. Bitou seed fly has now been released at three sites in NSW. It is too early to say whether it has established at one of these sites but at the other two it has spread several kilometres up and down the coast in less than 12 months. This fly is present in very high numbers and is causing significant damage to seed at these two sites.

Traditional Control Methods

Traditional control methods include physical and chemical control. Physical control is usually carried out by local volunteer groups. These groups mainly organise working parties to remove bitou bush plants by hand pulling although painting cut stumps with glyphosate is also practised. The cut-stump method is preferred by many workers because it results in minimal soil disturbance. These forms of control are particularly effective in small areas of high conservation significance. Larger scale control using these methods is not practical because it is too labour intensive. The possibility of removing bitou bush in areas infested for many years is compounded by large soil seed banks. Weiss and Milton (1984) recorded a soil seed bank of 2030 seeds per m^2 near Moruya on the south coast of NSW and Holtkamp (unpublished data) has recorded a soil seed bank of up to 1968 viable seeds per m^2 as well as almost 4000 damaged seeds per m^2 at Port Macquarie.

Bitou bush can be controlled using herbicides. However, various problems such as access to sites and the possibility of non-target damage arise. The most effective method of application is by air, either by plane or helicopter, but this is extremely costly. Cooney *et al.* (1982) evaluated the herbicide glyphosate (Roundup®) on bitou bush infestations and found that it was effective on the target plant and caused little damage to native species in the same area. However, only five native species were tested in these trials. Unfortunately, as the large bitou bush plants died, there was prolific germination of seeds. This necessitated re-treatment of infested areas. Re-spraying needs to be carried out regularly until the large soil seed bank is exhausted or the surrounding native vegetation out-competes the emerging bitou bush seedlings. Re-treatment on this scale is extremely costly.

Toth *et* al. (1993) have considerably refined the original work on aerial application of glyphosate using helicopters and have discovered a "window of opportunity" during the winter period immediately following peak flowering of bitou bush. At this time bitou bush was most susceptible and seven native species tested were least susceptible. Toth *et al.* (1995) increased this number to 66 native species tested and recently this has been increased to 160 species tested (J. Toth, pers. comm.). Further herbicide treatments are required approximately every two years until the soil seed bank is exhausted. It is important that none of the regenerating plants be allowed to flower and set seed. Aerial application of glyphosate has now become widely accepted and several hundred hectares of NSW National Parks and Wildlife Service land was treated during 1995 (J. Toth, pers. comm.).

Integrated Control

Toth *et al.* (1995) are currently investigating the feasibility of integrated control of bitou bush at several sites on the NSW coast including Jervis Bay National Park and Myall Lakes National Park. The technique involves the aerial application of glyphosate to control mature plants, combined with the release of biological control agents to control seedling regeneration.

The role of fire in an integrated control program for bitou bush is currently under investigation on the NSW south coast by the CRC for Weed management Systems. Preliminary observations of burnt areas suggest that fire stimulates large scale germination of bitou bush seeds. These young seedlings support extremely large and active populations of bitou tip moth and are also easy to hand remove or re-treat with herbicide.

TAKE HOME MESSAGE

Biological control of bitou bush, if successful, will reduce this weed to a minor component of invaded vegetation. However, it must be remembered that biological control will not eradicate bitou bush. Integrated control combining biological control, strategic herbicide application and possibly fire appears to be the most viable long term solution.

Any integrated program will have to ensure that sufficient biological control agents remain following other forms of treatment to ensure re-establishment of biological control agent populations. Continuing physical and herbicidal control by volunteer groups in areas of high conservation significance is also important. The regeneration of coastal areas cleared of bitou bush by local volunteer groups also forms an important component of this program.

It is essential that revegetation of disturbed habitat occurs quickly to prevent the niche previously occupied by bitou bush being occupied by bitou bush seedlings or by another weed species.

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THE "SPRAY-GRAZE" TECHNIQUE
A METHOD OF PASTURE MANIPULATION

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The "spray-graze" technique for broadleaf weed control in pastures and winter forage crops (oats) is based on the integration of the application of sub-lethal rates of the herbicides MCPA, 2,4-D amine and 2,4-DB amine with heavy livestock grazing pressures.

ADVANTAGES

Although all herbicides have some effect on pastures and crops, particularly legumes, there is generally no permanent damage to established pastures because of the low application rates.

There is a cost saving because the technique relies on the application of low sub-lethal rates. The technique is environmentally sound due to its selectiveness and the low application rates used.

THE TECHNIQUE

Sub-lethal rates of the herbicides MCPA or 2,4-D amine are effective in controlling the listed broadleaf weeds if applied at the correct growth stage of both the weed and pasture/crop, and used in combination with the recommended grazing livestock pressure.

The pasture treated must have the potential of being a well balanced productive pasture with a good legume component in order to replace the weeds controlled.

Timing

Apply the herbicide at the recommended rate when the weeds are actively growing. The weeds must be sprayed when they are most susceptible; this is usually when they are in the small rosette stage. The clover component of the pasture should have at least two to three leaves before spraying.

Autumn spray application, six to eight weeds after the autumn break (good opening rains) when the broadleaf weeds are most susceptible.

Seven to ten days after spraying, the paddock should be stocked with sheep at preferably eight to ten times the normal stocking pressure until the weeds are selectively grazed as closely as possible.

Grazing should not continue to the stage where the pasture is damaged. It is more important to consider the condition of the pasture than be concerned about the presence of the weeds.

Why the technique works

The pasture treated must be a reasonably well balanced legume-based pasture capable of competing with, and replacing the weeds after applying the herbicide and grazing pressure.

The recommended application rates will not permanently affect clover and other pasture species; however, medics are less tolerant and the lower application rates should be considered. The sub-lethal application rate will not kill the weeds by itself. However, the herbicide is absorbed by the weeds causing them to wilt and become more palatable to stock. The palatability increases as a result of the sugar levels rising following a short period after spraying. The weeds also assume a more erect habit allowing for easier grazing.

If the weeds are not heavily grazed at this time, most of them will recover after three weeks, making normal growth. In the wilted state, the weeds are selectively and quickly grazed.

Any regrowth which does occur after grazing, usually survives. However, following treatment the pasture makes normal growth which will compete strongly with these weeds.

Weeds controlled

Caltrop	Shepherd's purse	Turnip weed
Capeweed	Saffron thistle	Wild radish
Charlock	Slender thistle	Wild turnip
Mustards	Spear thistle	
Paterson's curse	Variegated thistle	

Table 1. Application rate (per hectare) **For Spray-Graze**

MCPA	MCPA	2,4-D amine	2,4-D amine	2,4-DB amine
250 g/L	500 g/L	500 g/L	800 g/L	500 g/L
MCPA 250	MCPA amine 500	Amicide 500 Amicide LO-500 A	Baton®	Trifolamine® Legumex Super® Buttress®
litres	litres	litres	grams	litres
700 ml - 2.8 L	350 ml - 1.4 L	350 ml - 1.4 L	250-900 g	1.0 L - 3.2 L

Rain safe period

Do not spray if rain is likely within four hours.

Withholding period

Do not graze or cut for stock food for seven days after application.

DISADVANTAGES AND PITFALLS

- Pasture treated must be a reasonably well balanced legume based pasture.
- Weeds must be small.
- Weeds must be actively growing; consider stress such as waterlogging and frost.
- Sheep are the most effective; cattle usually give poor results.
- Heavy stocking is critical.
- Weeds remain palatable for about three to four weeks after spraying. High stocking rates must be maintained.
- Keep the paddock size manageable. Too large a paddock makes it difficult to achieve the desired grazing pressure.
- Slow germinating weeds such as saffron thistle and wild radish seedlings may appear after treatment and will not be controlled.
- For spring `spray-graze', graze the paddock hard during the winter and apply the herbicide before the clover flowers.
- Care must be taken if the pasture is based on medics because they may be killed using this technique.

Caution

This technique is a valuable method of controlling weeds. However, some weeds are potentially poisonous and can become more toxic and more palatable when sprayed. Paterson's curse and variegated thistles are examples.

In order to minimise the risk to animals ensure that the stocking pressure is high. This will minimise the intake per animal. Maintain a close watch for any adverse effect on the animals and if necessary remove them at the first signs of abnormal behaviour.

Dry sheep or wethers should be used rather than young breeding stock. Horses should not be used.

Further Reading

`Weed Control in Lucerne and Pastures 1997/98' - J. J. Dellow. NSW Agriculture Booklet.

ALLIGATOR WEED

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ORIGIN & INTRODUCTION

Alligator weed apparently originated in the lowlands of the Parana River near Argentina's border with Brazil and Uruguay, a region which lies at a similar latitude to Sydney. But the weed tolerates much cooler climates.

Hockley (1974 suggested that alligator weed was bought to Australia in ships' ballast), but extracts of a letter by E. Riley dated May, 1946 accompanying the early specimens of alligator weed indicated the last ballast was dumped at Carrington near Newcastle in 1914. It is more likely that alligator weed was introduced via ships' cargo at a later date, perhaps during the Second World War (A. Kanis, pers. comm. 1979). Records suggest that all alligator weed in Australia is a clone of the same parent materiel that has spread from the point of entry at Carrington (M.H. Julien).

Spread

The large persistent infestation near the mouth of the Hunter River at Williamstown, north of Newcastle, now covers in excess of 2,000 ha of swampy land including paddocks. Infestations have been spread to other areas, some known, by movements of stock and contaminated machinery but is suspected to be in other areas not yet detected.

It is thought the weed was introduced to the Botany Bay area during the Second World War, spreading to the George's River, then by sand and soil extraction to diverse areas in the Sydney Metropolitan area. Now alligator weed has spread extensively over the Sydney Basin, which includes 20,000 km of creeks and rivers, and is out of control, especially in the South and in Kemp's Creek, part of the Nepean Hawkesbury Catchment, posing a threat to Agriculture valued at approx $2,000 million in the Sydney Basin, including the turf farm industry valued at $54 million. There are now many new outbreaks being reported and the spread is now at explosion point.

Description

Alligator weed is a perennial, stoloniferous herb, that has invaded waterways and banks as flood plains began to be used for pasture, agriculture and turf production in Australia. In Australia, alligator weed has the potential to spread throughout inland waters of the mainland, particularly in the wetter near-coastal and coastal zones (Anon.1982).

Infestations consist of a tangled mat of old, prostate stems supporting younger upright stems bearing pairs of leaves on each node. When floating on water, roots are adventitious, stems are thicker with large air spaces and dense mats of stems cover the surface. When on land, stems are thinner, air spaces are smaller or absent and plants develop tap roots. Flowers are white in a rounded spike, borne on an axillary flower stalk and occur mainly in late summer. Viable seeds are not produced and propagation is by stem fragments (Julien and Broadbent 1980).

The pest status of alligator weed on waterways results from excess growth which restricts use of water, alters aquatic ecology and excludes growth of other plant species. It causes problems associated with the flow of water, flooding, sedimentation and provides habitats for disease vectors and insect pests such as mosquitoes (Mitchell, 1978; Julien and Broadbent, 1980). Alligator weed has invaded terrestrial areas, including agricultural land, where it may be spread by vehicles or livestock as well as in hay, turf sand or soil to other waterways. The plant's status as a weed is enhanced because herbicides are unable to translocate down the stems and, although emergent and above ground parts may die, regrowth quickly occurs from submerged or underground material. Biological control reduced large mats of alligator weed to edge infestations on large permanent waterways near Sydney, but not in smaller waterways, drains, swamps or terrestrial areas (Julien 1981).

The weed can tolerate a wide variety of mono-climates and has become a problem in cool and warm, temperate regions. It requires a warm growing season, but will tolerate cold winters including severe frosts, which may kill emergent stem materiel (Coulson, 1977). In the United States and China, freezing conditions such as ponds frozen over with ice cause a kill above the ground and surface areas, with regrowth occurring as the temperatures rise again.

Spread

A survey of the Nepean-Hawkesbury catchment was carried out by NSW Agriculture with assistance from the Wollondilly Shire Weeds Officer, Kevin Burton, during July and August, 1995 in order to identify the source and extent of alligator weed in the catchment area.

The source of alligator weed in the Nepean River was traced to a swamp just above Menangle Weir where, in times of heavy rain, this swamp drains to the river and sand and soil was contaminated with alligator weed introduced into the area some years ago. Many small, floating and attached infestations were located from Menangle to Richmond.

The area from Menangle to Wallacia Weir has now been brought under very good control mainly due to the effort of Wollondilly Shire Weeds Officer, Kevin Burton, who, with an assistant and a small boat and using a gas gun has maintained good control over a two-year period with two treatments each summer.

The area between Penrith and Richmond is being controlled by Hawkesbury River County Council, who had great success treating a major Water hyacinth infestation only to find a rapidly-increasing alligator weed infestation taking its place. The treatment of alligator weed in this area is severely stretching the resources of the County Council.

The South and Kemp's Creek infestations are out of control, and will require thousands of litres of chemical, both on water and in terrestrial infestations. The creeks run through residential, grazing, and vegetable-growing locations.

I feel that even if adequate funding was to be made available, it would be difficult to obtain EPA approval to continuously use large amounts of chemical in these areas. If this were to be the case, and as there are no other methods of control, alligator weed would have to be taken off the list in these areas and try to have it contained in non-affected areas, especially inland in the wetlands and irrigation areas.

Sri Lankan Community

To further compound the problem, it has been found the Sri Lankan community in Australia have been using alligator weed as a herb and being mistaken for *Alternanthera sessilis* which is called Mukunu-wenna by the Singhalese and Pononcarni by the Tamils.

This was discovered by accident in Queensland early in 1996 by the Department of Natural Resources when an infestation of alligator weed was found growing in a suburban garden in Brisbane. Upon further investigation it was found to be widespread in the Sri Lankan community in approximately 70 gardens stretching from Cooktown , west to Roma and Brisbane.

NSW Agriculture were notified, a Sri Lankan consultant, Lalith Gunasekera, was appointed on a temporary basis to work with me in order to appraise the situation in NSW. We found that the use of alligator weed grown in home gardens was widespread in the Sydney area as well as in smaller portions of the Newcastle and Wollongong areas. Also, small numbers were found at Dubbo, Parkes, Forbes, Peak Hill, Brewarrina, Grafton, Lismore, and Armidale.

A replacement plant, Mukunu-Wenna, (*Alternanthera sessilis*) has been propagated at NSW Agriculture's Horticultural Research and Advisory Station, Gosford, and this has been supplied free of charge and distributed at Buddhist Temples and Sri Lankan food fairs. This was done as a inducement to report alligator weed.

Good control is being achieved where Shire Weeds Officers in country areas have treated the gardens. However, it is difficult in the Sydney area as the Sri Lankan population is estimated at around 20,000 people and many Sydney Councils do not have with full-time Weeds Officers.

Another problem in the Sydney area is the number of Sri Lankans who have rented and moved on over the past fifteen years, this is the length of time the growing of alligator weed in gardens is estimated to have been occurring in the Sydney area. Quite a number of people, when they discovered that they were growing the wrong plant, tried to dig it out, used a whipper snipper, mowed and disposed of it in rubbish bins, or in the case of mowing, contractors took clippings to a rubbish tip or dumped it in the bush.

The growing of alligator weed as a herb has been solely confined to the Sri Lankan community. Ed Ferry, Weeds Officer with Fairfield City Council, could find no evidence of its use by the Vietnamese community in the Cabramatta area.

Lalith Gunasekera has had contact with 610 Sri Lankans in Melbourne, six in South Australia, four in Tasmania, 24 in Western Australia, and knows of 100 families in Darwin, as well as reports of it growing in New Zealand. It is feasible the growing of alligator weed as a herb could be worldwide.

A strategy for control in home gardens is still being developed. During the 1996-97 summer the services of a contractor was offered at $90.00 per garden treatment, approximately four treatments being required for two summers, but this was rejected as being too expensive.

The proposal now is to endeavour to have Metsulfuron prepared in 2 g packs, so owners can carry out their own treatment. They will be advised that they will be unable to use the alligator weed garden for two years. The smallest amount of Metsulfuron that can be purchased is a brand called Generex(R) in a 50 g pack, and as only half a gram is required in five litres of water, it would need to be purchased by groups and divided.

City Councils may be able to inspect properties and possibly supply small quantities of Metsulfon as members of the Sri Lankan community make contact with council or council can contact them. City Councils will be encouraged to carry out random inspections from rate notices on properties owned by Sri Lankans and also train Council Officers in the sections which require council inspections to identify alligator weed.

Biological Control

The alligator weed flea beetle, *Agasicies hygrophila* has evolved with the aquatic form of the plant, which has a different growth pattern to the terrestrial form. The adult beetle eats the plant's leaves and then burrows into hollow stems to pupate. As the terrestrial form is under a degree of water stress, it is usually smaller and produces thinner, tougher stems with no hollows at the apices to accommodate beetle larvae, and as the terrestrial form is less attractive both to adult and larval forms of this beetle, it causes little damage.

Alligator weed mainly grows in summer, achieving peak growth rates in January when temperatures are highest. Effective control depends on insects emerging towards mid-spring and building up large populations by completing several successive generations before early autumn. In cooler areas, emergence is delayed and the insects do not have time to develop populations large enough for effective control.

Chemical Control

Approximately 100 different combinations of herbicides, additives and surfactants were tried by Dr. Kath Bowmer from the Division of Water Resources (see Queen of the Waterways. Eccs. 80), a specialist in the control of aquatic weeds with herbicides at the Williamstown infestation in the mid 1980's.

Many simply scorched off the tops of the weed leaving underground rhizomes intact. Eventually it was found that the herbicide, glyphosate, would only control floating mats of the aquatic form, which does not form rhizomes and root systems. However, the terrestrial form of alligator weed proved quite resistant.

Using radioactive tracers, Bowmer and her colleagues were able to track the uptake of glyphosate by the plants. They found that only a tiny fraction of the herbicide applied to the leaves was translocated to the underground parts of the plant. Additionally, the plants were able to exude the herbicide from their root systems. Another herbicide, Metsulfuron, was found to be successful on the weed's terrestrial forms, while a third chemical, dichlobenil, controlled marginal, detached plants on the edges of waterways.

NSW Agriculture intends to conduct further trials in the Sydney and Williamstown areas during the 1997-98 summer. The nature of biological control is that it suppresses the weed, but does not eradicate it, so integrated methods of weed control need to be developed.

TAKE HOME MESSAGE

Alligator weed could have been easily controlled or eradicated years ago at very little cost, but now control attempts could run to many millions of dollars.

Alligator weed can easily be spread to other areas by contaminated machinery, stock movements or boats arriving from infested waterways.

Weed Officers across the state are urged carry out public awareness as to any unusual, quick growth of aquatic weeds in their area and to follow up any lead, however small. As alligator weed can be very difficult to identify in different climatic/water nutrient conditions, be sure to seek advice from someone who can make positive identification.

I strongly suspect alligator weed is growing in some area of New South Wales not yet identified.

Check out any Sri Lankan residences in your towns.

A draft action plan for Alligator weed in New South Wales from June, 1997 to June, 2000 has been developed by Richard Carter, State Weed Co-ordinator, NSW Agriculture, Orange.

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ALLIGATOR WEED

IT CHOKES RIVERS AND IRRIGATION SYSTEMS AND IS EXTREMELY DIFFICULT TO CONTROL

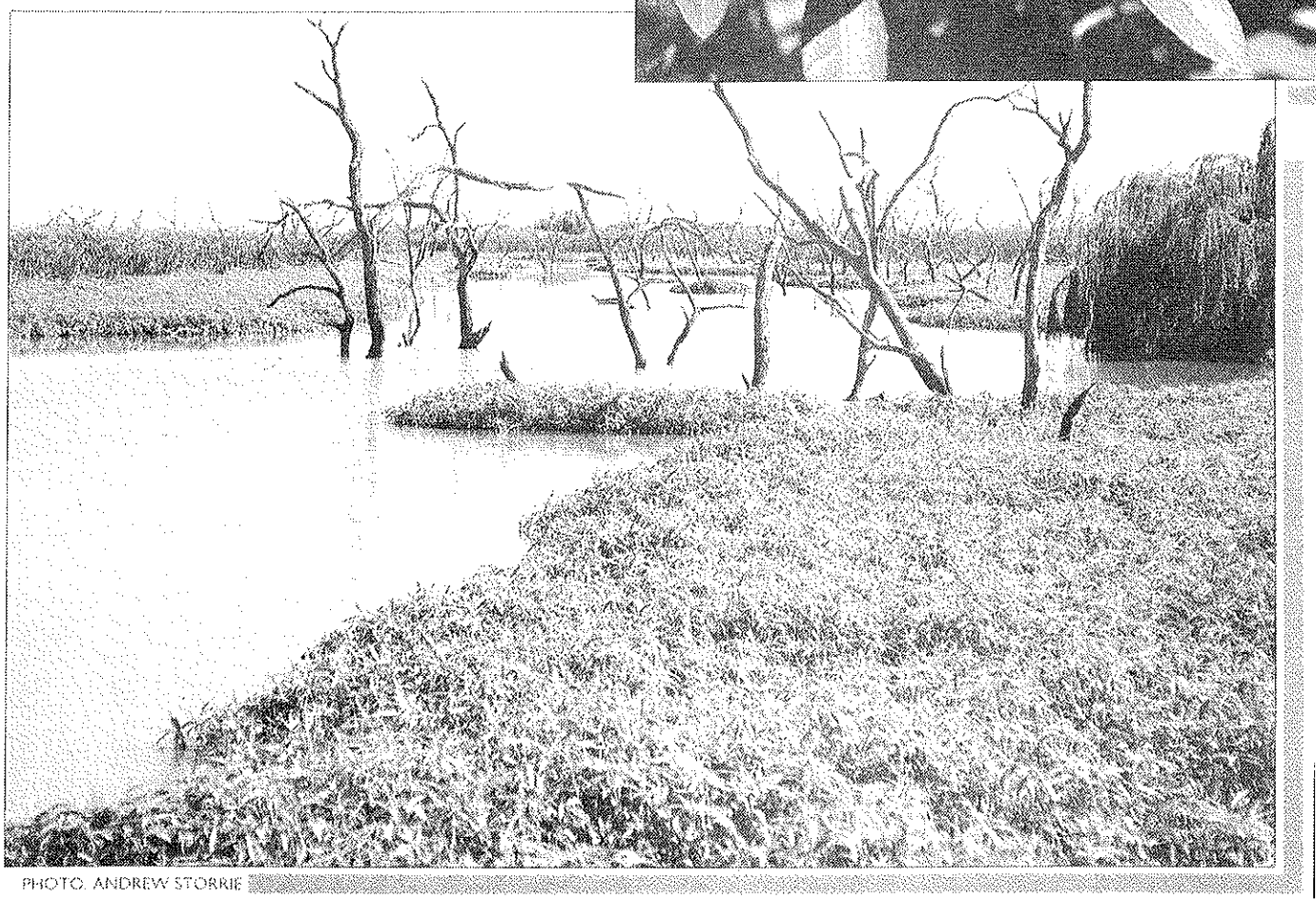


PHOTO: ANDREW STORRIE

"CAN YOU IDENTIFY IT?"

If you see any plant that looks like this contact NSW Agriculture or your Local Council *IMMEDIATELY*

NSW Agriculture
Alligator Weed Taskforce

MURRAY-DARLING BASIN COMMISSION

BEATING BLUE HELIOTROPE
Solutions For Long Term Control

David Newell
Landcare Co-ordinator
PO Box 181, Gilgandra NSW 2827

INTRODUCTION

Blue Heliotrope (Heliotropium amplexicaule) a native plant of South America, is a widespread noxious weed of cultivations, pastures and forests in Australia.

Introduced to Australia in the 1800's as a ornamental plant or possibly in contaminated grain, this plant has spread through NSW, Southern Queensland, South Australia and Victoria. It infests over 110,000 hectares in NSW alone.[1] Over the years, widespread clearing, farming and overgrazing has degraded country making it prone to invasion, greatly assisting the spread of this weed.

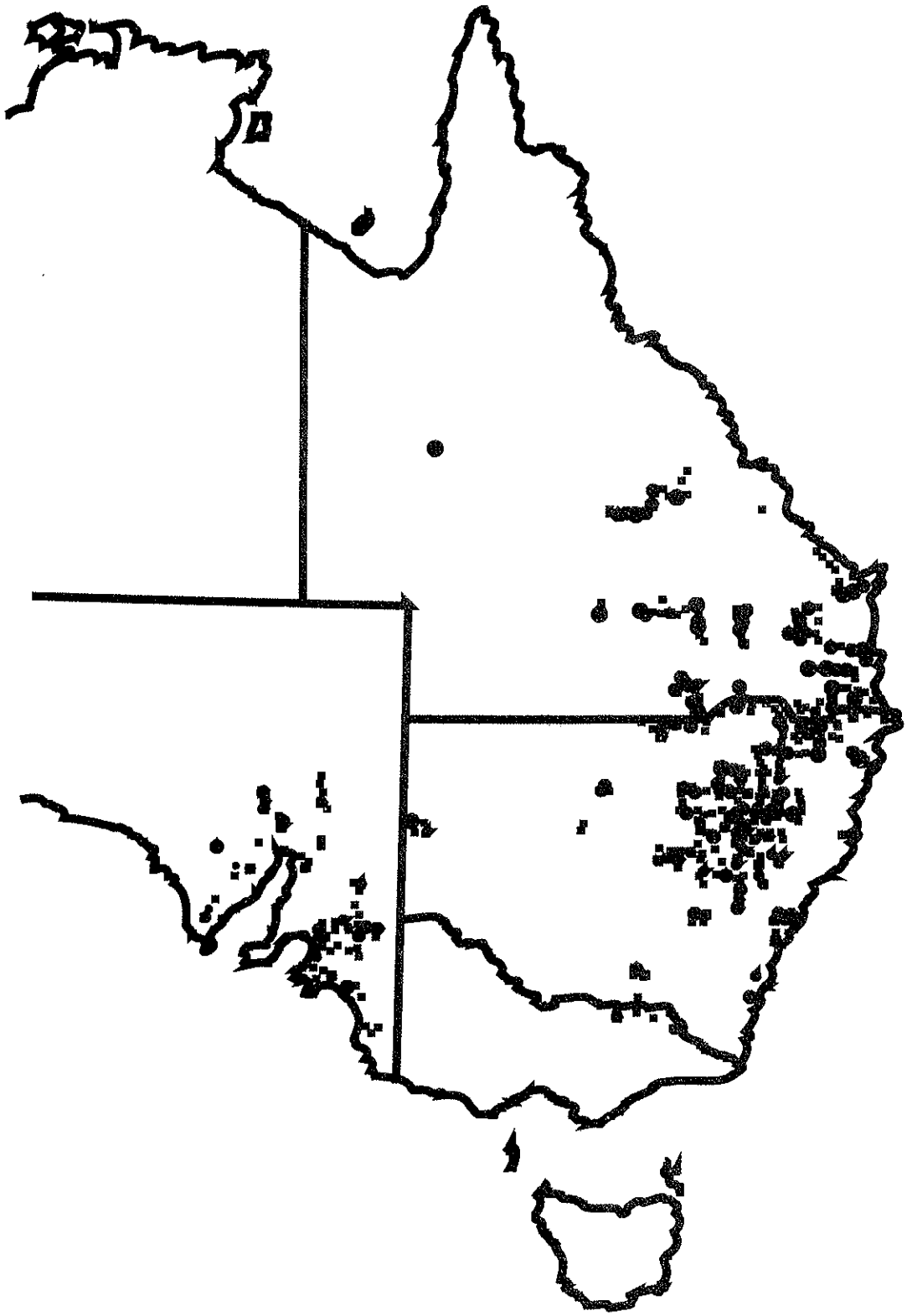
Survey work carried out by NSW Agriculture prior to 1989 showed that Blue Heliotrope occurred in 50 out of 140 shires in NSW. It is declared noxious in 14 local government areas in Central and Northern NSW. [2]

Blue Heliotrope is poised to become a major problem weed through much of the productive agricultural country of Australia, with disastrous results to the industry and the environment.

One problem facing the control of Blue Heliotrope is a lack of knowledge amongst many landholders about the weed and the potential damage it can create. Once established it is difficult to control.

Action to control this weed needs to occur now on a broad scale. This will need to include increasing landholder identification of the weed, raising the awareness of the weed's problems, encouraging research trials and implementing these trail results over broad areas.

Many Landcare and other farmer groups are developing practical solutions to controlling Blue Heliotrope and preventing further spread of this tenacious weed.



Distribution of Blue Heliotrope in Australia
(Adapted from *Noxious Weeds of Australia* and BHAC survey results.)

Why is Blue Heliotrope a Big Problem?

Blue Heliotrope is a spring to autumn growing perennial plant, which flowers in summer. It dies back to the root after the first frosts of winter.

The plant has a long slender tap root which can grow up to 3 metres and numerous lateral roots.[3] It regenerates from seed and root fragments, making it extremely difficult to eradicate. Seeds can remain dormant for more than a year in the soil and can germinate at any time given the right soil moisture and temperature. Blue Heliotrope may decline during drought periods, but will regenerate soon after rain.[2]

It competes aggressively with desirable pastures and other ground covers. The plant also posses toxic alkaloids making it poisonous to livestock, causing damage to the liver and brain which often results in death.

Production losses occur from the loss of grazing and farming country and a decline in animal performance on livestock grazing infested country. Invasion of areas of native vegetation by Blue Heliotrope also results in a reduction of habitat for native wildlife and a reduction in biodiversity.

The weed is highly persistent and adaptable to a wide range of soil and climate types. Major infestations appear to occur in areas which receive 500 mm/year or more of rainfall.[2] Although the plant will grow in lower rainfall regions, such as in the Western Division of NSW.

Blue Heliotrope is often found along roadsides, in waterways, on non-arable country, in degraded pastures and on fallowed cultivation. Plant fragments and seeds are spread by road graders, on cultivation machinery, along water courses and by livestock and humans.

What Has Been Done to Control Blue Heliotrope and Has it Worked?

Over the years, a huge amount of time and money has been spent by farmers and government agencies in attempting to control this tenacious weed. Many different methods of control have been attempted, trialed and researched.

- **Chemicals**

Many research trials have been carried out using various chemicals and different combinations of chemicals to control Blue Heliotrope.

There is no real selective herbicide to control Blue Heliotrope. Therefore to get any sort of control, non-selective herbicides have to be used which has the disadvantage of baring the ground and removing any possible future competition for the weed.

The chemicals which are currently registered for use on Blue Heliotrope have had limited success on controlling the weed. Some chemicals have been trialed which are not registered for use and have had mixed success. In addition, many of the chemicals can leave residues in the soil, effecting future growth of desirable plants such as pasture legumes.

The best success with chemical control trials in the Central West to date has been with the use of glyphosate (not registered) on mature, flowering plants. Follow up spraying of seedling growth is essential to prevent re-establishment.

Overall, the use of chemicals for controlling Blue Heliotrope is costly and unreliable. This method can only be considered as a short term, "quick fix" solution, and many areas may need to treated on a continual basis. Consideration also needs to be given to the possibility of the weed developing resistance towards certain herbicides used for prolonged periods.

- **Cultivation**

Cultivating country infested with Blue Heliotrope does give short term control, but has the potential to spread the problem. As discussed previously, Blue Heliotrope can regenerate from any sized root fragment and cultivation will produce huge amounts of these fragments.

- **Pastures for Competition**

Out-competing Blue Heliotrope with pasture species is the only solution that has provided effective long term control. Many landholders have used native grasses, introduced perennial grasses and legumes to provide competition.

Once established, these pastures persist and out compete the weed. The most important factor is to remember that it will not happen overnight and good management of the pastures is essential, especially in the first few years of establishment.

- **Grazing Management**

The management of grazing on Blue Heliotrope infested pastures is needed to allow competition to grow. This may involve the management of livestock and wildlife grazing pressure. Remember that one of the main causes of Blue Heliotrope infestation is overgrazing.

In order to allow pasture competition to become established, paddocks may have to be locked up for a few years. This is a small price to pay to get on top of a Blue Heliotrope problem.

- **Biological Control**

Research has already been completed into the possible biological control of Blue Heliotrope. Initial studies in South America have shown that there are four (4) potential insects that may provide some level of control.

Further research needs to be done and then the insects can be brought into quarantine in Australia for further testing. As always, funding provides a vital component of research programs and at present there is limited funds available.

The Blue Heliotrope Action Committee[4] is currently developing a funding proposal in an attempt to attract funding to continue this vital research.

It must be remembered, however, that biological control is not a "silver bullet" solution. Any biological control program needs to occur in conjunction with other control methods.

A Success Story

The Warrumbungle Landcare Group, west of Coonabarabran, is one group that has had success in the fight against Blue Heliotrope.

In conjunction with the Castlereagh Macquarie County Council, the group has established a three (3) acre trial block to determine what perennial grasses compete well against Blue Heliotrope.

15 different types of grasses have been planted and the group will monitor the success of each grass in suppressing the growth of the weed. These grasses include Rhodes grass, Consul lovegrass, Premier Digit grass, Wallaby grass and several types of Buffel grass. Recently, winter legumes have been broadcast with fertiliser to improve the persistence and feed value of the trials.

These grasses have provided excellent competition against the weed, which previously covered the paddock. After the second summer of the trial, the infestation of Blue Heliotrope was down to about 20%. The group now intends to apply the results from this trial to properties on a broader scale.

A major factor to the success of this trial, was the construction of a total exclusion fence to prevent livestock, kangaroos, wallabies and rabbits from grazing the block. This has allowed the grasses to become well established and provide strong competition for the weed.

The next step in the groups control program is to fence off the creek system that runs through their area. This will prevent livestock spreading Blue Heliotrope seeds from the infested creeks and will also allow competition to establish along the banks.

In 1996 the Warrumbungle Landcare group organised a public meeting on Blue Heliotrope to increase awareness and develop control strategies. The group is also behind the push to secure funding to continue research into bilogical control.

The Warrumbungle Landcare group's approach is to develop an integrated control program and not look at one method in isolation. Management strategies are changing to provide long term, effective control of Blue Heliotrope.

TAKE HOME MESSAGES

- **Increase Awareness, Knowledge and Co-operation**

Blue Heliotrope has the potential to become a huge problem across much of the arable agricultural land of Australia. A lack of identification skills and knowledge of the weeds potential impact is a major stumbling block in controlling the spread of infestation.

It is up to everyone involved in weed management to increase the awareness and understanding of Blue Heliotrope amongst weed managers. Skills in identification are vital to allow early recognition and control.

It is also important to encourage groups and individuals to work together and co-operate with other organisations. Sharing information and resources is vital in achieving effective control.

- **Develop Long Term Solutions not Short Term, "Quick Fix" Solutions**

We all need to develop solutions to control which are effective over the long term.

Chemical control on it's own is costly, often needs repeating and has limited success. The only real long term solution lies in better management.

Managing grazing and other land use practises to maximise ground cover and provide competition is the answer. This may involve encouraging native grasses to proliferate or establishing native or introduced perennial grasses to provide vigorous competition.

We need to stop looking for the "quick fix" solutions, such as always reaching for the chemical drum. Achieving effective control can only occur if we make sacrifices and commit ourselves to making changes in management.

- **Use Examples of Success**

There are groups, individuals and agencies who are looking at integrated approaches to controlling Blue Heliotrope. They are changing management practises and achieving lasting results.

Use these examples of success to motivate and direct others. Remember that there are things that can be done.

- **Promote Good Ideas**

Promote practical ideas that people can implement in the short term to prevent weed spread, such as restricting livestock access to rivers and creeks and cleaning farm machinery and road graders before moving to other areas.

Remember, it is up to us all to spread the message.

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Note

The Blue Heliotrope Action Committee (BHAC) was formed in 1996 to acquire funding for research into biological control and to promote awareness of the weed and it's control.

BITOU BUSH AND OTHER NOXIOUS WEED CONTROL IN MACLEAN SHIRE

Ian Tye
Maclean Shire Council
Maclean

OVERALL NOXIOUS WEEDS PROGRAM

Many people know of Maclean Council for its Bitou Bush control but I must emphasise that this is only one part of Council's noxious weed control. The success we have had with Bitou Bush pales in comparison to the success in the control of Groundsel Bush, Red Flowered Lantana, Giant Parramatta Grass, Green Cestrum, Crofton Weed, and Johnson Grass.

Having held my position for 6 years I am now seeing the results of a consistent annual noxious weeds control program. I can now reflect back to past Council monthly reports and yearly noxious weed grant submissions that I wrote and see a marked improvement in expenditure on noxious weeds. This is evident due to overall reduction in infestations of all of these weeds present at the time of my appointment.

Expenditure can be stated to have reduced when the increased cost of wages, plant, and herbicides are taken into account. Added to this factor is new declarations we have made with Green Cestrum, Crofton Weed and recent (1995) Mother of Millions. Only the latter is needing major control work due to it being in the early stages of its control programme.

Council has submitted this year to have a number of environmental weeds declared in the W4 category to prevent further sale, propagation or deliberate distribution. They are:- Madeira Vine, Cats Claw Creeper, Coastal Morning Glory, Blue Morning Glory, Morning Glory, Climbing Asparagus, Ground Asparagus, Glory Lily, Fishbone Fern, Chinese Celtis, and Broadleaf Pepper Tree.

This list is being updated and revised to include a number of other weeds which have become garden escapes in the Clarence Valley. Grafton district National Parks and Wildlife Service is assisting in compiling this list. Maclean will lobby the Clarence Weeds Group, North East Noxious Plants Advisory Committee, and Noxious Weeds Advisory Committee to have these weeds declared through-out the state in the way mentioned.

This action would allow for prosecution if these weeds were dumped in any manner other than by the proper means. This list should be expanded to include weeds that are a problem elsewhere in the state. To be successful it must be, at the least, through out NSW or the weeds will be sold and introduced to new areas.

A weed that is a problem in the west, or on the coast, should be listed to prevent further devastation by their introduction to the bushland which they threaten. Not to act will be seen in the future as a major mistake as categorisation was introduced to cater for this purpose.

The other major weeds for Council to seek declaration are:- Camphor Laurel W3 (all trees less than 1 metre in circumference at 1 metre in height), Black Willow W2, Privet W2, Mysore Thorn W2.

Council receives separate funding from the NSW Noxious Weeds Advisory Committee (hereafter NWAC) for the control of noxious weeds in Vacant Crown Land which amounts to well over 1,500 hectares. Council has had great success in all areas that were originally undertaken in 1990 except one which has been addressed by a limited buffer zone.

This has been accomplished with funding for VCL that fluctuates from year to year and has been reducing in latter years. Council was successful in receiving increased funding for the 1996/97 financial year, partly due to better consideration being given by the newly appointed Regional Noxious Weeds Coordinator, Rod Ensbey.

Adding to the difficulties in yearly control is the fact that new, VCL areas not previously listed by State Land Service certificates, have been found and identified. Unfortunately each seems to always require treatment for noxious weeds.

Council believes that it has a responsibility to control VCL noxious weed infestations and limit their spreading onto adjoining land, as stated in the Act. We endeavour to carry this out, in the best way possible, with the funds that are distributed by the Committee for this purpose.

Responsibility for Prickly Pear control and enforcement is to be handed to Council and limited funding was allocated to treat all VCL and carry out related property inspections. Council has only recently completed the first year in controlling the Prickly Pear in the VCL and sees this weeds control program on target.

Council has a small boat for weed patrols on the Clarence River banks and islands, which are either privately held, controlled by Council or VCL. We have a small manual spray unit which is used in a 19 foot hire punt for riverbank and small island control of noxious weeds.

The section also has two 4 wheel drive units which are both equipped with Quik-Spray units (that are equipped with remote control hose reels) that are used in general weed control. The manual spray unit is loaned out to landcare or dunecare groups whenever the unit is not deployed with Council work. This offer has been often taken up with Envite work (dunecare employment programs) carried out in the Shire.

The effectiveness of the programs is mainly due to the support of all Councillors, senior Council staff and my dedicated work force. A point that I appreciate after working for 3 years at a Council in Queensland that did not give me this support.

DECLARATION OF BITOU BUSH (1994)

As stated in the section outlining new declarations, the Noxious Weed Act 1993 has made it possible for Councils to declare weeds that are not only a threat to health or agriculture. These weeds are considered "environmental" noxious weeds and can be declared, on condition that no matched grant funding allocated by the NSW Noxious Weeds Advisory Committee is used for their control.

In early 1993 I tabled a revised list of noxious weeds and their categories to Council for it's approval. It came to Council's notice that the Act would allow for Bitou Bush to be declared as an environmental noxious weed and Council requested a report from staff in this regard.

In my report that was tabled at the following meeting and I pointed out the difficulties that would be encountered if the weed was declared. It contained information that had been relayed at the time by the NSW Dept of Agriculture that the National Parks & Wildlife Service (NP&WS) were totally opposed to this declaration. I included a statement that had been forwarded that the action would prevent Land Care and Dune Care from securing funds. Both were found to be totally untrue.

Contrary to these claims, both the NP&WS and DL&WC have cooperated and frequently assisted the Shire in its control program with noxious weeds. This applies in particular to the treatment of Bitou Bush and the revegetation of controlled areas. Both bodies are kept well informed on these activities and often assist the groups and Council with advice when it is required.

I advised that some federal funds may not be available to Council for environmental weed control due to the noxious weed declaration. This has not effected Maclean Shire Council Bitou Bush control programme in any way. In most cases the Bitou Bush treatment is carried out by Council funds. Revegetation, firebreaks and other related works have been addressed with separate grants that were pursued mainly from employment schemes.

It was imperative that Council secure the support of Dune Care and Land Care groups and encourage the formation of more such groups that could assist in revegetation. This was carried out and Council has enjoyed a good working relationship since the weed's declaration.

Much to Council's credit, they chose to ignore my recommendation against declaration and directed me to pursue declaration of Bitou Bush as W3 noxious weed. It became clear that Council was committed to the weeds declaration. Any doubts I may have had were permanently allayed at a Council meeting where all Councillors showed the commitment they had with the weeds declaration.

I then set out to derive a manner in which the declaration would be approved. This was made by compiling control zones and a programme that was clearly achievable.

The weed was gazetted on 12th August 1994 and Maclean is the first Shire on the north coast to have taken this action. The control zones are outlined in the Bitou Bush Policy which was adopted early last year and is attached. It addresses all facets of the W3 control category and clearly states why some areas remain untreated.

A Bitou Bush control strategy was adopted in early 1994 and addresses the manner in which the weed is to be controlled and action taken after control. Some of the issues addressed were:

- to work closely with present Dune Care groups and encourage the formation of new ones who can assist with revegetation.
- to leave dead weed to mulch and so provide ground cover against erosion
- not to fire the dead weed, unless close dwellings would be threatened
- endeavour to make fire breaks to at least reduce the damage of fire, if it were to occur
- make efforts to assist revegetation, if such is lacking
- give every assistance possible to all groups involved in revegetation

- under no circumstances would the Bitou Bush control program take priority over any agricultural noxious weed.

We commenced the program in late 27th June 1994 by the use of the "Maclean Shire Council Coastal Revegetation LEAP Project" which employed and trained 9 young people between the ages of 15 to 20 for a period of 6 months.

A lot was achieved by this project with fencing erected along fragile areas of beach, the Bitou Bush bio control agent Tip Moth was spread to areas adjoining aerial treatment sites, marking out areas to be treated by aerial application, native seed collection, planting of native tube stock in treated areas, clearing areas of environmental weeds, clearing walk tracks to a number of beaches, pulling small areas of Bitou Bush in fragile area and treating large areas of Bitou Bush and other environmental weeds with the application of herbicide.

Matched funding was acquired from this venture which allowed for further planting of treated areas and control of Bitou Bush through a Job Skills project in 1995.

Both the 1994 and 1995 work was subject to the requests of active landcare and dunecare groups in the Shire. They were all asked to contribute to the program by submitting requests of what work should be undertaken. As the project transpired these groups were consulted and often worked along side the team.

This cooperation allowed for the program to continue until a separate allocated budget was enacted in 1996/97. The separate budget allocation of $12,000 allowed for matched funding to be sought from Department of Land and Water Conservation. The matched funds were granted in June, 1997 and there is every likelihood that Council will again be successful in 1997/98. Council has increased its budget allocation for Bitou Bush control and revegetation to $18,000 for 1997/98.

This makes the expenditure on Bitou Bush control, revegetation and related works greater than any other one noxious weed that is controlled in the Shire.

AERIAL CONTROL (1994)

The 1996 separate funding allowed for an expanded Bitou Bush control program. Part of this control program is aerial treatment and this was not part of the original declaration submission to NWAC. This treatment is carried out in the area that is described as Zone D in Councils Bitou Bush policy.

Aerial treatment has become a major part of the attack on Bitou Bush and is pursued with 2 treatments followed by no control the 3rd year. The growth of Bitou Bush will be monitored in the future and treated when necessary. The aim is to control the weed to a level that it will enable native species to gain a foothold and compete with the weed. This will give the native species a chance to produce a canopy that will reduce Bitou Bush germination.

Council carried out its first aerial treatment as part of NSW Agricultures, John Toth's 1994 control programme. Seven demonstration sites were treated on 22nd July 1994 for a total area of 47 hectare. The cost of $200 per hectare was borne by the Clarence River Total Catchment Committee (via Angourie Dune Care Group) and NP&WS (via John Toth).

The results proved the 2 litres per hectare of Glyphosate in 30 litre of water, when applied by helicopter, to be highly effective. I must say I was completely surprised at the extreme low rate's success and admit I had had reservations of the outcome. This rate compares well with the 1-200 label rate of Glyphosate which, with Council's manner of application, works out at 13 litres per hectare in 2,600 litres of water. The cost of this ground control using spray units equipped with remote control reels, was over $2,000 per hectare. This is in only the most suitable of conditions that had easy access and increases as conditions deteriorate.

No doubt John Toth and his team have done a wonderful job with their research and have came up with an amazing low rate that will kill Bitou Bush while having little (if any) effect on companion native species.

GROUND CONTROL HIGH VOLUME RATES

On prompting from John Toth, who felt we could dramatically reduce the rate that Council was using, we applied to the National Registration Authority for a research permit for below label rates of Roundup and Cut Out. The resulting control work of 1996 was at the rate of 1 part Roundup to 300 parts water and a very reliable kill was achieved in all areas treated.

The research sites that were treated, in 1996, proved that good kills could be achieved at up to 1 part Roundup to 450 parts of water. This successful work has led to a permit being granted for 1 part Roundup to 300 parts water and 1 part Roundup to 400 parts water. The lower rate of 1 to 400 is mainly used on regrowth.

The lower rates are in line with Councils Spray Application Policy and means less herbicide exposure to the environment. Added to this advantage is that grass species are not killed and even less damage on native species that are subjected to overspray.
Deliberate treatment of grass at this rate causes a brown out of the grass and it recovers within weeks.

An area of new Bitou Bush treatment has been accessed this year and the 1 part Roundup to 300 water rate has been calculated at 8 litres of Roundup has is applied per hectare. It would be expected that the 1 to 400 rate to come back at around 6.5 litres per hectare.

NSW requires legislation to enable the use of herbicides below label rates and it needs to be fast tracked. I understand that we are one of the few states that don't allow such use and this courses the NRA to be bogged down with permits that are purely a formality.

AERIAL TREATMENT (1995)

As John had control commitments up and down the coast, we found that this meant we would have to fit in with his program. Council decided to call for quotes from the major helicopter contractors on the north-coast for 1995 in order to be more independent. This was so that we could carry out our control at a time that suited Council and the public.

As a result of the 1994 treatment, the community was found to have accepted and were supportive of the control program. This led to the decision that Council would carry out its own aerial treatment in future. The decision was not taken lightly as the community places a great deal of responsibility in Councils application. It was felt that the future of aerial control

of Bitou Bush relied on the confidence of the community in this manner of treatment. To get people offside is very simple, but to get back their confidence can prove to be next to impossible.

The most difficult factor is securing a permit to go ahead with treatment and we failed to get it approved before 1996. This prevented Council's aerial treatment to go ahead in 1995 as the NRA couldn't obtain the support data required from NSW Agriculture. In 1995 an area of around 20 hectare was treated in the Shire by NP&WS. It was part of the NSW Agriculture program carried out by John Toth.

AERIAL TREATMENT (1996)

Maclean Shire Council treated an area of 96 hectare on the 24th June, 1996 using Precision Helicopters Pty Ltd and was very happy with results. Open areas again were controlled at perhaps just short of 100%. The coverage in sites that had a timbered canopy appears to have had an even better result. Follow up treatment was carried out by Council's spray unit of the Bitou Bush missed in these areas. Overall I was very happy with the pilot, Mark Hodgkin's application and his company was again contracted to carry out the work the following winter.

I was also very impressed with the responsible manner that Mark carried out the work. He took great care to ensure that all the work was undertaken in a manner that left no avenue for people to claim that the treatment could be deemed unsafe in any way.

The major problem encountered was people who insisted on disregarding the signs and entering the areas that were closed to the public. The pilot would move have to another site until the area was cleared by ground staff. This added an extra hour of flight time to the treatment and we expected any future control would have to have this factor taken into account.

No reason existed of why these people should have been in the treatment sites as the public was made fully aware that the control was to take place. This was by way of a public meeting, press releases, radio announcements and all tracks and roads had notices erected of the pending control the night before. They were then closed very early on the morning of the treatment.

The cost of helicopter and herbicide for the 1996 treatment was $39.34 per hectare.

Council has employed the services of Geoff Watson of Clarence Peak Nursery in Yamba to evaluate the effects of our treatment on native plants in the control sites. Geoff has a Masters Degree in Botany and is suitably accredited to give an unbiased opinion of any perceived damage that may occur. He will monitor the sites each year and record any changes in the native species and Bitou Bush that are present each year.

Council has worked closely with the Iluka Landcare Group, Dart Island Landcare Group, Yamba Dunecare Group, Angourie Dunecare Group, Green Point Landcare Group, Birrigan Gargle Dunecare Group, and the Brooms Head Landcare Group, in all the areas of Bitou Bush treated. Only two of these groups existed prior to Council's 1994 action in this field. A great deal of assistance has been given to these groups by way of free use of the manual spray unit, herbicide, tube stock, signage, coppers logs and other related items.

I have always made myself available to address the meetings and encourage this participation by the community. I am always available to offer advice and support the groups wherever necessary with dealings with NP&WS or DL&WC. I have been greatly assisted by the appointment of a DL&WC Reserves Management Officer, Frank McLeod and we have worked well together.

Council has always promoted that it requires the assistance of the community to control Bitou Bush. It has advised groups that the main control work can be carried out by Councils experienced staff and that it appreciates the groups targeting revegetation. To date this cooperative effort has worked very effectively and will improve further with Councils continued financial commitment and DL&WC's matched funding.

GIANT PARRAMATTA GRASS

Another recent benefit to the Shire has been Landcare/Dunecare Coordinator, Debbie Repschlarger whose appointment has allowed more time to be spent on issues that have been overdue for attention in the Clarence Valley. One such project is the Giant Parramatta Grass Control Demonstration that has been undertaken by the Maclean Shire Council and Clarence River Catchment Committee.

This project is aimed at demonstrating control methods that have been derived by research by staff of NSW Agriculture. The work is carried out on plots of around 1 hectare and give a good indication of the control that is achieved. It is to be an ongoing project that is carried out on private land under a 10 year agreement with the landholder.

The first field day was held on the 29th June, 1997 and about 100 members of the community were present. It was a very successful day and those that attended gave full support to the aims of the demonstration.

CLARENCE WEEDS GROUP

Council has also been instrumental in the formation of the Clarence Weeds Group. The group came about from discussions that weed inspectors had that pointed towards the need for such a group. The overall aim of the group is to attend to weed matters in the Clarence Valley and has a broad representation of Local Government, Government Departments and the community.

1997 BITOU BUSH CONTROL PROGRAM

Council intended to aerial treat an area of 150 hectare but due to the excellent conditions the area was increased to 192 hectare. The work commenced on Friday 18th July, 1997 but was postponed after 88 hectares was controlled in the Iluka area. It was terminated due to unfavourable weather conditions caused by wind speed becoming unsuitable for aerial application.

Treatment continued on Tuesday 22nd July, 1997 and a further 104 hectare was controlled in near perfect spray conditions. It means that all major Bitou Bush infestations have been treated on the immediate coast from Iluka Bluff to Angourie.

It was very fortunate that this area was treated on the Friday as it is in an Airforce restricted fly zone. The military aircraft activity in the area on the following Tuesday would have prevented the helicopter entering that area. The restricted fly zone and busy boating traffic at

the mouth of the Clarence River makes planning each year's aerial control program very difficult. We could be refused entry on the day, at the last minute and it leads to an uneasy night prior to treatment

All treatment sites were closed on the day of treatment and signs were in place two days before the first control. They were undated when planned treatment dates changed or were confirmed. All signs were removed on the same day as soon as possible after the completion of control in each area.

Problems were again encountered with the public ignoring the signs and entering the treatment sites. Those that entered the sites were quickly escorted off the sites before any work was carried out in their immediate area. This inconvenience is likely to be rectified by legislation which will allow Council to quarantine the spray zones and allow infringement notices to be imposed.

The areas that are treated are on Maclean Shire Council or Department of Land and Water Conservation controlled land. The 152 hectares treated by Roundup was $57 per hectare and the 40 hectares treated with Roundup Biactive was $59.50. The latter was due to its close proximity to water.

The Zones outlined as B in the Bitou Bush Policy have had significant areas treated by ground control and have greatly improved with natural, community and Council enhanced revegetation. The Zone A has been completely controlled for Bitou Bush infestations. The Zone B is increasing each year after all the sections that were previously treated have been controlled.

All the revegetation work will be carried out in the 96 hectare that was treated in the winter of 1996. Fire breaks will be placed in the new areas treated and old firebreaks maintained. Council will be assisted by the dunecare and landcare Groups of each area. This assistance varies from the groups doing all the planting and future maintenance to just assisting by watering the plants after planting.

INSECT BIO-CONTROL

The Tip Moth (*Comostolopis germana*) was released throughout the Shire by the LEAP project (1994), Dune Care groups, NSW Agriculture and Queensland Department of Lands and is now firmly established in most parts of the Shire. As the insect has established and is reducing the flowering of the weed, it can be considered as a success. We hope the insect will take advantage of the young growth in the aerial treated sites and carry the time period over as mentioned earlier.

On the 16th August, 1996 the Maclean Shire was the site for the first release of the Bitou Bush Seed Fly (*Mesoclanis polana*). It has again raised our hopes that a combination of bio-control, ground control, and aerial treatment will create the desired control of Bitou Bush. An integral part of Zone D's control is availing the Shire to any future bio-control releases. It is hoped that the insects and pathogens will, in time, greatly reduce the reinfestation after treatment. Early indications are that the insect has multiplied and is showing promise that it may properly establish.

Funding for other insects and pathogens should continue as the right control could be there waiting to be discovered. I believe for a bio-control to be a success, it needs only to establish

and damage the target weed. Council must thank NSW Agricultures, Royse Holtkamp and the relevant departments for giving us the privilege of making the first release site for the Seed Fly in the Maclean Shire. The release was made possible with the funding of CSIRO, NSW Agriculture and NP&WS and let us hope that funding continues for these projects.

GROUND HIGH VOLUME TREATMENT

The success of the hand control treatment is well established and one area at Lovers Point/Pippie Beach is documented since the first treatment in 1990. This control took 9 days work to complete in that first year and this compares well with the 2½ days that are required now. This was achieved partly due to the assistance of the Yamba Dune Care Group and general public who assist by pulling small Bitou Bush.

As most would well realise, the seed has a life of at least 7 years and much of the 2½ days were spent searching all the area to ensure that all plants were treated. The control program must therefore be a long term one but the benefits can already be clearly be seen. Areas that were impregnable in 1994 have now got walking tracks through them from the public's use and the plants that were under pressure before control are flourishing. Access is now becoming more difficult due to the native plant growth.

The same can be said with the response of the native species that have germinated since the ground and aerial treatment. Both have soared in growth and it is clear that little planting and seeding is required, if the sand/soil is not exposed. The major focus on revegetation is on native plant species that are not common in the treated sites, but are native to this area.

CONTROL ON PRIVATELY OCCUPIED LAND

As Bitou Bush is grazed to some degree by stock, it is rarely a problem on private grazed land. It can pose a problem on vacant fallow land, but the response to it's declaration has so far not made it necessary to serve many notices for Bitou Bush. As part of Councils General Noxious Weeds Policy a letter is first sent before any notice is served and this has achieved the desired response.

Naturally as the program progresses we will be putting further pressure on land holders around treatment sites and this may lead to Council having to take firm action. This may be by way of $200 penalty notices, prosecution under the Act and entry to carry out the control at the occupiers expense.

It is hoped that this action will not be necessary as most land holders are controlling the weed as the program moves along. We firmly believe at Maclean Shire that we must endeavour to clean up your own back yard before you approach others to clean up theirs. Council has been impressed by the response of the community that are assisting to this end.

COUNTY COUNCIL OPTION

Concerns in this area are genuine as the members of NWAC still seem to want noxious weed control to be taken from Councils such as Maclean and given to larger bodies. This was much talked about in the draft of the much talked about "Noxious Weeds Strategy".

The success of Maclean Council in this area has led to the suggestion that a business unit be created to address all noxious weed and weed matters on a Clarence Valley basis. A brief outline of this business unit was offered to all Councils in our lower catchment by Maclean

Shire Council. It would still give a degree of responsibility to noxious weed matters to each member Council.

I am of the opinion that Councillors best represent the views of the people and this led directly to our Bitou Bush declaration. In our area the County Council office of complaint would be either Grafton or Casino and this would lead to a bureaucratic process and little representation to coastal weed matters.

In such a case Bitou Bush control would no longer be a priority and Council could not enforce it's control. I feel that very few environmental weeds will be declared with County Councils unless they have an impact to some degree on agriculture. Again a business unit is the only option or the communities good work to date will be at risk and the areas treated successfully may revert back to their former state.

I personally am opposed to the County Council system due to the fact that it does not appear to work. All reports I have had from other Council Inspectors are consistent with my observations. I helieve that Councils should be offered a system that works before threats of forced entry to County Councils are made.

It should also be remembered that some individual Councils in NSW have also failed to adequately address noxious weed issues. I would hope that Weeds Strategy will include provisions to deal with non-performing Councils or County Councils. Proper unbias monitoring needs to be undertaken by NSW Agriculture Officers in this regard.

The draft strategy has coursed major feelings of insecurity to Council Inspectors and Councils. As a consequence it has prevented many Councils investing in plant, equipment, and permanent staffing.

CONCLUSION

Council will continue to encourage the participation of residents and community groups in the control and revegetation program and is hopeful that an even better effort will be made in the future. We have requested assistance in all areas by seed broadcasting, planting tube stock, watering and maintenance of planted native tube stock, or seed collection.

Bitou Bush is at present greatly effecting the tourist industry and I have no doubt that Council made the right decision in its declaration. With Council's action we are now producing a more pleasant environment for people to enjoy themselves. The vast majority of the public can see these advantages and support Council's declaration and control program.

I believe there will be no reduction in Councils commitment to the Bitou Bush program and this is shown with the increase in funding by 50% this year. I believe this determination will only increase as the improvements in the treated areas become more evident in the future.

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THE USE OF HERBICIDES

BR Milne
Noxious Plants Advisory Officer
Orange Agricultural Institute

WHAT IS A WEED?

There are many descriptions of a weed, but put simply a weed is a plant growing out of place or where it is not wanted, for example clovers are a valuable pasture plant, but are considered weeds of crops.

The effect of weeds to Australian agriculture in monetary terms is hard to determine, however, they are estimated to cost more than $3 billion annually. The cost of herbicides is more than $450 million per year.

WHAT IS A HERBICIDE

Herbicides are chemicals which are applied to plants to either kill or suppress their growth. They do this by changing the structure of cells or by altering chemical pathways within the plant, causing death of cells and plant tissue.

Herbicides can be classified as contact, absorbed and residual in the soil. Herbicides can have a single mode of action or a combination of one or more ways of effecting plant growth. Some herbicides can effect plants by killing the leaves on contact, others by being absorbed through the leaves and translocated throughout the plant to the roots and some can also be residual in the soil. Residual herbicides are those that when applied to the soil or leach from the plant remain active for varying periods. These chemicals are absorbed through the roots, not only the roots of the target plant, but by other root system in the contaminated area.

Advantages

The development of herbicides has been the basis for the rapid expansion of agricultural production throughout the world. Landholders and weed control authorities can selectively control weeds or manipulate plant growth in crops and public land. Herbicides have significantly reduced the cost machinery and labour in the control of weeds.

Disadvantages

The disadvantages of herbicides comes mainly from misuse associated with over-spraying, chemical drift, leaching across or through the soil resulting in killing of desirable flora, contamination of waterways and the effect on humans affecting their health or causing mental stress. The problem of herbicide resistance continues to increase in importance.

Selecting a Herbicide

Herbicides can be either selective, non-selective or provide total weed control. Products containing glyphosate (eg. Roundup®) will usually kill most plants provided they in good spraying condition, while products containing triclopyr (eg. Grazon®DS) will selectively control some weeds without effecting others plants, eg. grasses.

The herbicide selected should, therefore be one that will control the target weed without effecting other desirable plants. The herbicide should control as many of the problem weeds as possible.

This will simplify the overall management of chemicals, reduce the need to have more herbicides in store than is necessary. It will help to reduce wear on equipment, do away with unnecessary travel and inspections and save time washing and decontaminating spray equipment between herbicides.

An example of this comes from the Orange City Council where they use only three herbicides to control their major weeds, Grazon®DS (triclopyr 300g/L+picloram 100g/L), Roundup®Biactive (glyphosate 360g/L) and Frenock® (flupropanate 863g/L).

Orange City Council - Table of Herbicides

	Herbicide		
Weed	**Grazon DS**	**Roundup Biactive**	**Frenock**
Blackberry	* registered		
Sweet briar	* registered		
St John's wort	* registered		
English broom	* registered		
Bathurst burr	** not registered		
Scotch thistle	** not registered		
Johnson grass		* registered	
African love grass		* registered	
Serrated tussock			* registered
Weeds in drains		* various weeds	

Source: Mr Roger Smith, Noxious Weeds Officer, Orange City Council.
**In situations where herbicides are not registered for use on certain weeds a pesticide permit should be obtained.

Landholders and councils would benefit form the experience of the Orange City Council in formulating a table of weeds and herbicides that will reduce the number of chemicals and assist in containing the ever increasing cost of weed control.

OTHER MEANS OF CONTROL

While herbicides are the main method of weed control, there are several other ways to remove and control single plants or small isolated outbreaks.

Before the expansion of herbicide products, physical methods, chipping (grubbing), hand pulling, burning and mechanical means such as pushing and slashing were used. Chipping and hand pulling weeds is tiring, back-breaking work, but where single plants or small areas of

weeds persist, these methods can significantly reduce the amount of herbicide being used and will protect the environment. To apply a herbicide to a single plant can mean that a significant area will be sprayed and other desirable plants will be killed or severely affected.

Pushing or pulling can be used in conjunction with herbicides, for instance, where bushy weeds or shrubs, such as African boxthorn, are growing under host trees, or plants are growing in sensitive areas, pushing or pulling plants out and spraying the regrowth will protect the host plants and reduce the overall cost of herbicide control.

Methods of Application

Herbicides can be applied in several ways, the most common application methods are by calibrated boom (broad acre weed control), application from the air, spot spraying (high volume), and to a lesser extent by low volume applicators (gas gun) and ropewick applicators.

Herbicides can also be applied as basal bark, cut stump, tree injection. These methods are mainly used for application to single bushes or small areas of woody shrubs or trees.

Herbicides can be applied directly to the soil, these herbicides can remain residual in the soil for varying periods, can leach through the soil, down slopes and have a serious effect on surrounding desirable plants.

Broad acre boom spraying is used where large areas of annual weeds are to be controlled, this is usually on farms to control weeds in crops and pastures. Some noxious plants such as St John's wort and blackberries are controlled by boom spraying or by application from the air.

High volume, is the main method of controlling most noxious weeds. Herbicides are applied to the foliage and stems by a hand held spray gun. Unlike other calibrated application methods, the efficiency of high volume spraying is in the hands of the operator. While all the herbicides registered for the control of noxious plants have similar requirements for application to thoroughly cover the plant, they can vary in their requirements as to how much spray solution is needed to give satisfactory control.

In blackberry research trials conducted by the Weeds Unit (Orange), it was determined that control could be obtained with 40% less spray solution of Roundup® compared to Grazon®DS due to their specific application requirements.

Products containing glyphosate (Roundup®) and metsulfuron methyl (Brush-Off®) require that all leaves be thoroughly wet, while products with triclopyr (Grazon®DS) need to be applied to wet leaves, stems (canes) and have some chemical applied to the crowns of some plants.

OPERATOR SAFETY

The person who applies the herbicide is the one at the most risk. Take particular care when mixing or handling the concentrated product. Herbicides vary in their toxicity to humans and some people react differently to certain products. The main risk is direct poisoning (Paraquat, Diquat), allergies (skin infections) and accumulation in the body. Small doses of the common herbicides are usually well tolerated, being broken down and excreted from the body. However, long term exposure to any herbicide can be dangerous and should be avoided.

CONCLUSION

There are far too many herbicide products to discuss them in detail in this paper. The point to remember is , know your weeds and select the herbicide that will control as many of them as possible in one pass over your allotted area.

A herbicide is only as good as its application, successful weed control depends on efficient application, using the correct rate and best herbicide for the job.

Spray equipment, whether it is a boom spray or a hand gun, must be properly calibrated to deliver the correct amount of herbicide to adequately control the weed. Spray operators should become conversant with the requirements of the herbicides they are using.

We have, perhaps become too dependent on herbicides for weed control. We sometimes ignore our responsibility in recognising possible weeds and allow them to become major problems before implementing control. Prevention is always the best option.

Supervisors must consider the operators who use herbicides and ensure that they are adequately trained and protected.

Remember to safeguard people and animals, the environment, particularly desirable, sensitive plants and waterways.

Take care with chemicals, always read the label, seek advice from your supervisor, chemical supplier or NSW Agriculture.

TAKE HOME MESSAGE

* Remember - Care With Pesticides:

  - always read the label.

  - always follow the instructions on the label.

  - protect people, the environment, flora, fauna and waterways.

PRACTICAL APPLICATION OF THE NOXIOUS WEEDS ACT, 1993
Effective Ways Of Achieving Compliance With Weed Control Obligations

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INTRODUCTION

The Noxious Weeds Act, 1993 imposes the obligation to control weeds declared to be noxious on the occupier of land. It is probably true that most occupiers of land in New South Wales voluntarily meet the obligations imposed on them, at least to some extent, and that they are encouraged to comply to an acceptable level by a combination of good land management practices, economic considerations, programmes which educate and increase awareness, and by community pressures.

There will however always be some occupiers who are not willing to comply voluntarily, and in respect of whom the punitive powers provided for in the Act need to be brought into play. The use of such powers has the immediate consequence of punishment for past non-compliance and the further consequence of deterring further breaches of the Act. Achievement of those consequences depends however upon the potential for successful conclusion of the prosecution process.

Public authorities have a general duty to act fairly and impartially when dealing with ratepayers and in the role of a prosecuting authority a Council must ensure that the decision to prosecute in a particular instance is well-founded. The prosecutor's role is to lay all the relevant information before the Court with a view to proving the commission of the offence to the satisfaction of the Court and having the Court impose an adequate and proper penalty. The community interest is not served when a prosecution fails or when a successful prosecution does not result in the imposition of a penalty which truly reflects the gravity of the offence.

This paper addresses the means by which preparation can be made for the successful exercise of the ultimate sanction of the power to prosecute under the Act and indicates some of the potential obstacles to such success.

Practical Preparation

- A consistent approach to all occupiers is essential.
- Take all possible steps to avoid allegations that the authority is conducting a vendetta against particular occupiers.
- Encourage voluntary compliance.
- Lay the ground work for prosecution.
- Make sure your inspection reports are accurate as to formal details and comprehensive as to descriptions of identification of weeds and extent of infestation.
- Give additional publicity in relation to particular weeds which are a problem in your area.
- Use leaflets - information sessions - and local newspapers.
- Advertise the availability of personnel for giving advice and assistance.

- Advertise the availability of group control programmes and financial assistance.
- Always use the possibility of prosecution as a deterrent rather than a threat.
- Use Section 18 Notices to increase awareness of obligations.
- Keep advance diary notes - follow-up inspections which reveal a problem and Section 18 Notices.
- Develop precedents and standard forms for letters, advice and Notices.
- Consider issuing *On-the-Spot* Infringement Notices under Section 63 of the Act to first offenders but remember that these Notices are in the nature of a prosecution and if an occupier elects to take the matter to a Local Court then you will need to formally prove the offence. The maximum penalty under a penalty notice is considerably less but it creates a record of an offence and should result in a higher penalty for the second offence before the Court if a prosecution is warranted at a later time.

Gathering Evidence

- Work on the basis that in future prosecution may be necessary in respect of every property.
- Keep systematic files and collect evidence as you go.
- Record information in a diary or note book contemporaneously.
- Ensure your file is correct as to details of owner.
- Make a search at the Land Titles Office if there is doubt about identity of owner.
- Record any information which indicates the identity of the occupier and the source of that information.
- Record any information as to the last known address of the occupier and the source of the information. The Supreme Court of NSW confirmed in Ancart Pty. Limited-v-Snowy River Shire Council (1995) 39 NSWLR 78 that there may be more than one last known address for a person under Section 71(3) of the Act.
- Record in detail any conversations with persons at the location or about the land.
- If the land is owned by a Company identify the persons who control the activities on the land.
- Obtain a copy of the Deposited Plan or Parish Map.
- Mark on a copy plan the location of fence lines or significant features relevant to the location of infestations.
- Notices issued can be used as evidence of action taken even if prosecution does not primarily depend on the validity of the Notice.
- Ensure that Inspection Reports are accurate and detailed.
- Keep copies of all correspondence.
- Keep a record of the posting of all Notices and correspondence.
- Make notes of telephone or other conversations use any contact as an opportunity to obtain information as to the occupier of the land or other doubtful facts.
- Keep a diary.
- Take photographs to show significant landmarks, buildings, stock etc and include a person, ideally the occupier, in photos if possible - make a note of location and date them on the back as soon as they are developed.
- Mark locations where photos are taken on a map or plan as you take them.

Authorities And Notices

The best factual evidence of breaches of the Act cannot overcome fundamental flaws in procedures and documents in respect of which the Act imposes strict technical requirements. The practical problems created by the absence of any case law to interpret and explain the scope of, for instance, Sections 25 43 45 46 47 48 49 50 and 51 will not be solved until the Act is amended. If the District Court adheres in future to the strict interpretation of the Act in favour of the occupier which is evident in the SRSC-v-Eber decision the practical problems for inspectors will multiply further. In the meantime inspectors should ensure compliance with their obligations in a thorough practical and commonsense way and ought not be deterred by the possibility of challenge to their actions in a Court.

- Ensure that all persons who are to exercise functions under the Act are properly appointed and that such appointments are documented.
- The certificate of authority under section 50 should specify all the matters set out in the Section.
- Any person who acts in Council's area under the Act should be authorised properly and a certificate issued.
- Develop precedents for the various Notices under the Act.
- Section 45 Notice can be oral or written. Keep a copy of any written notice and the time and manner in which it was served. Make a note of when, by whom and to whom, any oral notice is given.
- Section 18 and 20 Notices should be formal, detailed and precise.
- Section 45 Notice is required with Section 20 Notice. (See District Court decision in Snowy River Shire Council -v- Eber [Downs DCJ-unreported-19 September 1995-Appeal No. 94/42/012].
- Section 20 Entry is "illegal" if a Notice under section 45 is not given and if so Council MAY not be able to recover cost of the entry and work done. The question of recovery of costs of entry in those circumstances has not been the subject of any decision of a Court. (See SRSC-v-Eber but note the comments of Bryson J in Ancart Pty Limited-v-SRSC (1995) 39 NSWLR 78 at 82).
- Section 19 prosecution will fail if Section 18 Notice is defective.
- The right to appeal to the Land and Environment Court under Section 25 against the issue of a Section 18 Notice has not been the subject of any decided case.

Planning The Prosecution

When all else has failed and the evidence has been collected:

- Make a further inspection of the land, particularly if the offence is alleged to have occurred over a period of time, to obtain a date to close off the period.
- See your Legal Adviser.
- Proof of some formal and procedural matters is not required unless the defendant brings evidence to the contrary but you should be prepared to prove all elements of the offence if required (Section 697 Local Government Act, 1993).
- Obtain a copy of the Government Gazette notifying the particular weed for your area.
- Obtain a print-out of the Council's rate and other records for the property.
- Decide which Section to use. If the prosecution is for failing to control noxious weeds remember that there are fewer formalities to prove under Section 12. Section 19 involves the validity of a Section 18 Notice and service of the Notice and proof that the Notice has not been complied with. It is more technical but the maximum fine is $10,000 compared

to $4,000 under section 12. Prosecutions under other Sections such as Sections 28-32 and 54 require special preparation.

- Assess the accuracy and sufficiency of the evidence.
- Decide who to prosecute. Determine whether there is any evidence that the owner is not the occupier. If there is such evidence identify the occupier and proceed against the occupier.
- Remember that more than one person can occupy the same land at the same time. If a Company is involved look carefully at the evidence of occupation decide whether the persons controlling or working for the Company should be prosecuted as well as the Company.
- Report to Council and obtain authority to prosecute. The Local Court is given jurisdiction to hear offences under the Act by Section 61 and authority to lay the Information and conduct proceedings is found in Sections 684 and 687 of the Local Government Act.
- Try to have several matters ready for prosecution together to maximise use of human resources and time at Court.

Court Documents

The Information and Summons are technical documents and require careful drafting by a person familiar with the evidence and if possible by the person who will conduct and hearing in the Court. The Registrar of the Court will witness the swearing of the Information and issue the Summons. The Summons will be returnable on a Court List day and should be served as soon as possible after it is issued.

The Justices Act provides that the Summons may be served by mail at the address shown in the Summons. Service must be proved if the defendant does not appear. Have the person serving each Summons swear an Affidavit of Service and keep it in the file. If the Summons is heard in the absence of the defendant there is provision in the Justices Act for application to be made to re-hear the matter if the defendant can satisfy the Court that he or she did not actually have notice of the hearing

At Court

What happens depends upon the response of the Defendant. Most will plead *guilty* either on the first day or after a short adjournment. In those cases your legal representative will summarise the evidence and show the Court any photographs or relevant correspondence or other documentation, and oral evidence will not be required unless there is a particular point to be made.

Sometimes it is appropriate to provide information to the Court to educate the Magistrate about the properties of a particular weed and the reasons for it's being declared noxious. That information can take the form of oral evidence, photographs, publications such as *Agfacts,* and even a sample weed taken from the particular land.

The defendants who plead *not guilty* will be asked to come back to Court on another day, usually several weeks ahead, when the Court will set aside time to hear the evidence, which is taken orally. Council's case is the evidence of the Inspector and in some cases an expert or other person such as a neighbour to confirm the Inspector's evidence as to the extent of the

infestation, effectiveness of any control work, or any other matter peculiar to the case. Photographs, maps and plans, diary entries and other documentation are tendered through the witnesses.

When the Magistrate makes a finding as to whether the offence has been proved either after a plea of guilty or a defended hearing, he may make orders as to penalty. Legal costs and witness expenses may be ordered in favour of the successful party. The Court allows an appropriate time in which the defendant is to pay any monies ordered. Fines are receivable by the prosecuting authority.

The defendant may appeal to the District Court on either or both of the grounds that the offence should not have been found proved or that the penalty is too severe. The Notice of Appeal must be lodged within 28 days. The lodging of an appeal stays the order of the Magistrate. The Appeal process involves substantial delays because of the backlog of cases in the District Court and because Criminal cases have priority, particularly in country listings.

Publicity

It is generally agreed that the exercise of the power to prosecute and the achievement of successful results in particular cases should be used as a tool to deter others from committing similar offences. Well written and accurate reports to Council and in the local press as a follow-up to every prosecution will assist in achieving this goal.

TAKE HOME MESSAGES

- Treat every inspection as a potential basis for a prosecution.
- Keep accurate and comprehensive records.
- Communicate with occupiers with a view to achieving compliance without prosecution.
- Take every opportunity to educate the community.
- Use *On-the-Spot* Penalty Notices for first offenders.
- Take affirmative action to bring about compliance.

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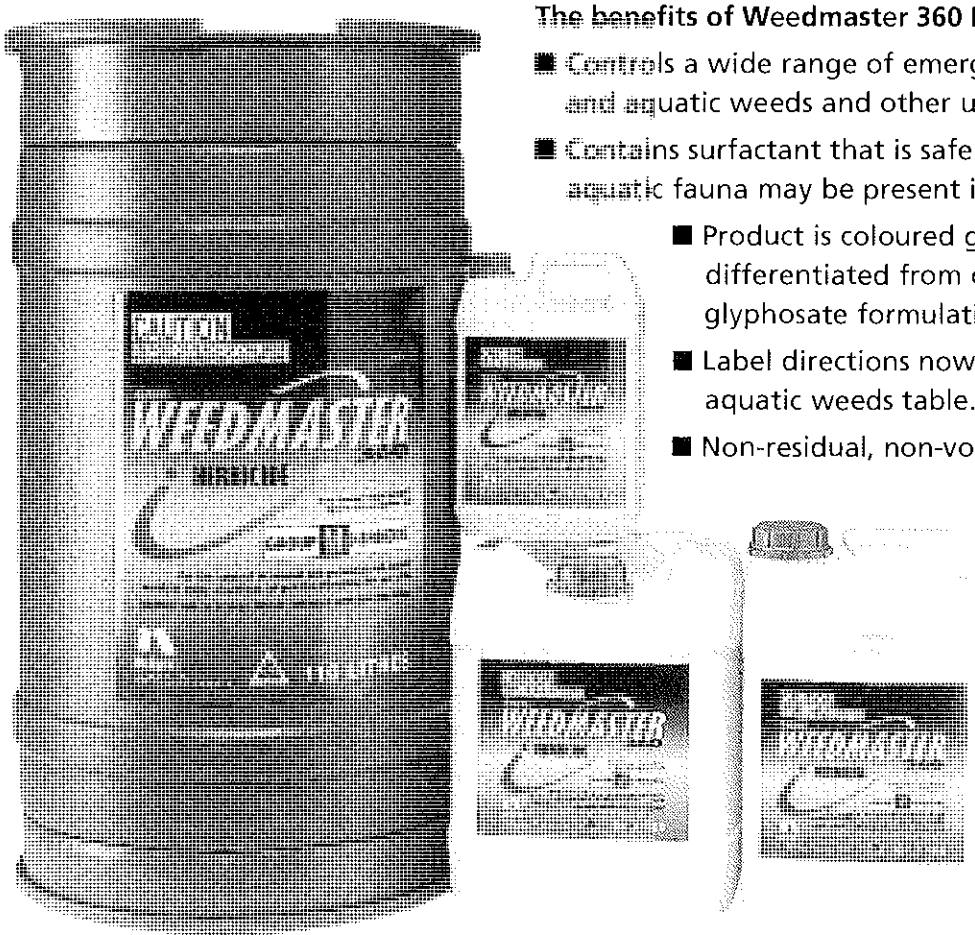

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THE CHANGING COMMUNITY PERCEPTIONS ON WEED CONTROL

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This paper outlines the sometimes turbulent history of weed control in the Bellingen Shire. It will discuss some theories on why this may have happened, and hopefully offers some solutions, so others can avoid what has been a difficult period of mid north coast history.

THE SHIRE

Before launching into a view of history, it is important to outline the physical characteristics of Bellingen Shire.

- Total area - 160458 ha
- State Forest - 60544 ha (38% of area)
- National Parks - 24083 ha (15% of area)
- Freehold and other Crown land - 18078 ha (11% of area)
- Altitude (ASL) - 0 to 1000 m
- Average Annual Rainfall - 1500 to 2000 mm (Ave 1900 mm)

These statistics show that Bellingen Shire covers a wide range of topographies, from flat coastal heath and swamp to mountainous forest country. Soil types vary from highly productive alluvial river flats to highly erodable granitic soils to the deep, red kraznozems of the Dorrigo plateau. Rainfall is the highest in the state. At present the main agricultural production is dairying and beef cattle, with potatoes also being important. Timber and tourism are also major enterprises in the shire, with 53% of the area being covered by National Park and State Forest.

PROPERTY TYPE AND NUMBER

Total Number of Rate Assessments - 5427
Number of Rate assessments from: - Farmland -511 (9.4% of total)
- Rural residential (31.6% of total)

Farmland makes up nearly 10% of the rates notices while rural residential accounts for almost 32%.

Table 1. Rural Property Sizes in the Bellingen Shire, April 1997.

Lot Size (ha)	Dorrigo Plateau	Valley and Seaboard	Total
0 to 3	**269**	**514**	**783**
4 to 40	**79**	**507**	**586**
41 +	**306**	**31**	**537**
Total number of rural properties			**1906**

Source Valuer General Report

Table 1 shows that the larger properties occur on the Dorrigo plateau, while the valleys and seaboard contain the bulk of the rural residential properties.

HISTORY

The current unrest in the Bellingen Shire commenced in late 1995. This may have been sparked by the Council commencing roadside maintenance spraying of glyphosate and sulfometuron. Community groups were concerned about three main issues:

1. Human health aspects:

    * herbicide washing into the waterways and rivers, from which many people draw their drinking water.
    * containing the applied pesticide, being raised by passing vehicles, which could then be inhaled by children waiting to catch their buses.

2. Environmental effects of the herbicides.

3. Soil erosion and corresponding damage to the roadways.

As well as these concerns there was no evidence that noxious and environmental weeds were any less of a problem in the Shire despite ongoing weed control. Bellingen Shire Council on the other hand, via recommendation from the Noxious weeds sub-committee, attempted to implement a system of notification regarding Noxious weed spraying.

Areas were notified that spraying for certain weeds would take place within a certain time frame and if occupiers of the adjacent land did not want their verges sprayed they could undertake control work themselves. If the stated weeds were not controlled within the 3 month period the Council would control the weeds at their discretion.

This system appeared to fail for a number of reasons.

Possible Reasons For The Increased Number of Conflicts With Council

From talking to a range of community members in the Bellingen area it appears the increased level of conflict between Council and certain sectors of the community has been occurring for approximately 20 years. So what has been happening over this time?

1. Changing demographics.

The past 20 years has seen a vast increase in the population of the north coast, attracted by the mild climate, beautiful scenery and the dream of "Paradise".

The following table shows some key changes in the statistics of the Bellingen Shire from 1974 to 1994.

Table 2. Changes in Bellingen Shire Demographics - 1974 to 1994.

	1974	1984	1994	Change '74 to '94
Total area of agricultural production	69000 ha	53182 ha	40523 ha	- 28477 (41%)
Number of establishments with agricultural activity	494	358	246	- 248 (50%)
Total number of cattle				
- Dairy	17441	12859	10546	- 6895 (40%)
- Beef	29114	24470	24397	- 4717 (16%)
Resident Population	6580	9950	12460	+ 5880 (89%)

Source: Australian Bureau of Statistics

Over the 20 year period from 1974 to 1994 the area devoted to agricultural production has reduced by 41%, the number of properties relying on agricultural production has halved, while the resident population has increased by almost 90%.

These trends are likely to be mirrored to similar or lesser degrees over much of the coast as well as shires close to larger towns such as Wagga Wagga, Canberra, Dubbo and Tamworth. The areas which were originally developed for primary production are being sub-divided into rural residential blocks and being occupied by people with different sets of values and ideas. This leads to tensions between the traditional landholders and the new residents. The traditional landholders feel a loss of "power" and can feel under siege as the environment they grew up with changes forever.

2. Greater awareness of environmental degradation.

As the 20th century advances the pressures of increased human population on the environment becomes more evident.

Rachel Carson (1962) was one of the first people to bring the over-use of pesticides into the public view when she wrote "Silent Spring". The writing of this book followed the explosion in the use of synthetic pesticides following World War II. Words like eradication were widely used and the perception that man now had the tools to dominate nature was very strong. In some circles these ideas and terms remain popular to this day. Despite this weeds remain a major cause of concern in most rural-based communities.

Various environmental disasters have kept pesticide use in the public eye. Organochlorine residues in north coast and Victorian dairy pastures, "Agent Orange", Helix® contamination of livestock fed cotton trash, arsenicals in wool, alleged health problems caused by pesticides in Emerald, Gunnedah and Young, have all managed to focus the public's attention on these "toxins".

Despite nearly all these incidences have been with insecticides, and not herbicides, (except "Agent Orange"), all pesticides are lumped into the one basket.

3. Lack of trust between the community and "the Establishment".

There is a basic lack of trust between many community groups and what is seen as the establishment. There are many precedents throughout history to give people ample justification for not being trusting of authority.

When organochlorines were first introduced, the public was told how safe they were. They were used recklessly and it was not until years later that it became public knowledge that they bio-accumulated and caused health and environmental problems. Thalidomide was great for morning sickness. No child will live in poverty by the year 2000. Take a "Bex" and have a good lie-down, next to your dialysis machine. Nuclear power was safe and clean, until Chernobyl.

A CHANGE IN DIRECTION?

Traditional western modern science and agriculture (rational science) is seen as the pursuit of change via the findings of research stations which is then transmitted to farmers via a structured and technically orientated extension service (Scoones & Thompson, 1994). Farmers (and other community members) are seen as either adopters or rejectors of technology and not as originators.

However there is another school of thought that sees the starting point of change or development as an active and equitable partnership between rural peoples, researchers and extensionists. The way to make real change in weed management is to avoid the "top-down" approach and try involving the community in developing solutions. Many Landcare groups were formed with weed management as their focus. This approach can be very confronting and threatening because many extension people, weeds officers and researchers are used to being "in control". It comes down to accepting that other people may possess knowledge or ideas that are valid.

Chambers(1994) suggests there are many systems of knowledge, with modern science, although being powerful and monopolistic, is just one. He states that "rural" knowledge on the other hand is "situated" - that is it differs by group and location, with different people knowing different things.

With this in mind, it would be unwise to ignore these other sources of knowledge, but it would require a suppression of ego. This is where the shire-wide roadside management plan is a useful tool for developing a system which should be accepted by at least 95% of the community.

ROADSIDE MANAGEMENT PLANS

Early 1996 saw the involvement of NSW Agriculture in Bellingen as a neutral party to reach a solution.

After some initial meetings with various groups to get a feeling for the main issues a meeting of all the identified stakeholders was held in an attempt to come to some form of consensus on the direction which should be taken. It was agreed that the development and implementation of a roadside management plan was the way to proceed.

Weed control was seen as one of the main issues concerning roadsides, however other issues were important to the groups such as conservation and regeneration of native vegetation, safety, erosion and aesthetics.

A second meeting one month later saw the formation of the "Roadside Management" steering committee. The role of this committee was to ensure the development of a draft roadside management plan and oversee the selection and management of the person who would develop the plan.

What is a Roadside Management Plan?

Roadsides are complex environments and to manage them properly planning is essential.
In the past roadsides have been managed on an ad-hoc basis, with each stakeholder doing their job with little regard for the system as a whole. Road construction crews often disturb large areas of ground destroying habitats and leaving bare areas for the establishment of weeds. The weed control team would come and spray weeds. The slasher teams would slash everything they could.

A well developed and implemented plan would allow all of these groups to cooperate and work more effectively.

A roadside management plan (RMP) consists of three steps:

1. Assessment

Roadside management objectives and issues must be determined and agreed upon by council and the community. Public meetings held and groups consulted. Assessments of the roadside are made and classified into category A,B or C plus identification of sites which require specific management techniques. An example of an area requiring specific management is a new infestation of Giant Parramatta Grass in a previously clean area.

Additional information required includes legislative requirements, topography, soils, State Forests, National Parks, stock routes, organic and bio-dynamic farms, heritage sites and rare and endangered species. Collate all the roadside information and prepare maps showing the different roadside categories. Define the management categories to be used.

2. Planning

List the issues concerning the area. Establish Policies and guidelines. Incorporate existing legislation

3. Implementation

A plan that is not implemented is a waste of time and resources, and will create disharmony within the community.

Training of all staff, from the Gangers to the General Manager, is essential. This not only helps create interest with the staff but it gives opportunities for staff to increase skills and make informed decisions about the work they are performing. Interested stake holders and community groups should also be involved in certain sections of the training program.

Community awareness of implementation is also important. The community will be well aware of the assessment and planning stages and will be keen to know all the hard work has been worthwhile. Communities and businesses can be encouraged to take responsibility for a certain section of roadside. In the Bellingen Shire the Mountain Top Landcare group looks after the area from the top of Dorrigo Mountain to the lookout. Promised Land Landcare group are also active along the roadsides in their area.

Once implementation has taken place a review of the plan will be necessary because of the dynamic nature of roadsides.

How Many Local Government Areas Have Plans in Place?

Victoria is leading the country as regards RMP's with 60% of councils having implemented plans. NSW has been lagging behind with 10 councils having plans in place, however the momentum is increasing with up to 30 councils beginning to develop RMP's.

The NSW Roadside Environment Committee was established several years ago to encourage better management of roadsides and are an excellent place to start if you are thinking of getting a RMP started. This group now have excellent publications and offer support and advice to Councils on these issues.

TAKE-HOME MESSAGES

1. Weed management, not weed control is the issue. Weeds are plants that are better adapted to a specific environment than the vegetation it has displaced. Look at the environment, not the weed in isolation.
2. The client base has changed in the past 20 years, as have attitudes to herbicide use and the environment.
3. People other than agronomists, weed officers and engineers have knowledge and this should be harnessed for positive ends. Everyone has something to offer.
4. People have concerns about the health of their children and the future of the planet. Who is to say they are wrong and someone else is right? Be willing to make compromises.
5. Involve the community in decision making

Bring all of these points together and you have: A ROADSIDE MANAGEMENT PLAN

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BELLINGEN SHIRE COUNCIL - OPPORTUNITIES FOR CONFLICT RESOLUTION

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INTRODUCTION

Bellingen Shire Council are in the unenviable situation of trying to implement an effective noxious weeds program, when in some parts of the shire there is strong opposition to the use of herbicides. Giant Parramatta grass is the noxious weed being targeted and so far has been difficult to control other than using registered herbicides. Some attempts to control the weed manually have occurred, but this has not been effective.

The solutions to the problems in Bellingen Shire are obviously not easy. There exists long standing conflicts and mistrust between Council and some Community groups, dating back several years. Council itself at times has been divided on herbicide use issues, combined with the increasing pressure from the community groups has apparently prevented the implementation an effective noxious weeds program in all parts of the shire. Council has received threats of injunctions and legal action if it continues roadside spraying and has implemented moratorium areas on the use of herbicides along sensitive roadsides and in urban areas.

To attempt to resolve this situation, the main issue being the use of herbicides for weed control, Community groups, Council and NSW Agriculture are working on several fronts to try and achieve a practical outcome. The actions that have been or are currently being carried out include:

- An alternative Giant Parramatta Grass control trial
- A Roadside Management plan
- EPA roadside spraying trial
- A Noxious Weeds Management Plan

Hopefully upon the completion of the trials and plans a workable solution will be in place. If this fails the situation may end up in court which is likely to be a protracted expensive exercise.

GIANT PARRAMATTA GRASS

The control of Giant Parramatta Grass (GPG) along roadsides has been the prime source of conflict between Council and the environmental groups. GPG is a W3 noxious weed, being major problem on the north coast and high on the priority list for control. Roadsides are a major seed source for spread and therefore all Councils are conscientious regarding roadside

control. The main control technique used is the boomspraying of Frenock at 1.5l/ha. At this rate during late winter and early spring frenock gives very good selective control, killing GPG leaving behind desirable grasses, such as kikuyu, bahia, paspalum and kangaroo grass.

Wick wiping using glyphosate is also being investigated. This principle is effective on GPG, but can be awkward along roadsides which have uneven surfaces or where there are guide posts and trees present.

Bellingen Council previously used the technique of boomspraying glyphosate and Oust for general vegetation and GPG control along roadside, at a 2m width. This operation of total vegetation control was probably the main practice that attracted the community groups attention. It was highly visible, roads were bare of vegetation, causing erosion and allowing reinvasion of weeds.This practice has now been abandoned, but it appears now all boomspraying operations have been targeted. Environmental groups are now questioning the use of frenock, its fate and residual effects. This brought about the need for the EPA trial and NSW Agricultures alternate GPG control trial.

ALTERNATIVE GIANT PARRAMATTA GRASS CONTROL TRIAL

NSW Agriculture is currently evaluating various management techniques for GPG along roadsides. Traditional roadside control methods include boomspraying with frenock,which is very effective. As a result of the conflict there is now a need to identify, if any, other possible effective control techniques for roadsides.

The trial aims to evaluate all possible control methods for GPG on roadsides and includes herbicide and non-herbicide options such as,

- Manual removal utilising a Grapefruit knife
- Slashing
- A "non-tox" solution, a mixture of salt, molasses, and potassium permanganate
- Flaming
- Mulching
- Wick wiping with glyphosate, using the Weedbug
- Frenock through a wiper, and
- Frenock boomsprayed

The trial commenced in May 1996 and will probably take at least 3 years to give reliable results. There are eight treatments replicated three times in 20m plots 3m wide, simulating a roadside situation. Preliminary results to date indicate the following;

The manual removal option hasn't started due to a lack of volunteer cooperation. One of the community group members was to undertake this section to demonstrate the Grapefruit knife removal technique.

Slashing has reduced possible seed production but needs to be carried out regularly to be effective. No reduction in plant numbers is evident. Its possibly too early to tell with the mulching, but so far little GPG has penetrated, with some bahia and couch grasses starting to spread on the surface. This option could be useful for new roadworks and other appropriate areas.

The Flame cultivation option has been combined with the Weedbug wiping. A reasonably good kill of GPG and little seedling regrowth is apparent here. The flaming technique is unlikely to be successful as a single control method.

The alternative spray solution technique had little effect on GPG control. Both Frenock treatments gave good GPG control with an overall increase in other desirable grasses occurring.

As expected the traditional control methods of using frenock and wick wiping glyphosate are giving the best results so far. It is possibly too early to determine the effectiveness of the other techniques, with mulching in certain areas showing promise for longer term control, particularly when combined with the planting of other desirable species.

ROADSIDE MANAGEMENT PLAN

A roadside management plan provides a strategic framework to manage a roadside environment by protecting and enhancing ecological, economic and social values. A plan identifies major issues, maps significant areas, provides guidelines for improved road maitainence and construction, staff training, and strategies for resolving issues.

Meetings with community and stakeholder members in June and July 1996 identified that a Roadside Management plan would be the best option to guide the management of roadside vegetation in the Bellingen Shire area. A steering committee was elected, which became a subcommittee of the Bellingen Council.

Funding has been sought through varies bodies to employ a Project Officer to consult with all stakeholders and develop a draft management plan. Bellingen Catchment Management Committee and Council have provided funds to start the project. Tim Scanlan has been appointed to the position and is currently consulting with various community and industry groups, discussing priority issues and possible solutions.

Hopefully with the implementation of this plan and by taking a more holistic approach to roadside management and weed control a workable outcome will be achieved.

ENVIRONMENTAL PROTECTION AUTHORITY SPRAY TRIAL

In December 1996 the Environment Protection Authority (EPA) undertook a roadside spraying simulation and monitoring trial at two sites in the Bellingen Shire. The trial was initiated by the EPA as a result of concerns by several community groups of herbicide contamination in waterways. The groups concerns were that herbicides could be washed into waters during frequent rainfall events and threaten human health through drinking water, the environment by off target effects and to agriculture by residues in livestock.

The trial included the collection of water samples before and after a roadside spray event, to assess whether herbicides could be detected in the waters adjacent to the roadside. The sampling program was designed in consultation with Bellingen environmental and community groups and Bellingen Council.

Two herbicides used in the trial were flupropanate (which is water soluble) and glyphosate (which binds strongly to organic matter). These herbicides were selected as they are used for

boomspraying on roadsides by Council. Flupropanate, Frenock is used for GPG control and glyphosate for general vegetation control.

The aim of the sampling program was to determine whether these two herbicides used for roadside weed control were detectable in the table drains and nearby creeks following herbicide application and a simulated rainfall event. **The trial simulated a worst ease scenario event**, with rainfall being applied at 2 and 6 hours after the herbicide application. A modified fire truck was used to apply the simulated rainfall, which fell at 31.6mm over 10 minutes. This was higher than the maximum recorded rainfall for 1995/96 at 14.5mm over a 10 minute period.

The results of the study found that low levels of herbicide were detected in the run off, but that these levels were not high enough to present a danger to human health or the environment. The detected levels were well below the national guidelines for the protection of aquatic ecosystems and drinking water. This study was undertaken as a worst case scenario event to obtain maximum residues possible. Therefore when a herbicide application is undertaken using best management practices, it should fall into a best case scenario event, with even less residues being detected. Full details of the trial are contained in the EPA's Report on Roadside Tests in Bellingen.

As a result of this trial the EPA are now drafting new guidelines for the use of herbicides near waters. These guidelines will be enforceable under the Clean Waters Act and will require operators to follow best management practices for herbicide use on road verges and near waterways.

NOXIOUS WEEDS MANAGEMENT PLAN

Bellingen Council have also drafted a Noxious Weeds Management Plan. The aim of the plan is to give a detailed account of the noxious weeds program and how it will be implemented. The need for such a comprehensive management plan is to provide Council with a document which it can gain direction from, and have available to outline to residents the noxious weeds program. Resident s will have the opportunity to comment on the document. Input will also be gained from the Councils Noxious Plants Advisory Committee.
The management plan includes sections on:

- General Overview
- Declared Noxious Plants
- Property Inspection Procedures
- Weed Control Methods
- Council Controlled Lands
- Vacant Crown Land
- Public Awareness
- Environmental Awareness
- Funding
- Staffing and Equipment
- Special Projects
- Review Procedures

For each section the plan describes the aims, scope, references, actions, documentation and performance assessment of the implementation and effectiveness of the program.
It is important for Council to outline their proposed control methods, as the community wants transparency in decision making. The various control methods are outlined and how they are to be implemented for effective integrated weed control. Much of the detail and specific control measures for certain sites will be adopted from the implementation of the Roadside Management Plan.

CONCLUSION AND TAKE HOME MESSAGES

The problems currently being encounted by Bellingen Council on this scale are probably unique to this shire. Although the issues of herbicide usage and there possible "toxic" effect on the environment and human health are widespread throughout the community. Adoption of the following concepts and practices may prevent such conflict occurring in your Shire.

- Encourage Council to implement a roadside management plan as guided by the NSW Roadside Environment Committee.
- Cooperate with environmental and organic grower groups as best as possible, encourage alternate methods if practical, give these groups some responsibility for manually removing roadside weeds if they wish to so. The bottom line is noxious weeds must be controlled, but all feasible control options should be considered.
- Promote integrated weed management principals and implement non-chemical weed control methods where appropriate, such as biological control, competitive grasses, manual removal and mulching. When a success occurs promote it in the media as a good news story.
- Develop a detailed Noxious Weeds Management Plan outlining Councils Program.
- Always operate within EPA guidelines and obtain licences when required.
- Always use herbicides as directed on the lable and according to best management practices, with well trained staff. Minimise the reliance on herbicides were possible. At all time be conscious of the surrounding environment, avoiding off target damage and minimising other possible environmental damage.
- Avoid boomsraying broad spectrum herbicides that give total vegetation control on roadsides. This creates bare areas allowing reinvasion by weeds, erosion and because of the scorched earth appearance it will also be cause for complaints to council.
- Communicate with all groups, advising them of weed problems, particularly there environmental impacts and appropriate control methods.

Many of these practices may already be in place in your Council. Taking a pro-active view on this issue may alleviate possible conflict in future.

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FARMING FOR THE FUTURE

Combining extension, facilitation and groups to deliver property management planning workshops

Todd Duffy
Rural Community Extension Officer
NSW Agriculture

WHAT IS FARMING FOR THE FUTURE

The Farming for the Future program is the New South Wales contribution to the National Property Management Planning Campaign.

The National Property Management Planning Campaign aims to help primary producers increase their levels of skills, knowledge in property management planning. Property management planning is strategic and holistic in nature and involves all aspects of a farm business.

The Farming for the Future program is a partnership between NSW Agriculture, Department of Land and Water Conservation, National Parks and Wildlife Service and the NSW Farmers Association. The program is staffed throughout New South Wales with a team of staff from NSW Agriculture, Department of Land and Water Conservation and the National Parks and Wildlife Service.

What does Farming for the Future do?

Farming for the Future operates by offering, facilitating, and or, conducting workshops for groups of primary producers. The workshops are held all over New South Wales in the participating group's local community.

A feature of the Farming for the Future program is it's flexibility. Workshops are based on current market research and each workshop is moulded by the group undertaking it to insure it is relevant to their needs.

Groups participating in the Farming for the Future program can choose the form of their involvement. They can choose:

- any number of one off workshops,
- to have specialised workshops developed to meet any special needs the group might have, or
- to do the property management planning workshop series.

The Property Management Planning workshop series as an example

The Property Management Planning workshop series packages together in eight workshops the range of topics fundamental to property management planning. The workshops are

designed and developed around adult education and group process principles. Groups will choose to do these eight workshops at their convenience usually within a six to twelve month period.

The workshops are facilitated by Farming for the Future staff with specific technical input from accredited providers like consultants, accountants, bankers, and extension officers.

The topics in the Property Management Planning workshop series include:

- Your farm today, creating your future

  In this workshop participants learn a formal planning process, define what their farm business in and start to develop a personal and a farm business vision.

- Your farm today, the physical environment

  In this workshop participants begin the stocktake of the physical resource aspects of their farm business. They will map their properties using their aerial photograph and plastic overlays and look at local climate.

- Your farm today, families and farm transfer

  In this workshop participants undergo a human resource stocktake. They look closely at communication skills, management and operational skills, the issue of farm succession and begin to develop a shared farm business vision amongst their family.

- Your farm today, assessing natural resources

  In this workshop participants will complete their physical resource stocktake by examining nature conservation, pasture assessment, completing soil tests, assigning and mapping land classes and determining physical resource performance and condition indicators.

- Your farm today, financial realities

  In this workshop participants learn how to conduct a financial stocktake. To do this they can either use figures for their own property or the case study we provide. In this workshop the cashflow statements, trading accounts, profit and loss statements, balance sheets and financial performance indicators are covered.

- Your farm today, enterprise analysis

  In this workshop participants complete a stocktake and analysis of how their current enterprises use and effect the human, physical and financial resources of the farm business.

- Your farm tomorrow, making plans

  In this workshop participants begin to draw together all the information and analysis they have done on their farm business in relation to their overall shared farm business

vision and key goals. An ideal property layout is mapped and some indicative budgets are completed. They use this information to develop effective strategies.

- Your farm tomorrow, making it happen

  The last workshop in the series turns strategies into practical plans and actions including how to monitor and evaluate each plan.

More than just a collection or sequence of eight workshops - the property management planning workshop series examines the farm business as a whole. The workshop design and facilitation ensures participants plans are holistic and integrated.

Making sure Farming for the Future is relevant

Farming for the Future is managed by a board of directors comprising the Chief Executive Officers of NSW Agriculture, National Parks and Wildlife, the Department of Land and Water Conservation and the NSW Farmers Association. A state consultative committee comprising primary producers, agribusiness, TCM, Landcare, other education providers and community representatives feeds information to the board of management.

NSW has been divided into eight regions and each region has an area board of management comprising primary producers, agribusiness and community representatives and is responsible for managing the program on a regional basis and deciding strategies and priorities for the staff act on.

The consultative nature of the program together with a thorough evaluation program ensures the Farming for the Future program is totally relevant.

The Farming for the Future program has seen over 17,000 primary producers involved over a three year period and has just started a second phase which is funded for a further three years.

TAKE HOME MESSAGES

- Farming for the Future offers primary producers holistic workshops in property management planning in participants own communities
- Farming for the Future staff are trained in group process, facilitation skills and have expertise in one or all of the following areas financial, human, and physical resource planning as well as farm business management
- Farming for the Future is a flexible extension program offered through four organisations working together as a team
- Farming for the Future accesses technical expertise outside the program either in other programs, government agencies or the private sector to deliver information in specific areas eg. control of a particular weed or succession planning etc.
- Farming for the Future is gaining more and more momentum and opportunities for involvement are being created in line with this demand.

CONCLUSIONS

Farming for the Future is addressing a need to help primary producers create strategic property management plans which consider the whole farm and all the people involved.
It is a program which links strongly with other extension programs, government agencies and the private sector.

Farming for the Future is expanding and so too are your opportunities for involvement in this program.

WEED MANAGEMENT IN THE ARID ZONE
A Systems Approach to Weed Program Analysis

Michael Michelmore
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INTRODUCTION

A systems analysis of weeds; by examining each component of the ecosystem, its functioning and processes; and subsequently examining the whole system; provides a most efficient method of gaining an understanding of the potential impact of weeds to a land use system. Management of weeds can be better targeted to the weakest links in a weed's biology and become more efficient. This paper gives an overview to weed management in the arid zone by outlining the systems approach.

PROCESSES AFFECTING WEEDS OF THE ARID ZONE

Environmental determinants

As a large part of the factors affecting the success or failure of an invading species is a function of the frequency of suitable sites for germination, growth, and reproduction (Michelmore 1995); an examination of weed management in the arid zone must consider the distinguishing features of the area and how they influence weeds and their management (see Table 1.).

The determinants of change in the rangeland (Walker 1988) are an interaction between:

1. Life history characteristics of the existing range of plant species;
2. Community processes - competition, facilitation, and the progressive influence of the different species on the soil (biotic reaction - includes animals);
3. Climate;
4. Fire regime;
5. Type and degree of grazing and trampling pressure.

The interaction will determine the pattern between weed, pasture and other species (Michelmore, 1995). The outcome is in large part dependent on the relative timing of the particular events. Management that aims to conserve the native pastoral vegetation will generally succeed in minimising the naturalisation and spread of weeds. To do this the manager must be responsive to the events that drive the rangeland ecosystem.

Through the whole rangeland environment the degree of weed invasion is not random, but highly patterned - increased invasion is consistent with high water and nutrient availability and a long history of grazing (Tiver 1991).

Introduction of weeds

The introduction of weeds to most sites (whether deliberate or inadvertent) is generally poorly documented. For any infestation of weeds, a large amount of speculation is generally needed to make any understanding of how the initial weed seeds first arrived (see Table 2.). Plants that have dispersal characteristics or attractiveness to people that allow multiple introductions must certainly have an advantage. Of the many seeds that must have been introduced to the arid zone only a very small portion has successfully naturalised. The relatively low frequency

of human activity and the rarity of favourable sites in the arid zone must sure help reduce weed colonisation.

Table 1. Affect of environmental influences on weed management and their application to the arid zone. (After Michelmore 1995)

Characteristic	Influence on weed management	Application in the arid zone
Land use	Can explain: method of introduction, spread away from the site, habitat modifications, likelihood of survival, weed impact, potential control methods, possible landholder attitudes	Much of the area is dedicated to grazing. Generally stock are sold off rather than brought in. Farming or other agriculture exists around the margins and at specific habitats. Normal stocking rates may prevent some weeds from establishing - they get grazed off. Weeds of farming little effect on grazing, while the traditional weeds of grazing land are likely to have the same sort of impact in the arid zone. Broadacre spraying is very rare in the arid zone.
Climate	Climate obviously affects weed growth. Climatic certainty for a species indicates its likelihood of naturalisation.	Rainfall variability may prevent a weed from completing its life cycle. Timing of moisture with temperature is important for the germination of many seeds. Extreme heat, or insufficient cold, may prevent some plants from completing their life cycle. In general, weed plants from other arid areas have some proven ability to withstand drought. Climatic correlation can help indicate which plants are going to be weedy in arid areas - but plants that fail such a test may still survive in microclimates.
Topography	Local rainfall and surface water flow patterns are modified by topography.	Micro-climates may exist in an otherwise hostile environment which allow a weed to survive. Floodouts are the classic microclimate of the arid zone which support a vast range of otherwise alien weeds.
Soil	Soil type greatly affects vegetation types, land use and the weed flora. Rainfall and topography affect the amount of water that an area receives, soil type affects the amount of infiltration, water storage, and availability to plants.	Deep clay soils of our arid zones seldom get wet enough in their profile to support weeds and other plants. Duplex soils of the arid zone (desert loams) frequently support many annual weeds, such as onion weed, Wards weed and burr medic; or weeds with lateral roots, such as prickly pear. Arid sands can support many annual weeds after rains, such as wild turnip, or spiny emex. Winged sea lavender and barley grass are often the only introduced plants growing in areas with moderate salinity.
Vegetation	Relationships between weeds and vegetation in natural environments are frequently unclear. Mostly, any relationship observed can be linked to soil type or disturbances.	Some relationships exist; such as African boxthorn growing under trees, annual weeds or spear grass dominating after a fire, or woody weeds being minimised by a fire.
Disturbances and human influences	Naturalisation is normally dependant upon disturbance. The type, scale and frequency of the disturbance help determine the success of the invasion. Fire is a natural disturbance which may kill certain weeds or allow others to invade.	Although disturbance is a natural phenomenon, the types and scale of disturbance has increased greatly since European settlement - roads, stock waters, grazing. Weed invasion in the arid zone is normally successful with these disturbances. A period without grazing, or with markedly reduced grazing, can also affect weed naturalisation. As stabilisation occurs slowly in the arid zone, the effects of a disturbance can last for many years, allowing weeds to continually naturalise.
Tenure	Various tenure systems may alter landholder attitude, land use and management options.	Extensive areas of leasehold land in arid areas of Australia has often conjured the attitude of lessees that 'we do not own the weeds'. Lease agreements may hinder or prevent some weed management options.

Table 2. Examples of different types of weed invasion to the arid zone. (After Michelmore 1995)

Mode	Examples
Deliberate introduction for naturalisation.	Sand rocket (lincoln weed) and buffel grass were deliberately introduced so that they would naturalise and stabilise soils.
Deliberate introduction for other purposes.	Garden plants, such as parkinsonia, pepper tree, tamarisk and others, have escaped as weeds. Mimosa bush (*Ac farnesiana*) was introduced by aborigines trading beads.
Accidental introduction - burr weeds	Traditional pastoral weeds, such as horehound and Bathurst burr, spread through large areas of the arid zone with the introduction of stock. In later times, prickly weeds such as caltrop, wards weed and spiny emex, have spread with tourist activity.
Accidental introduction - seed passing through stock	Wards weed seeds readily pass through animals.
Accidental introduction - seed adhering to vehicles.	Weeds on vehicles and machinery are a classic case of a known dispersal mechanism with very few practical solutions.
Accidental introduction - seed in imported goods	Paterson's curse, caltrop, spiny burr grass, and spiny emex are common contaminants of hay.
Natural dispersal	Dispersal by flood waters, wind and the movement of animals are mostly involved with local dispersal, as distinct from regional dispersal.

Plant attributes

Numerous plant attributes have been established which help increase a specie's capability of invasion (Newsome and Noble 1986). The ability of a specie to occupy a site in abundance is chiefly a function of the success of its ancestors in producing well adapted offspring (Harper 1977). A species that can occupy a range of sites must have evolved populations adapted to different habitats - a larger requisite variety. Some of those adaptations and plant attributes which are important for weeds of the arid zone are noted in Table 3.

The most reliable plant attribute to consider when determining whether a plant will be weedy in the arid zone is if it is weedy elsewhere, particularly if it is weedy in an arid or adjacent area.

IMPACT OF WEEDS IN THE ARID ZONE

The short term profitability of pastoralism is affected by weeds. In the long term, weeds affect both pastoral profitability and non-pastoral areas by changing ecological structure and processes. See Table 4 for examples. As a generality, the traditional noxious weeds of the settled areas are of minor importance compared to both native woody weeds (such as punty, hopbush and turpentine) and the widespread introduced herbs (such as Wards weed, saffron thistle, wild hops and wild turnip).

Potential spread and impact

The question, "Which weeds are going to be important?", needs to be asked by all arid zone weed managers. From my knowledge of weeds in the arid zone, particularly in South Australia, I suspect that African rue, hopbush, spiny burr grass, mesquite, Noogoora burr, pimelea, punty, turpentine and winged sea lavender are most likely to spread and have significant impact on agricultural profitability and environmental sustainability (Michelmore

1996). These species have the ability to spread and there are numerous suitable niches available.

Table 3. Attributes of successful invaders in the arid zone. (After Michelmore 1995)

Attributes	Explanation and examples
Life history	In unpredictable environments, such as the arid zone, no one particular life history strategy can predominate as species will be increasing or decreasing according to timing of environmental events. For perennials to survive they must be drought tolerant. Mesquite does this by having a low water usage; prickly pear has a low water usage and stores water; African rue tolerates drought by dying back to dormant buds below ground level. Annuals need to be able to complete their life cycles rapidly and produce resistant seeds. Gap grabbers germinate early with fast initial growth that occupies space before later germinators. Examples include Paterson's curse, saffron thistle, and spiny emex. Competitors interfere or out-extend their neighbours. Examples include thornapple, caltrop and spiny emex. Survivors are long lived individuals that are resistant to most causes of mortality. Examples include African rue, mesquite, and prickly pear. Swampers have a mass germination of seedlings. Examples include onion weed and Wards weed.
Taxonomy	Certain groups of plants have become more invasive in some regions than other taxonomic groups. For the arid zone, highest ranking introduced families are GRAMINAE, COMPOSITAE, LEGUMINOSAE, CRUCIFERAE, CAROPHYLLACEAE, AND SOLONACEAE. However, not all of the introduced plants are considered to be weeds. The highest ranking families of noxious weeds in the arid zone are COMPOSITAE, CACTACEAE, CRUCIFERAE, and LEGUMINOSAE.
Weedy elsewhere	A more reliable indicator of invasion potential is if the species itself is invasive or troublesome elsewhere. If a species is weedy in its country of origin, or occupies a wide range of habitats in its country of origin, then its chances of successful colonisation in other areas is increased. This seems to be the case for African rue and Wards weed from the Middle East and for mesquite and prickly pear from the Americas.
Spreads easily	Plants which have dispersal characteristics which allow multiple introductions must surely have a higher chance of successful introduction. Horehound and Wards weed both have very efficient dispersal mechanisms - they have been spreading in the arid zone with scattered multiple foci and have nearly saturated susceptible areas. Onion weed has relatively poor dispersal mechanisms and its local dispersal has relied upon natural dispersal on an invasion front.

MANAGEMENT OF WEEDS IN THE ARID ZONE

Possible weed management options for the arid zone are outlined in Table 5. To ensure that well planned weed control programs are implemented, managers need to be presented with the information relevant to them. The type of information presented should vary for weeds at different stages of the invasion process. Information for weeds which are likely to have significant impact on production or on the environment should be presented repeatedly. Government intervention using facilitation and regulation are useful to strategically get landholders to initiate programs.

Table 4. Impact of weeds in the arid zone. (After Michelmore 1995)

Type of impact	Explanation and examples
Economic	
Alteration in value of product.	Prices received for infested products, especially wool, are frequently discounted. Certain wool buyers refuse to buy noogoora burr infested wool.
Alteration in amount of product:	The following weed impacts decrease the quantity of product.
- acute poisoning	Death of animals from poisonous weeds occurs frequently in the arid zone where diverse ranges of species exist in pastures. Mostly deaths are associated with native plants, such as rattlepod.
- chronic poisoning	Plants which cause minor damage to organs or alter metabolism, debilitate or cause injury may slow growth rates and lower wool production and reproduction. Paterson's curse is a common example in the arid zone.
- competition for space, water, nutrients	When weeds invade bare areas little competition for space can be established. When a weed grows next to a desirable neighbour competition occurs. This can be seen with Paterson's curse and native woody weeds. When a weed grows next to a plant which has little value for pastoralism competition can not readily be established. This can be seen when African boxthorn invades floodouts already covered in dillon bush, Australian boxthorn, or cotton bush. Although the mere presence of a weed need not mean that competition for moisture is occurring, when roots occupy similar parts of the soil profile competition for moisture may occur. Examples of competition for moisture may exist when burr medic and barley grass grow together.
- lower nutritional value	Wards weed is an example of a plant which has invaded many areas of the arid zone and, because of its success, has reduced the nutritional value of the whole pasture.
- stock access	Only seldom do weeds produce a continuous stand which truly prevents stock access - normally a route through the weeds can be found by stock. On occasions saffron thistle and African boxthorn form dense impenetrable thickets in the arid zone. The thicket lasts for a relatively short period for the annual saffron thistle, while the problem will persist for the perennial boxthorn.
Management:	The following weed impacts make management difficult.
- access	Species which form dense impenetrable thickets in a habitat, especially prickly shrubs, make mustering and other normal operations very difficult. Examples in the arid zone include woody weeds, prickly pear and African boxthorn.
- cost of control	Control costs, to either limit the weed or to limit its impact, adds extra impact to profits.
- opportunity costs	Weeds affect management options - managers with certain weeds may not be able to carry out certain practices or may be limited in the type of stock that they run.
Ecosystem structure and functions	
- increased pressure on desirable species	When a portion of the pasture is taken up by weeds, the remaining pasture will have increased pressure from grazing animals.

Table 4. Impact of weeds in the arid zone. (After Michelmore 1995)

Type of impact	Explanation and examples
- competitive displacement	Increasing abundance of woody weeds ultimately displace native species.
- alteration of physical structure of vegetation	The invasion of woody weeds into grassland or shrubland ultimately alters ecosystem functions.
- erosion	Dense stands of woody weeds alter water infiltration, runoff, erosion, and deposition patterns. Wards weed is often found between fertile patches of the arid zone, fertile soil may deposit in amongst the Wards weed, decreasing the production of fertile patches.
- mineral cycling	Although native species may respond to increased nitrogen from the introduced burr medics, it is likely that nitrophilous weeds would respond more, placing more pressure on the native ecosystem and processes.
- fire regime	Fires were a normal feature of many grassland communities of the arid zone. The reduction in fires due to grazing has led to an increase in native woody weeds. The degraded pastures may now not have enough grass to carry a fire, whether natural or prescribed.

SYSTEMS APPROACH TO WEED PROGRAM ANALYSIS - AN EXAMPLE

Efficient weed management programs are developed by following the logical steps of evaluation, strategic planning, tactical planning, implementation, and review. The process is appropriate for weed management at all scales in rangelands - property, district, and region. An example of prompts that could be used when developing a weed program for a property is shown in Table 6 for African rue. The prompts consider the elements of the whole weed system outlined in this paper; environmental determinants, propagule dispersal, plant attributes, impact, and management options.

TAKE HOME MESSAGES

Arid zone weed managers

Options for weed management in the arid zone are limited. Managers should always try to minimise introduction of seed and to control primary infestations.

All arid zone weed managers should be alerted to, or be implementing programs for, the emerging weeds listed in this text under 'Potential spread and impact'.

All weed managers

The systems approach described here is useful to examine weeds and their management in any area. Control programs developed by this method can be applied with confidence.

Table 5. Possible weed management options for the arid zone.

Management method	Examples
Prevent introduction	As in other areas, managers may be able to hold stock bought onto the property in holding paddocks, and for sheep weed infested wool can be shorn off. Similarly imported fodder can be fed out in specific localities.
Control primary infestations	Due to the relatively low value of pastoral areas and the normally high costs of weeds and weed control it is important to control infestations of weeds as soon as is possible, that is, early in the invasion process. This is most important for those weeds which are likely to have great impact to the environment, such as mesquite.
Control secondary infestations	Later in the invasion process, when weeds are scattered as patches through paddocks, the options for control decrease markedly. Rangeland managers normally have large extensive areas and the likelihood of controlling every weed every year until weed seeds are exhausted is not at all high. Range managers normally expect that, at best, they may be able to slow the spread of the new weed for some period. Eradication in these circumstances is a rarity. Native woody weeds occurring as scattered patches should have a high priority for management, whereas weeds which are not likely to have a high impact, such as Paterson's curse, are often neglected.
Control of tertiary infestations	Weeds that have become widespread and dense across a paddock are best managed by careful pasture management, the saying "look after your pasture and let the weeds look after themselves" applies.
Minimise the impact	To minimise the impact of burr weeds or grass awns managers may alter the timing of shearing or lambing. Burr weeds and poisonous plants are frequently controlled near stock waters and yards where animals concentrate.
Government intervention - facilitation	The cry of "it's different out here" has for a long time been used in the arid zone as a reason to do nothing until outside help is provided. Organisations which provide help for arid landholders to implement weed control should understand where this help is placed in relation to previous help, and how it relates to the other tools used by government, regulation and extension.
Government intervention - regulation	The setting of minimum accepted practices is an easy task compared to the enforcement of those practices in the arid zone. The vast areas involved need a specialised inspection sampling technique which targets specific habitats or is a generalist low intensity technique such as aerial survey. The use of regulation is a useful method of "kick starting" a weed management program on an arid property.
Government intervention - extension.	When landholders want to control weeds because they know that it is right, and they know how to do it, then the need for facilitation and regulation is diminished. The aim of extension, to raise this awareness, does result in weed control and is a useful tool for government to apply to arid landholders.

Table 6. Prompts for weed management planning for a South Australian property: African rue. (After Michelmore 1996)

Link with your property plan.

1. Consider your property plan. Would dealing with the problem/issue meet your ultimate aims? If so, then continue with the evaluation and plan.

   It is likely that African rue would have some influence on agricultural business in pastoral areas adjacent farmland.

Evaluate problem

2. Map current infestation. Are certain habitats or types of land more vulnerable? Can spread rate be quantified? Is the problem increasing? Has there been a change in management practice or some other change in environmental conditions that may have promoted this change?

   Mapping need only be rough, perhaps making four abundance classes: thick, patches common, patches sparse, and absent. It is very difficult to quantify spread rate.

3. Map potential infestation if left unchecke.

   It is likely that roadsides, waterpoints, and creek banks will be most vulnerable.

4. Map areas with highest impact on - current and potential - agricultural production quantity and quality, environmental, management and social losses (and gains). Can losses (or gains) be quantified?

   Losses due to pasture competition with African rue are likely to be negligible unless the population is very high. Management must never over graze as Africa rue may become very dense.

Management planning

5. Consider treatment options - benefits and faults of each treatment; integration between control methods; link with neighbours. Are there special aspects of the biology/ecology of the problem that must be considered?

   Treatment with Roundup or Arsenal herbicide in mid flowering is the only worthwhile control method. Prevention of overgrazing in the best preventative method.

6. Highligh areas with best benefit/cost ratio - select priority areas. Determine control program - eradication, control to contain, control to minimise economic damage, or monitor. Follow any legal obligations, such as requirements of the Animal and Plant Control Commission or soil conservation board.

   Decisions on intensity of weed control effort for a district are commonly made by Animal and Plant Control Boards (South Australia).

Tactical planning

7. Consider timing - in relation to cash flow; problem biology, spread and impact; treatment availability, success and follow up.

   Control of primary infestations in mid spring is likely to be most successful.

8. Where necessary, prepare special plans for each priority area.

Review plans

9. Look back just before you do it, check that your plans will meet the aims and visions of your business.

Implement management

10. Apply integrated treatments, follow up and related management that leads to better production!

    As preventative management has been suggested as being of highest importance the doctrine "Manage the pasture well and let the weeds look after themselves" applies.

Review progress

11. After a while, review management of the problem in relation to your current business aims and objectives.

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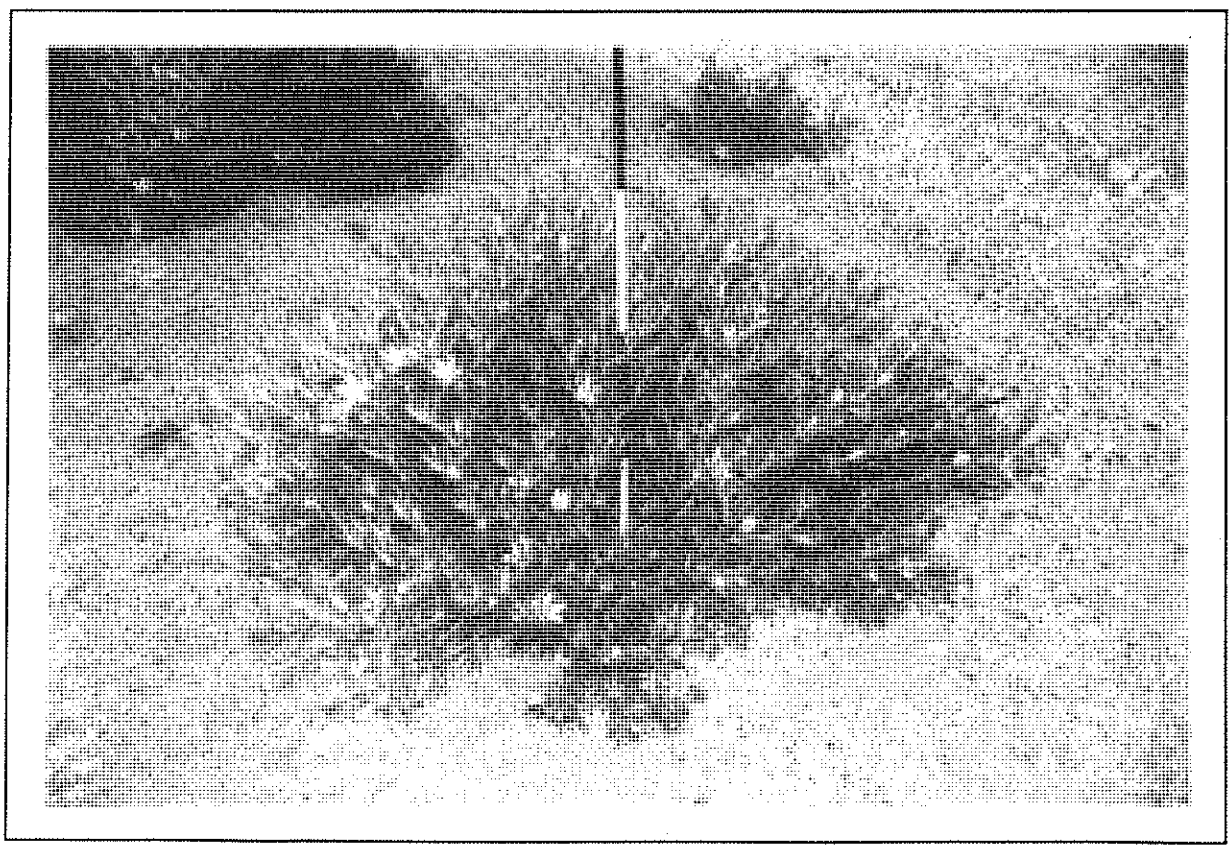
Figure 1 African rue (*Peganum harmala*) is common in the arid zone adjacent some of the marginal farming land of South Australia, and elsewhere around the world. Analysis of the plant and the system it grows in suggests that early control is warranted. (Spaces on marker = 15 cm)



African rue. Spaces on marker = 15 cm.

THE FUTURE OF AERIAL AGRICULTURE.

Harvey Baker
Environmental Director
Cotton Australia

Recommendation 39 of the Senate Select Committee on Agricultural and Veterinary Chemicals in Australia Report in 1990 requested " The Australian Agricultural and Veterinary Chemicals Council consider every aspect of the social and environmental impact of aerial spraying. The Council, in consultation with the Civil Aviation Authority, representatives of the aerial agricultural industry and other interested parties , should develop a uniform, national approach to the regulation of aerial spraying of agricultural chemicals.

The Committee further recommends that , if its recommendation in relation to aerial spraying is not implemented fully, calls for the banning or phasing out of the aerial spraying of agricultural chemicals should be supported".

Given this statement at face valuc , made seven years ago, one could be forgiven for believing that the application of agricultural chemicals by aircraft had a very bleak future. Precedents set overseas where increasing restrictions destroyed the viability of the technique would also add weight that aerial agriculture was at best marginal.

WHY?

Aerial application of agricultural chemicals according to the preamble to the 1985 aerial spray provisions of the NSW Pesticides Act "an essential and efficient technique.." .Similar statements appeared in many advisory bulletins by Departments of Agriculture supporting aircraft application of seed, fertiliser and pesticides. Calls for banning of an essential technique are not made lightly yet the Senate Committee made that statement.

In order to understand why this situation occurred one must understand the various different pressures on the industry and there source. Such an exercise does also give guidance on what must be done to improve the prospect for aerial agriculture.

The history of the beginning of aerial application in Australia is fascinating story however it gives a clue to a contributory factor in the pressure; the attitude of the industry itself. Aerial application began in 1947 using surplus wartime aircraft, predominantly the small Tiger Moth biplane by ex service personnel. The book "Aerial Agriculture" by Derrick Rolland recounts the stories of bravado, skill and ignorance of the application of agricultural chemicals. Clearly the image of "Buzz the Cropduster" was generated and fostered by these hardy early pioneers of the business. It was as near to the deeds of derring -do that could be portrayed. While this may have seemed glamorous at the time that image of a reckless , individualistic pilot unfortunately is the only perception that many in the community still have. This may seem harsh criticism of the people with the vision to start an industry of such importance however the industry is still identified by its "characters" and the self assurance that comes from being one of the few with the talent to control an aircraft at low level in agricultural spraying is perceived by outsiders as arrogance. In short, until recently the industry did not resile from the image of those early years and in turn presented themselves poorly when the media spotlight focussed upon them.

As the industry developed and the use of aerial spraying became a core part of the way we grew and protected crops purpose built aircraft were employed with increasing sophistication in the application equipment fitted to those aircraft. Aerial application became so central to many commodities that farm layouts and management changed to accommodate the technique. Operators in Australia developed techniques for ultra low volume drift spraying for extensive agriculture that enabled large areas to be treated with great efficiency. The skills of the pilots especially in some commodities such as cotton were renown. Systems were developed for night spraying of crops, larger turbine aircraft, technologically superior equipment all contributed to a belief within the industry that this technology enabled them to control every aspect of the application of chemicals.

Additionally the cost of this technology meant that the planes had to be employed in more marginal conditions to return a profit. A combination of overdependance on their skill and equipment and the operation in these conditions inevitably led to incidents. Especially in the cotton industry, a high profile "alien" industry to Australian agriculture , such incidents of drift attracted considerable media attention ,to the discredit of both industries ; one chemically dependant and the other perceived as the means of uncontrolled distribution of chemicals into the environment. The association became so entrenched that often any television story about cotton always included a highly visual aerial spray scene even if the story was reporting on something totally unrelated to aircraft. This did nothing for the image of both industries ,especially aerial application ,for the perception spread to operations carried out on other crops, even when the aircraft were involved in spreading of fertiliser or aerial seeding. This was strongest in the cities where ignorance was high, but even in rural communities , especially amongst the older traditional farming areas where aerial application was not used there was a high level of antipathy because they did not understand the need for such technology.

The environmental movement saw that attacking aerial application could progress their cause against the use of agricultural chemicals. Pesticides have always struck an emotive cord in the general community, increasing so in Australia as the population becomes more and more divorced from the practicalities of food and fibre production, and to also portray that the means by which they were applied was flawed reinforced their push towards eliminating chemicals. Aerial application is visual, noisy and alien to those not involved. Some notable aerial drift incidents were enough to set that perception as fact.

When one looks at the "evidence" given to the Senate Inquiry , especially the sources of the submissions , the strength of the perceptive force generated can easily be seen. The evidence in the Senate Report was "constructed" primarily as part of the Tasmanian anti pesticide "brigade" who had support of a sympathetic Senator. This group had strong affiliations with the NSW based Total Environment Centre and other minor activist groups. The evidence as such was comprised of anecdotal statements, conjecture, and wild claims. It did not warrant the Inquiry's Recommendation 39 and it raises the question whether the Recommendation was influenced outside of the Inquiry.

Nonetheless the statement was made. It has set in motion a process that will ultimately result in impediments to aerial application. While progress towards national standards has been slow, increasing the vulnerability of the agricultural aircraft industry to further attacks, however an agreed position on drift has been established and the general framework of a national code has been constructed. State problems, especially in NSW where the pesticides

legislation is now controlled by the EPA has put a different and higher profile on aerial spraying are seen as the next big hurdle in the progression of the code. Additionally those government departments which only have a peripheral interest in pesticides, and very little knowledge of application systems, are reacting still to the media and activist attention. They have been shown to be as damaging as some of the activist groups and as they can influence government, the latest example is a direction from WorkSafe that pesticide labels carry a "No human markers" statement. No definitive studies have been carried out on whether markers are exposed or not, in fact the procedure of night marking puts the marker always upwind of the pesticide so the likelihood is low however they saw fit to make that demand. This effectively eliminates night spraying

But is the industry so bad that it warranted such a statement in the Inquiry? Does it need further, more stringent regulation? Is its future in jeopardy?

The industry would not have survived so long if it had been inherently bad. Media , notably visual media, graphically the instances of damage. When one considers the numbers of operations flown by aircraft without incident the "strike" rate for an incident is extremely low. However , while this media bias is damaging it is probably something that will never change and apart from being the vehicle by which activists attempt to pursue their case on pesticides and in itself would not destroy the industry.

Thankfully, even though the industry is small and comprised of individualists, it has become cohesive and is presenting an industry image to government. It is very conscious that an action by any one of its members reflects on the industry and therefore the members are gradually losing the "Buzz" image amongst regulators. There is a significant culture change within the industry , partially driven by the pressures put on them, but fuelled by the need to change. They do not as yet have the ability nor capacity to change the wider concerns of the community and therefore are still a convenient "meat in the sandwich" in conflict issues such as is occurring in Gunnedah .

Again this culture change has had an effect on their clients. The unified stance that has occurred within the industry, the change in culture made them less isolated and has generated within the client group that their viability is dependant on the viability of the agricultural aircraft technique. This is not just for aerial spraying but if the technique was lost aerial seeding, fertilising and the associated activities that aircraft are used for would be severely curtailed. The integration with mainstream farming organisations will only be of benefit.

This change has not removed the threat to the industry. As agriculture becomes increasing more diversified, the community more and more concerned with respect to residues , the profit margins in agriculture more meagre and therefore agriculture more exploitive, there will continue to be immense pressure on the industry. Externally, the pressure on the use of pesticides in the Australian community will cause shifts in policy as to their use. The small Australian market and the phobia that is more evident and more politically motivated than I have seen in any country in the world , save Germany, will cause the global marketers of pesticides to second think about placing new generation pesticides (those with fewer off target effects) into the Australian market. It will indirectly impact on the aerial spraying of chemical. The chemical question will cause agriculture in general to adapt to the demands of the market and seek other methods for the control of pests which do not involve as much chemical use as at present or use different delivery systems in areas of potential conflict.

There is no doubt the industry will survive. The technique offers too much to agriculture and the community to be discarded. To a large part how well it survives will depend on the client group, whether it be the users of the technique to spray weeds, crops for insects, controlling mouse plagues or the multitude of uses where the agricultural aircraft has become a pivotal tool. They must offer support in working with the agricultural aircraft industry to formulate management plans that will not compromise the use of the aerial application and join with the industry in defending the technique. The agricultural aircraft industry is too small to fight the battles that lie ahead. In the past whenever an issue arose the client involvement evaporated . This must not occur in the future.

There will be change within the industry in order to remain viable and I consider the change will be quite dramatic. As costs rise ,applications become more specific there will be rationalisation to fewer , larger operations. There will be activities that those larger organisations will not enter into for fear of jeopardising their mainstream business. However, again with reference to the documented history of aerial agriculture in this country, the industry has shown the capacity to change and adapt. It is its very strength.

How Secure is the future?

The future of Aerial Spraying in Australia will be determined not by how technologically sophisticated the industry becomes nor how valuable it is to agriculture but how the perceptions and emotion that have been successfully established in the general community can be changed and to what extent they can be changed.

EPA, NOXIOUS WEED CONTROL AND THE PESTICIDE ACT

Angus Mcdonald
Environment Protection Authority
DUBBO

Responsibility for the Pesticides Act and associated functions was transferred from NSW Agriculture to the Environment Protection Authority (EPA) in November 1995.

The relevance of the Pesticides Act to those attending this Weeds Conference is that it is the principal Act regulating the possession and use of pesticides in NSW beyond the point of sale. The control of use of pesticides up to and including the point of sale is the responsibility of the National Registration Authority (NRA). The NRA therefore assesses and registers pesticides, including setting label directions.

Pesticides as defined in the Pesticides Act includes all herbicides as well as other pesticide groups such as insecticides, algaecides, fungicides, plant growth regulators and pheromones. All persons in the field of noxious weed control, whether direct users of herbicides or administrators, need to be aware of the responsibilities of pesticide users and ensure that pesticides are used in such a way that there is no harm to persons, property, the environment or trade.

Some important provisions of the Pesticides Act include:

- Users must use only registered pesticides, unless they hold an appropriate permit from the NRA.
- Users must read the label (or have it read to them) before use or disposal of a pesticide.
- All label instructions must be complied with.
- No one may claim that a pesticide will do anything more than the registered claims made on the label, no contrary claims can be made about matters required to be borne on labels such as expiry dates, and the label may not be detached, altered, defaced or destroyed.
- Users must not risk injury to persons or damage to the property of another.

Certain statements about pesticides such as "safe, harmless, non-toxic", may not be used unless very adequate proof exists to substantiate the claims.

The Pesticides Act is currently under review. The proposed amendments are detailed in a Discussion Paper entitled "Improving Pesticide Management in NSW". A copy of this Discussion Paper will be available in the Post Conference Papers, or can be obtained by phoning the EPA's Pollution Line on 131 555. A series of regional meetings was held in July 1997 to seek community input on the proposals, and many written submissions have also been received.

To ensure that the new pesticides laws work effectively, a number of key changes are proposed, including:

- Setting up an advisory committee to provide expert advice on managing pesticides.
- Ensuring that emerging best practice approaches to pesticide management are promoted.
- Making any use of pesticides contrary to label directions an offence.

- Ensuring that landowners take reasonable measures to prevent their contractors committing offences.
- Banning the use of unsuitable aircraft, not approved by the Civil Aviation Safety Authority.
- Extending the EPA's power to issue Orders to cover ground spraying as well as aerial spraying.
- Increasing maximum penalties for wilful or negligent pesticide use from $40,000 to $125,000 to bring them more into line with other state environmental laws.
- Providing consistency with the national registration scheme.
- Separating the Minister's Office from pesticide prosecutions as it is currently separated from other areas of environmental law.
- Strengthening the powers of authorised officers.

Comments received from all sectors of the community will be considered before legislation is drafted. Improved pesticide management is also being promoted through community education and ongoing liaison with industry and collaboration on a national level.

REPORT ON DUPONT TRAVEL AWARD, 1995

Dick Honeyman
Weeds Officer
Jerilderie Shire Council

AIM

To investigate Parthenium weed on site in Queensland and to aquaint myself with the plant and its various growth habits.

Method

An itinerary was planned with the assistance of Senior management of MACSPRED P/L and because of distance the timetable was spread over five weeks. This would allow extra time in certain areas if necessary and comfortable and leisurely travelling. Again time was thus available to study or view any weed problems discovered on the way.

The Route

The trip was planned in four main stages.

- **Stage 1 - Jerilderie To Sydney Via Parkes**

This section included a family send off to our youngest daughter who returned to work in Ireland.

At Parkes I was able to revisit a field site where methods of control on Silverleaf Nightshade are being trialed. I am indebted to Wayne Sheargold (Weeds Officer, Parkes Shire Council) for his time and information on this site.

It is apparent that Silverleaf Nightshade is almost impossible to eradicate on large scale areas and farmers are restricted to maintaining a "minimum seeding". Some ten thousand hectares are in this area and I am led to believe there are similar major problems in neighbouring Council areas.

For those unfamiliar with this weed, it is a member of the Solanum family as are such things as domestic tomatoes. The plant does not have a high rate of germination from seeds Approximately 25% under most conditions) but increases germination to almost 100% after passing through the gut of animals. The plant also puts up large numbers of suckers if cut or ploughed.

Chemical control of large infestations is prohibited by cost. A figure of $800 plus /ha was quoted in the early 1980's.

A couple of days R&R in Sydney allowed time to look at Parramatta Park and see the development of a major garden escape site. The waste and rubbish that has been deposited in what would otherwise be a very large and scenic public bushland area, in the middle of a major city, is disgusting even to one who would not rate highly as a "greenie".

Perhaps the cost of depositing rubbish in Council rubbish tips is causing people to deposit their clippings, papers and bottles in the water courses.

- **Stage 2 - Sydney To Brisbane Via Terrigal, Taree, Cape Byron, Bellingen And Coffs Harbour.**

Two days at Terrigal did not reveal any major weed problems but an enjoyable reunion with Eddie Felton (our best man) and his family was a great interlude. For those living near the area I can thoroughly recommend "The Snapper Spot" fish shop owned by Eddie and Pam Felton.

Also a Saturday afternoon in the Terrigal hotel watching football and races and the odd dozen beers with Eddie is an experience not to be missed by the more adventurous weeds Officer.

From Terrigal we moved to Taree and a dairy farm owned by Marjic's Uncle and Aunt (Arthur and Maureen Southwell).

This is a small well run dairy and it was here that I was able to see Fireweed in varying amounts. This weed has been a problem on coastal areas for some years and I first saw it on a bus tour at the Lismore weeds conference. At that time there were no really effective chemical control. I am advised that this situation still exists. Arthur has been able to maintain minimum infestations by hand pulling the weed and collecting the plants. He carries a bag at all times and pulls as many plants as he has time to at the moment.

Arthur was very impressed with, and complimentary to the local Council weed staff for their rapid response to his requests for control to be carried out on roadsides adjacent to his property. He was not so impressed with the attitude and action of some of his neighbours.

Arthur's farm is in a major flood plain and with the whole farm regularly underwater for varying periods he feels he will be controlling Fireweed for many years to come.

Bellingen

At Bellingen we spent a day with Graham Mathews, and this was the beginning of the rain and wind that was with us until after Brisbane.

It was too wet for field excursions with Graham but I was able to discuss the problems of a weeds Officer in that area with Graham. It would appear that the situation in that area is vastly different to any I have experienced. These were mainly due to the nature of the human inhabitants of the area.

To say the least it is different. In Graham's words the main problems are Parramatta Grass and locals. We were very well cared for by Graham and Leane and their family, and we were very grateful.

Coffs Harbour & Lismore

A short visit with Ken Hayes to see his depot and a chat. Ken was busy with his final assault on an infestation of Salvinia before he left on his trip through the islands on the "Kensark" which many of the weedies saw at Foster conference.

We then moved to Ballina and attended a meeting of Weeds officers at Lismore for a short while. The rain continued and we decided to get ahead of it or perhaps be caught south of the storm.

A visit to Cape Byron to see again the areas of Bitou bush seen at the Lismore conference. and also found a Noogoora burr in the lighthouse garden. They are a versatile little critters those Noogooras.

Brisbane & Rockhampton

We arrived in Brisbane in what became for us 'the BIG WET'. It rained heavily and continually for five days.

Through the assistance of Bernie Horsefield and his staff I was able to pr arrange a number of interviews from this point on.

Rachel Mcfadyen (Allen Fletcher Research Station)

Rachel has been investigating Parthenium weed for over twenty years and is considered to be the leader in this field by most of those to whom I spoke.

Sheldon Navvie (University Of Queensland)

Sheldon is assisting with research on growth patterns and habits of Parthenium weed. A list of points made by these two people follows.

- Parthenium won't compete with well established and strong pastures.
- Bio control is of no value on small infestations.
- Bio control in Queensland will aid New South Wales because much of the Murray Darling system is fed by Queensland streams from potentially infested land.
- The Murray Darling Commission is contributing to the bio control program, and also the border washing facilities to prevent seeds being carried into N.S.W on headers and other vehicles.
- Wind spread of seed is not considered a factor in spread of this weed.
- Water spread of seeds in short hops is the main way of spread of Parthenium.
- One single plant may not set viable seed. ie It may require two plants to pollinate. This is a theory not yet reliably proven. It may explain the non recurrence of plants found as single plants in various places.
- The most important factors in germination seem to be: 75mm-100mm summer rain to commence germination; bare areas, eg overstocked, drought and road edges.
- Bare black soils with summer rains seem to be the best situations for Parthenium weed to establish.
- Some rusts work better in cooler climates.
- It appears most people become allergic to the plant over a long period of time. A similar allergy is also common to ragwort, Noogoora burr and Bathurst burrs. It was noted that a

worker who had been working with Noogoora burr for many years became allergic to Parthenium within 48 hours of transferring to that section of investigation.

- Once established Parthenium releases toxins to prevent other plants growing (alelleopathic)
- Seed viability on the surface is about two years. Underground the seed is able to last much longer.
- The seed needs a longer day to night period to germinate.
- Stock generally don't eat the seed so seed viability is not affected by ingestion.
- If forced onto Parthenium cattle show a taint in meat and milk.
- Plants under experimental conditions were being grown in climates relative to the following climatic and soil situations -Ballarat (Vic), Emerald (Qld), Brisbane and under high carbon dioxide situations, eg The expected CO_2 conditions of the year 2020. All plants appeared equally vigorous.
- Seed numbers per plant have been stated as 15,000 but Sheldon Navvic claims up to 150,000 is more likely.
- Epiblema moth works well on ragwort & Noogoora burr. Bathurst burr appears too hard and shiny on the outside surfaces for the insect to enter the plant. (Bad luck for the burr growers!)

Control

- If plants are cut at the stem base the plant will go into a long dormancy which may last until the next season.
- If plants are sprayed late in maturity they will re- appear in the next season
- Frosted plants will regrow in the next season.
- Chemical control is as per the various State registrations and are not included in this document.
- The plant has a deep tap root and will exist on "ground stored" water for long periods.

Spread And Germination

- Spread mainly by water, tyres of vehicles and machinery and coats of feral and domestic animals.
- After heavy summer rain 40% of total Parthenium plants will germinate in five days. In the same period only 5% of ALL other species will germinate. This obviously gives the Parthenium plant a good start in obtaining a majority.

Major Activities

- In Queensland the major activities are aimed at public awareness and group control.
- Much of the central highland area (approximately 18,000,000 ha) is beyond control. Reclamation by pasture and stock management is the only solution.

David Akers (Rockhampton)

David works with the Department of Lands (Protection Section)and is responsible for much of central and lower Queensland. His territory extends west to the borders of both South Australia and the Northern Territory.

David concurred with most of the points already made and added the following points proven in the field.

- Central Queensland was beyond eradication and required management and pasture development. Buffel grass and native grasses would prove the best control in these situations he felt.
- Councils patrolled roads and were provided with chemical to spray approximately 6500 km of road edges to provide a roadside parking area on each verge to prevent seeds being picked up on parked vehicles. Chemical used is Atrazine.
- Construction of wash down facilities and air blast cleaners at strategic points was aimed at cleaning vehicles prior to them leaving Parthenium areas.
- Signs on roads indicated areas where one or more Parthenium plants had been found and in most cases the areas were controlled or eradicated.
- There are no known sites outside the Central Queensland area which had not been controlled.
- At the time of my visit, new infestations were being treated on the head waters of the Bulloo and Maranoa rivers. These rivers drain directly into the Murray Darling system.
- Landcare groups were considered to be very co operative and were organising good programs and publicity with the Department and the general public.
- David considered that past Noogoora burr sites were a good indication of potential Parthenium areas , although it was stressed by most people that Parthenium would grow on a much wider variety of soils and climates than Noogoora Burr.
- Rubber Vine and Mimosa were considered as big or bigger problems in much of the area covered by David. A site of both plants was visited and it can be seen that these plants are a really serious problem if allowed to become established.

Rockhampton To Townsville

This part of the trip mostly involved field observations of Parthenium weed on properties known to me from working in the area in the late 1960's and visits in more recent years.

Kevin Newell ("Yungaba", Capella)

Kevin came to the area from Forbes with his family in 1964 and has carried on mixed farming including cropping ,sheep and cattle in the early years. In recent times sheep were not continued because of difficulty in management.

Main crops now are sorghum and wheat although the whole area had been through a five year drought and cropping had not been successful during those years.

Yungaba has various amounts of Parthenium weed, and is at a stage where the owners admit to not being able to eradicate the weed. Farming practices aim at maintaining low infestations and "living with" the remainder.
In previous visits I saw programs of spraying and pulling of Parthenium but the spread continued to the current extent.

Kevin is of the opinion that it is uneconomical and physically impossible to eradicate the problem due to reinfestation from neighbouring land.

David Archer (Kywong, Dysart Area)

David drew this property in the early 1970's as part of brigalow development scheme. The property is 13,500 acres and runs cattle and share farming of sorghum (4,500 ha) is carried out. This property was obtained just before the 1974 drop in cattle prices and has suffered two droughts including the recent five year period experienced by most of Queensland.

- A number of interesting points were seen on this property and they are listed as follows:
- The property has won two successive Landcare awards for management and layout.
- Management techniques revolve around minimum use of chemicals in all farming practices.
- Cattle breed was changed to include a higher ratio of Brahman to shorthorn. The increase tick resistance removed the need to dip with residual chemicals.
- So far Parthenium has been controlled with management of pastures and grazing.
- One paddock had been locked up for 18 months and showed very little if any Parthenium and I am advised that there was considerable amounts prior to the spelling of the paddock and sowing of Buffel grass.
- This property was a pleasure to drive around with the following points of interest.
- Cattle were very quiet and seemed content to mingle with humans and native wildlife which was plentiful on all areas of the farm.
- Large earth dams supplied good water even though there had been no running water for nearly two years.
- Natural scrub had been kept to maintain natural conditions and had been pulled to a contour line to reduce erosion and retain natural grasses.
- The cleared area had large contour banks to prevent erosion and to direct water to the best advantage to retain as much water as possible on the pastures/crop.
- David was confident his management would eventually control the problem of Parthenium weed with minimum land degradation or use of chemicals.

David also maintains (as do many to whom I spoke) a nursery of bio controls to promote the spread of these organisms. As can be imagined David felt embarrassed during the major drought when he admitted to hand watering Parthenium weed plants so that they would support the bio control organisms.

Clermont

John Chamberlain (Dept Of Primary Industries)

Parthenium weed is but one of John's problems ,however he is working as a leader in the area on publicity and development of controls. Through John I was able to attend a meeting of the Parthenium Action Group (PAG) and to see first hand the work of a group of individuals from various interests who are developing a management action plan. PAG was commenced by the local Landcare group and extends its interests over the whole of the Central Highlands. Activities include field trips, supplying spray equipment for hire for small infestations, collecting and spreading bio agents and assisting with nursery sites and publicity.

Private individuals may join this organisation for a small fee and receive regular updates on current infestations and management progress.

This meeting and separate discussions with John Chamberlain reiterated the previous information about the importance of management and vigilance. The group feel there is a major need for a national plan to combat any future outbreaks in other states.

The area defined on a North / South basis extends from just south of the Belyando River to a line between Injune and Rolleston. The attached map indicates a rough idea of the area involved.

Dr Dhilleepan (Tropical Research Station, Charters Towers)

This was a new development and Dr Dhilleepan was not willing to advance any theories as yet. His main project is testing bio control for suitability for release in the field. Again much of his advice was repetition of previous advice and strengthened that information.

The following key words seemed to crop up with every person interviewed:

HOST SPECIFIC - COLONIES - PASTURE / CROP MANAGEMENT - STOCKING RATES - LANDCARE - BARE AREAS - GRASSES - STRATEGIC PLANS - WEED PRIORITY.

Townsville To Jerilderie

The remainder of the trip was intended to return via Coonamble and Gunnedah to visit with colleagues in those ares and study spiny burr grass.

Unfortunately the floods we left in Brisbane a month earlier had rolled out west and made the trip impossible. It was a matter of getting home the best way possible. We did take our time and saw the works of Scott Dearden (PAG INJUNE)and also some old Prickly Pear sites which I had seen in the late 1960's while working there.

The people mentioned in this report all feature in the video on Parthenium Weed supplied to Councils and that video is far more professional than my own production.

Conclusions

- Allergy will occur in most people working in the weed over long periods.
- Bio control useless on small infestations.
- Water, vehicles, animal fur, unclean seed and sale of unclean stock feed the main cause of spread.
- Will germinate on most soils and climates.
- Needs a good rain to commence germination.
- Life cycle from seedling to mature seed 28 days.
- Germination of young seeds very high when compared with other species, eg 40 % Parthenium /5% of all others in first four days.
- Seed life as much as five or more years in soil.
- Seed numbers per plant up to 100,000.

- Will grow on a much wider area than Noogoora burr.
- Noogoora burr is an indicator of likely sites.
- Private land holder has controlled some areas with management.
- Can become over-wintering if treated at the wrong time.
- Management of land use is major methods of control in heavy infestations.
- Chemicals used in Queensland are Glean, Ally and some Roundup (Not effective) on Agriculture. Atrazine on public roads (Soil sterilent).
- Needs national strategy to control new infestations or prevent spread to other states.
- Disposal of unclean seed is not known.

ACKNOWLEDGMENT

I am indebted to the following for support and assistance on this trip:

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- Ken Hayes, Coffs Harbour Shire Council
- Wayne Sheargold, Parkes Shire Council
- Rachel Mcfadyen, Sherwood Research Station Qld
- Sheldon Navvie, Qld University
- David Akers, Qld Dept Of Lands
- John Chamberlain, Qld Dept Primary Industries
- Scott Deardon, P.A.G. (Landcare Rolleston)
- Dr Dhilleepan, Qld Tropical Research Station - Charters Towers
- Kevin Newell, Farmer Capella Qld
- David Archer, Farmer Dysart Qld
- Marjie Honeyman, Long Suffering Co Pilot And Navigator (Who sat in the car and waited throughout various interviews.)

ROADSIDE VEGETATION MANAGEMENT

The NSW Roadside Environment Committee - The Picture So Far

Carolyn Woods
Executive Officer
NSW roads & Environment Committee

In many localities in NSW, the roadside environment is the only place where native bushland remains. Weed invasion, vegetation clearing, land degradation including soil structure decline, erosion, acid soils, dryland salinity and increased soil nutrients; grazing, inappropriate road construction and maintenance and other influences have effected the health and extent of native vegetation across the State. Five percent of the total land area of NSW is roadsides, an area equivalent to National parks.

Apart from the benefits of retaining roadside vegetation for habitat for plant and animal species and helping to prevent soil erosion and other land degradation problems, there are a number of other social and economic benefits of retaining remnant vegetation including containing natural and cultural heritage landmarks (bridges, Aboriginal scar trees), grazing for travelling stock and other important values.

The future of management of these areas requires the development of a coordinated approach by the community, local Councils, Rural Lands Protection Boards, Noxious Plants County Councils and others both for the assessment of native vegetation, the development of roadside management plans and also for the management of weeds. In Dumaresq shire, in the north west of the State, improved communication between key authorities for the control of weed species has lead to a coordinated and cost effective approach to weed control.

One of the NSW Roadside Environment Committees main roles is to try to assist local Government , RLPB's and others in the assessment of roadside reserves, the development of management plans, the implementation of these plans and the facilitation of training. Already about thirty councils have developed management plans so far across NSW.

ROADSIDE REVEGETATION MANAGEMENT USING CONSOL LOVEGRASS

Jim Morrison
Weeds Officer
Leeton Shire Council

INTRODUCTION

Leeton Shire is situated in the centre of the Murrumbidgee Irrigation Area with a population of approximately 12,000 residents (urban and rural) and has a very intense road system. Being an irrigation area a lot of our roadsides become waterlogged from leaking channels and farm levee banks and therefore a lot of vegetation grows on our roadsides.

Leeton Shire also has many travelling stock routes and with the abundance of feed, our roadsides become heavily invaded with travelling stock and this is where the problem begins. Stock travel from all over NSW and Victoria to this area and they denude our roadsides of vegetation to the extent there is virtually nothing left except Spiny Burr Grass, Silverleaf Nightshade, Horehound and Bathurst Burrs.

Within the Leeton Shire Spiny Burr Grass is now declared a W1 Notifiable Weed and the Shire closed two major stock routes mainly to prevent the spread of Spiny Burr Grass and other weeds and to assist revegetation of roadsides using Consol Lovegrass.

WHAT IS CONSOL LOVEGRASS

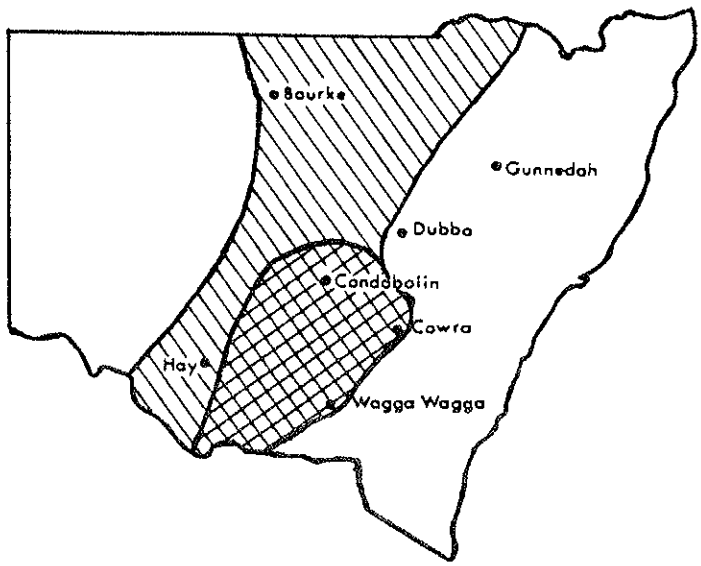
Consol Lovegrass has been registered and released as a herbage plant cultivar in NSW for areas generally west of the tablelands. Consol is a highly palatable summer active, productive Grass suitable for sowing in the 400-700mm rainfall zone on country which is too sandy, dry or conducive for anything to grow except Spiny Burr Grass and other various weeds. Consol Lovegrass pastures are long lived (20 years) and keep out a range of summer weeds including Spiny Burr Grass. Consol is not competitive against annual legumes (clovers) or winter annual Grasses.

Consol is highly palatable to stock from late spring to autumn. Consol Lovegrass has the same species name as naturalised African Lovegrass and despite its advantages weed authorities have not exempted it from provisions of the Noxious Weed laws. It cannot therefore be legally sown in areas where African Lovegrass is declared a noxious weed without appropriate approval.

The map below indicates areas suitable for Consol Lovegrass. The area in which the use of cultivar Consol is recommended for soil conservation and pastoral use is shown in the sketch. The extent of its likely area of use is also shown.

SOWING CONSOL AND EVALUATIONS

Council decided to trial Consol Lovegrass on their roadsides as an alternate means of controlling Spiny Burr Grass and also to help prevent erosion.



Recommended area for *Consol* lovegrass

Potential area of *Consol* lovegrass

After attending field days at Wagga run by Mr. Bill Johnston from CALM I began our first trials in the winter of 1992. We fenced an area of approximately 2 hectares as this trial was on a main travelling stock route (Leeton-Narrandera Road). I ploughed the area twice and planted Consol into a weed-free seed bed as recommended for pasture establishment and weed control purposes. Our main problem with the first trial was finding some implement capable of sowing Consol at the correct rate per hectare (recommended rate 250kg/ha to 0.5kg/ha). I managed to achieve a rate of approximately 1kg per hectare using an old Massey Combine with a fine seed box attached and using sand as a carrier, but I do not recommend sand as it is very abrasive on machinery.

This trial was sown on one of our worst infested areas of Spiny Burr Grass in the Shire and after the first six months this whole area had been completely covered with Consol and the growth rate of Spiny Burr Grass reduced by approximately 50%. Now after five years we have a 100% control of Spiny Burr Grass. This area has also been grazed approximately six times in this period.

The second trial was sown in different circumstances to the first trial. This was sown in September, 1993 using my own modified seeder at the rate of 0.5kg/ha using no sand or other carrier. The results of this trial after four years are excellent with a 100% control of Spiny Burr Grass and also Patersons Curse.

I now believe you should pack the ground before sowing with a roller or cultipacker as a firm to solid seed bed appears to give better germination.

KEYS TO SUCCESS

1. Low competition and ground cover at sowing.
2. Sow seed no deeper than 2 to 5 mm, if ground is soft drop the seed on the surface.

3. Sow Consol first and oversow later with annual legumes.
4. If sowing in spring don't graze until autumn.
5. Rotationally graze – never set Consol pastures.
6. Graze with enough animals to feed the paddock off in 2 weeks, then rest it.

ADVANTAGES OF CONSOL LOVEGRASS

1. Consol Lovegrass is highly palatable for stock.
2. It is not invasive (Ref. W. Johnson) and it will grow well on country which will not grow good phalaris, cocksfoot or lucerne.
3. Consol also controls some unwanted weeds including Spiny Burr Grass, WireGrass and also in our case Patersons Curse.
4. Consol grows best on acid. light soils.
5. Consol is also drought tolerant with very little rainfall needed to exist.
6. Consol is easily controlled in a farm situation.
7. Consol is deep rooted tussock Grass which helps prevent roadside erosion in sandy areas.
8. Consol seed is now readily available from registered seed growers at very competitive rates. (Mr. John Mann, Rylstone 063 794 281 and John Sutherland, Upper Murray Seeds, Tooma 069 484 497).

DISADVANTAGES OF CONSOL

1. The extremely small fine texture of the seed (less than 0.5mm in diameter and between 3.5 and 5.0 million seeds per kilo) make it difficult to sow over a large area without the proper equipment.
2. You may not be able to grow Consol Lovegrass in your Shire because authorities have not exempted it from the provisions of the Noxious Weed laws.
3. Getting a uniform germination of Consol Lovegrass appears to be a major problem in some situations. More research needs to be done in this area.

CONCLUSIONS

In conclusion from experience I would say integrated weed control using Consol Lovegrass on our roadsides far outweigh chemical control for cost and long term eradication of weeds. It gives us a long term revegetation program for our roadsides for very little labour outlay, once sown and germinated Consol looks after itself.

Council also held a Field Day on the 18th January, 1994 with approximately 80 landowners and Council Weeds Officers from other Shires in attendance. The Field Day organised by myslef included speakers from CALM Wagga Wagga, Mr. Bill Johnson and NSW Agriculture Yanco, Mr. Hugh Milvain mainly to educate landowners on the benefits of using Consol Lovegrass on light sandy country such as ours.

Council had a visit from the Noxious Weed Advisory Committee on the 17th April, 1996 to inspect our trial work. The Noxious Weeds Advisory Committee had some concerns from some Southern Tableland Shires and was considering Consol Lovegrass being declared a Noxious Weed. A favourable report was received on this matter.

Consol Lovegrass DON'T BE AFRAID TO USE IT on light sandy country. It provides good grazing pastures annually and is different in all respects to other types of African Lovegrass

naturalised in Australia. It is a good control measure for various unwanted weeds and Consol will not outcross with other varieties. (See Reference – Field Day Notes 17th February, 1995)

REFERENCES

- Mr. W.H. Johnson, CALM Wagga Wagga – Field Day Notes (17th February, 1995 soil Notes 17/86 and 16/85)
- Consol Lovegrass Ag Fact P2.5.33

USING THE MEDIA TO ADVANTAGE

Robyn Yeo
NSW Agriculture
Dubbo

ABSTRACT

The media can provide a useful tool in the fight against noxious weeds.

Newspapers, magazines, radio, and television can all be harnessed into action when there is a need to inform the public. Each arm of the media works in a different and unique way. Having a good understanding of each type of media enables weeds officers to make the best use of this resource. Selling the right message using an appropriate "news angle" and developing a good relationship with the local media are all part of the media game.

This paper will look at different types of media, the way each media type works, country versus city media, developing links with the media, selling the right message, and turning negative publicity into positive.

The full paper will be included in Conference Proceedings.

9th Biennial Noxious Weeds Conference

IMPROVING WEED MANAGEMENT FOR THE 21ST CENTURY

DUBBO RSL CLUB
DUBBO

16 - 18 SEPTEMBER 1997

Volume 2

Conference Proceedings

NSW Agriculture

9th Biennial Noxious Weeds Conference

Volume 2 Conference Proceedings

Dubbo RSL Club
Dubbo
September 16-18, 1997

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Conference Convener
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Dubbo

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Dubbo City is pleased to be the host for conference delegates and organisers.

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Cobbett Pty. Ltd.
Workcover New South Wales

The Weed Society of NSW
Dubbo City Development Corporation

EDITOR'S NOTE

Conferences normally present the progress of continuing work, as distinct from final reports. Alternatively, conferences may be used to present completed work that has previously been reported in a "final report" format or in a paper in a scientific journal. Please read the papers within these contexts. Authors are responsible for their own work.

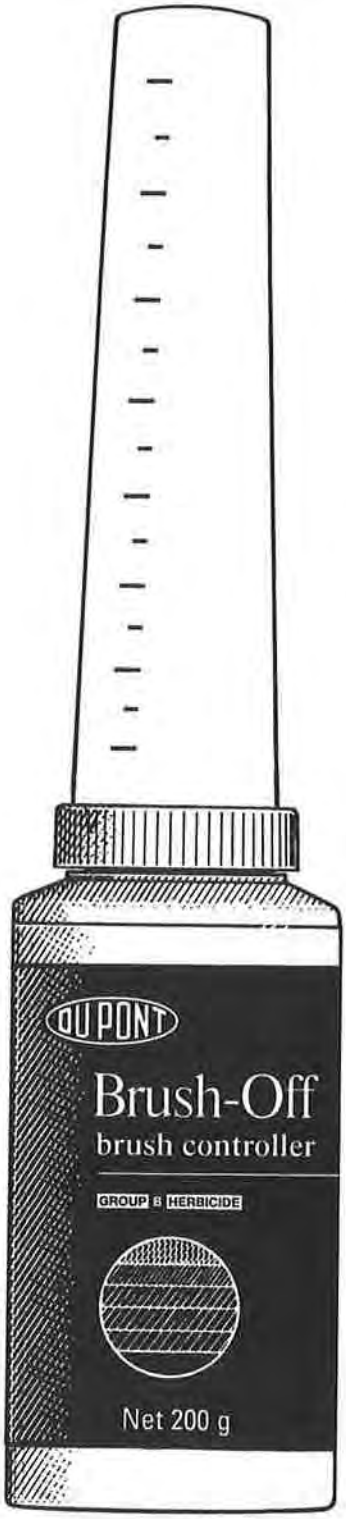
Authors were invited to submit a full paper for Volume 1 - Conference Papers. In cases where authors could not provide a full paper, an abstract was accepted. The full conference papers are published here in Volume 2 - Conference Proceedings. Page numbers continue from Volume 1.

Events that occurred at the conference are appropriately reported here in Volume 2 - Conference Proceedings.

I thank speakers for their help in preparing papers and abstracts.

Further copies of the Papers and Proceedings are available from me at the cost of $20 posted.

Michael Michelmore
Regional Weed Control Coordinator
NSW Agriculture, P O Box 389, Goulburn NSW 2580
Ph 02 4823 0617. Fx 02 4822 3261.



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Blackberry	Inkweed	Ragwort
Bitou bush/	Japanese Sunflower	Red Gum
Boneseed	Kangaroo thorn	Rubber vine
Bridal creeper	Lantana	Sweet Briar
Common Bracken	Mistflower	Tree-of-Heaven
Crofton weed	Messmate Stringybark	Wait-a-While
Darling Pea	Noogoora burr	Wild Turnip
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9th Biennial Noxious Weeds Conference

DAY 1 - Tuesday, 16th September 1997

TIME			PAGE
Chairman: George Hammond, Macquarie Valley Noxious Weeds Advisory Committee			
8.30	Introduction	Peter Gray NSW Agriculture	
8.35	Welcome	Cnr Anthony McGrane Mayor, Dubbo City Council	
8.45	Opening Address	Clr Bill Bott President, Shires Assoc.	
9.10	Weed Management in the Modern Community	Richard Groves, CSIRO	1
9.50	The Importance of Noxious Weed Control Programs for Agricultural Industries	Helen Scott-Orr NSW Agriculture	8, 161
10.00	***Morning Tea***		
Chairman: Val Stubbs, Mid-Western County Council			
10.30	Strategies and Planning for Noxious Weed Control	Richard Carter NSW Agriculture	9
11.00	Appraisal, Benchmarking and Auditing System for LCAs	John Fisher NSW Agriculture	17, 163
11.10	Parthenium Weed Update	Phil Blackmore NSW Agriculture	18
11.20	Headers at Queensland Border	Malcolm Smith, AGHA	166
11.30	Tour of Parthenium Weed Areas in Queensland	Bryson Rees Wellington Shire Council	24
11.40	The Parthenium Action Group's Program in Queensland	Scott Deardon Queensland Parthenium Action Group	26
12.10	NSW Agiculture's Noxious Weed Management Computer Programs	Alan Maguire NSW Agriculture	32
12.30	***Lunch***		

Chairman: Peter Gorham, NSW Agriculture			
1.30	A Computer Program for Noxious Weed Program Management	Campbell Petterson Kempsey Shire Council	169
1.50	Weed Mapping using GPS and Remote Sensing	Ian McGowan NSW Agriculture	33
2.10	Aerial Inspections using GPS	Lee Amidy Gunnedah Shire Council	43
2.30	"WeedMap" Software from Neumaflo for Noxious Weed Administration	Scott Clark, Neumaflo	173
	Pest Management Information Systems (SA)	Sue Southcott, Anadata	48, 174
2.50	Panel Discussion		
3.00	***Afternoon Tea***		
Chairman: Graham Matthews, Bellingen Shire Council			
3.30	Training and Competencies for Weeds Officers	Hugh Milvain NSW Agriculture	49
4.00	Control of Environmental Weeds Utilising Community Involvement	Judie Rawling, Urban Bushland Management Ltd	175
4.30	Proposed Vegetation Management Legislation	Andrew Kennedy and Len Banks, NSW Agriculture	51
5.10	Close.		
	Weed Identification Education Display (on going)	Bob Trounce, NSW Agriculture	
6.00	***Evening Meal***		
7.30	Weeds Officers Association AGM		180
7.30	Elected Members Meeting		

DAY 2 - Wednesday, 17th September 1997

TIME			PAGE
Chairman: Kate Blood, KTRI, Frankston, Victoria			
8.30	Monsanto: New Products / Developments	Darren Thomas, Monsanto	
8.50	Weed Introductions through Nurseries	Jim Dellow NSW Agriculture	53
9.10	New Weed Introductions	John Hosking NSW Agriculture	58

9.30	Giant Parramatta Grass	John Betts, NSW Agriculture	64
9.50	Weed Busters Week	Roger Smith Orange City Council Bob Trounce NSW Agriculture	68
10.00	**Morning Tea**		
Chairman: Brian Bywater, Dubbo City Council			
10.30	Integrated Control of Weeds	Tim Woodburn, CSIRO David Briese, CSIRO Bill Petit, CSIRO	71, 182
	Including: Distributing Biological Control Agents Distributing Biological Control Agents Bitou Bush Biological Control Program Spray Graze Technique for Weed Control	 Paul Lutschini, NSW Agriculture Bob Smith, NSW Agriculture Royce Holtkamp, NSW Agriculture Jim Dellow, NSW Agriculture	 74 78
12.30	**Lunch**		
1.30	Weed Excursion - "Weed problems in a unique situation - the Western Plains Zoo".	Marshall: Brian Bywater, Dubbo City Council	
5.10	Approximate time of return.		
6.00	**Evening meal**		

DAY 3 - Thursday, 18th September 1997

Chairman: Don Baldwin, Upper Macquarie County Council			
8.30	Alligator Weed	Jim Quinn, NSW Agriculture	81
8.40	Blue Heliotrope	David Newell, Landcare	87
8.50	Bitou Bush	Ian Tye Maclean Shire Council	93
9.00	The Practical Application of Herbicides	Barney Milne NSW Agriculture	106
9.30	Practical Application of the Noxious Weeds Act	Maria Linkenbagh, Cooma	110
10.00	**Morning Tea**		

Chairman: Michael Rusby, Broken Hill City Council			
10.30	Changing Community Perceptions on Weed Control	Andrew Storrie NSW Agriculture	116
10.50	Opportunities for Conflict Resolution	Rod Ensbey, NSW Agriculture	122
11.10	Changing Community Attitudes	Graham Matthews Bellingen Shire Council	197
11.20	Farming for the Future Program	Todd Duffy, NSW Agriculture	127
11.40	Weed Control in the Semi-Arid Zone	Michael Michelmore NSW Agriculture	131
12.10	DowElanco: New Products / Developments	Chris Love, DowElanco	203
12.30	**Lunch**		
Chairman: Stan Joyce, Castlereagh Macquarie County Council			
1.30	The Future of Aerial Spraying	Harvey Baker Cotton Australia	140
2.00	EPA and Noxious Weed Control	Angus McDonald, E.P.A.	144
2.30	Du Pont / Macspread: New Products / Developments	Geoff Keech, Macspread	206
2.50	Du Pont Travel Award Report	Dick Honeyman Jerilderie Shire Council	146
3.00	**Afternoon Tea**		
Chairman: Alan Bushby, Upper Hunter Noxious Weeds Authority			
3.30	Roadside Vegetation Management	Carolyn Woods, NSW Roadside Environment Committee	154, 210
4.00	Roadside Vegetation Management Using Consol Lovegrass	Jim Morrison Leeton Shire Council	155
4.20	Using the Media to Advantage	Robyn Yeo, NSW Agriculture	159, 217
4.40	Conference Closing Address	John Fisher, NSW Agriculture	222
5.00			
Chairman: Bob Trounce			
7.00	Conference Dinner		
	1997 Macspread Travel Award		226
	Valor Awards		232
	Photos		233
	Delegates		235

IMPACT OF WEEDS ON THE AGRICULTURAL INDUSTRIES

Helen Scott-Orr
Chief, Division of Animal Industries
NSW Agriculture
Orange

1) Weeds are a huge environmental and economic burden on New South Wales.

- $600 million a year in control and lost production.
- Few sectors of agriculture are not affected by weeds.
- There are now over 2500 naturalised plants in Australia, many are weeds.
- During the past 25 years 296 new species naturalised, about 12 per year.
- Perhaps half of these become weeds.

2) Some examples of the impact of weeds on agriculture are easy to see.

- Blackberry and gorse encroach on grazing and forestry lands.
- Seed-heads of spiny burr grass
  - ◊ increase the shive fault of wool;
  - ◊ penetrate the skin causing health problems for livestock;
  - ◊ may double the cost of shearing.
- Alligator weed and water hyacinth
  - ◊ block waterways;
  - ◊ increase water loss from storages; and
  - ◊ increase the cost of water for agriculture.

3) Other impacts of weeds are costly but often go unnoticed.

- Trace amounts of toxic plants like heliotrope, inadvertently harvested within grain
  - ◊ reduce growth rates; and
  - ◊ over time, kill intensive livestock such as poultry and pigs.
- The impact of weeds includes secondary effects such as
  - ◊ the use of atrazine which can find its way into the watertable; and
  - ◊ cultivation which leads to breakdown of soil structure and increased erosion.

4) Some new impacts of weeds are even less obvious.

- Under quality assurance programs, producers must declare when they use agricultural chemicals in production.
- Industries such as viticulture now have a well developed system of quality control and are moving to non-chemical management especially when marketing wines to Europe.
- Buyers of quality assured products do not differentiate between metsulfuron, dieldrin and chlorpyrifos - **they are all chemicals**.

5) This places new challenges on weed control authorities.

- When planning weed control programs, we must be aware that we could damage the industry we are trying to protect by imposing policies without consultation with industry.

6) Government recognises weeds as a major issue.

- The New South Wales Weeds Strategy
  - ◊ released in August;
  - ◊ provides the frame work for coordination of the effort on weeds.
- The State provides $6 million in grants for noxious weed control.

7) Local government contributes in the order of $8 million.

- Several hundred weed officers are employed by local control authorities to facilitate weed control.

8) The skills of weeds officers are the key to the success of control programs:

- Weeds officers generally are technically skilled; and
- experienced in regulatory approaches to weed control.
- Few weed officers are formally trained in
  - ◊ facilitation
  - ◊ extension
  - ◊ project management
- The Biennial Noxious Weeds Conference is one way the State supports local control authorities.
- NSW Agriculture is happy to assist further in the development of skills base for Weed Officers especially the facilitation, extension and management skills.

TAKE HOME MESSAGES

- Weeds have a significant impact on most agricultural industries.
- We have a system that will address many weed issues.
- The skills of the Weeds Officers are critical for success.

APPRAISAL, BENCHMARKING & AUDITING SYSTEM FOR LCAS

John Fisher
Program Leader (Weeds)
NSW Agriculture

A formal appraisal system has been developed by weed management staff of NSW Agriculture. The objectives of the appraisal system are:

1) For councils/communities
   - Enable comparison ("benchmarking") of their noxious weed programs with programs in similar areas.

2) For NWAC
   - Meet ICAC recommendations to prevent corruption in allocation of Government grants.
   - Assist with setting priorities for grants.

3) For NSW Agriculture
   - Provide justification, to Audit Office and Government, for noxious weed grant.
   - Assist with setting priorities for weed research and extension.

The appraisal system also meets the NSW Weeds Strategy:

4) Desired outcome:
   - Objectives are achieved in an efficient and cost effective manner.

   Action:
   - Develop performance indicators for weed control programs and use them to evaluate LCA noxious weed programs.

The appraisal system is also a requirement under ICAC - Principles for Grants Administration:

5) Disbursement of grants should be conditional on organisations agreeing to a set of binding conditions which stipulate:
   - purpose of grant
   - anticipated outcome(s)
   - monitoring/evaluation and audit requirements
   - etc

6) On-going payments should be dependent on ... work is of satisfactory standard, grant is accounted for through appropriate financial systems, and that costs are verified.

7) Evaluation of individual projects should provide verification that:
   - project aims and objectives have been achieved
   - the outcome is of a satisfactory standard
   - appropriate procedures have been followed
   - conditions of the grant have been met

8) Performance indicators and a process for evaluation should be established to enable routine evaluation at the end of each funding period and to assist with strategic planning. A substantial review should be undertaken every three to five years. All evaluations and their outcomes should be documented.

Benchmarking

Benchmarking is a management technique to improve competitiveness by outward looking for best practice, learning from that best practice, and implementing change.

Continuous Improvement Cycle:
Planning - Data collection - Analysis - Implementation

Steps include:

- Analyse process - identify goals and critical success factors
- Standardise data collection methods
- Finding best practice
- Initiate improvement

Benchmarking requires commitment from the whole organisation - but NSW Agriculture can assist committed organisations by providing some indices (based on annual returns and statistics) that may be useful in comparing programs.

TRENDS IN NOXIOUS WEED GRANTS

With the development of an appraisal system for Local Control Authorities, there may be a complimentary change in the method that grants from NWAC are applied:

Better defined goals and objectives (quantifiable)

- Submission of management plans with requests for weed declarations.
- NWAC policies - objectives for grants.

Collection of data to quantify outcomes:

- Record keeping.
- Mapping.

APPRAISAL SYSTEM

The appraisal system will follow the following process:

Step 1 - develop "desktop" assessment (standardised documented discussion)

Initial trial with six LCAs being conducted now
Review pilot appraisals in November
Implement state wide

Step 2 - develop indices that could be useful for "benchmarking"

Initially provide indices to LCA + state distribution
Later publish all indices

Step 3 - field inspections?

BENEFITS

There is a range of benefits for weed operations staff from the appraisal system:

- Assist LCAs to improve the effectiveness of their weed control programs.
- Provide information that LCAs could use in submissions to other funding sources.
- Provide data to help convince community/councillors/politicians of importance of weeds.
- Maintain (or increase?) noxious weeds grants.
- Grant funds targeted to obtain greatest community benefit.

HEADERS AT THE QUEENSLAND BORDER

Malcolm Smith
State Representative
Australian Grain Harvesters Association Inc.

I have grown and harvested wheat for the past twenty years and have seen many changes in that time, specifically with equipment, but also with the type of wheats grown. Although this comments does not relate specifically to the topic - it is still a valid point and one that should be considered.

The researchers creating the "best" wheat to sow have overlooked a very valid point. It was not that long ago that we used to commence harvesting in Northern Queensland and work our way gradually south to Victoria or South Australia with the harvest taking some four months to complete - now all the wheat ripens at once and the harvest is completed in about five weeks.

Because of this haste other problems arose - everyone was in such a rush to meet their commitment that shortcuts began to happen.

With the first outbreak of Parthenium Weed in NSW (not via a combine harvester) the situation was quickly reassessed and over a period of time, this Association in conjunction initially with NSW Agriculture, developed a cleaning program for harvesters which could be classified as basic housekeeping.

As the years have passed this format has been improved upon by continuing to work closely with NSW Agriculture plus, over recent years, liaising with NSW Farmers Association, Noxious Weeds Officers in the northern areas of the State and other relevant bodies.

However, into the more serious aspect of this "cleaning" of a combine harvester. Sounds relatively simple doesn't it - a couple of hours work at most maybe - well that is well and truly in the past - in fact, years ago a "clean down" was relatively easy!

Nowadays, to clean down a combine harvester correctly and have it in a condition that will pass the border inspection, requires some twenty hours of solid work it is not hard to appreciate the cost involved to the owner/operator of a machine.

If you base this as an example on last year's categories a top of the range machine was earning approximately $250 per hour - therefore the cost of a "clean down" would be around $5,000 plus the additional costs involved in actually crossing the border and being inspected.

When you know you are due to cross the border, you have to book your combine harvester in for inspection - you have to allow a minimum of twenty four hours for a "manned" crossing and forty eight hours for an "unmanned" crossing.

This in itself is not a major problem except when it rains and you are unable to complete the "clean down" or you are travelling to the border and a part breaks and delays you.

Again it can be argued that a simple phone call would solve the problem but, as we all know, mobile phones are a major benefit but there are still huge areas where they cannot operate nor is there always a farm house close by for you to make a call.

A thorough inspection of a combine harvester takes at least half an hour and you can queue for a couple of hours prior to that, so another day is wasted.

We also recommend to members that they cross at Mungindi, Hebel or Boomi as the general traffic is so much lighter than at Goondiwindi.

This, of course, is not always possible or practical - no one is going to drive out of their way without a good reason, but I prefer to enter NSW in this fashion as I feel it is safer having less general traffic on the road.

The reason for the comment is the fact that, as any large truck driver or combine harvester operator knows, the general public totally ignore signage (oversize), flags, warning lights, pilot vehicles when applicable, etc., all relating to wide loads.

As we well know, the normal motorists ignore roadside warnings that there is roadwork ahead, etc. - it makes our job very difficult as we are not just trying to arrive safely at our destination by complying with the regulations but we also acquire an unfair responsibility at the same time which is to look after the totally inconsiderate motorist so that they arrive home safely to their families!

Having stressed the importance of cleaning down our combine harvesters prior to crossing the border from Queensland into NSW, I would like to close by stressing that the vast majority of our members "clean down" their combine harvesters between jobs and this takes some three to four hours to do.

We also note in our diaries where and when the "clean down" took place. This also applies if we do have a break-down during harvesting - we keep accurate records of when and where with reference to the farmer and we assume that the farmer is now doing this as well.

The farmer should know where every stock float, grain truck, sales representative, stock & station agent or family member has been on the property on any one day.

Finally, having crossed the border many times over the past twelve years, cleaning my machine is part of the business and having the machine inspected ensures that my clients know and are aware of the fact that I practice machine hygiene to the very top standard and I can say that this applies to the members of the Australian Grain Harvesters Association.

We appreciate that not every contractor is a member of this Association, but the top professional operators are members and **that is the point for all of you to remember.**

TAKE HOME MESSAGES

- Headers can be cleaned by following the 19 point cleaning plan.
- Insist that grain growers always select contractors who use the 19 point cleaning plan.

A COMPUTER PROGRAM FOR NOXIOUS WEED PROGRAM MANAGEMENT

Campbell Peterson
Kempsey Shire Council

Geographic Information

A System of Management For Local Government

Taking the initiative

The Council at Kempsey on the sunny Mid North Coast of New South Wales has established a reputation for innovation in the use of technology within the broad framework of local government.

This is no more evident than in the establishment of a Geographic Information System

The success achieved by Kempsey Shire Council has resulted in their appointment as a business partner of MapInfo Australia. The only local government authority in Australia accredited in such a way.

A council is no different to a large corporation in that most of the information it requires to function, although totally different in its source, application and purpose, has the commonality of relating to one geographic location.

Problems of access to the highly diverse data stored within a local government environment and analytical difficulties have been sources of concern to council managers for a long time. The introduction of PC based geographic information svstems to the market, for the first time has given a low cost solution to this dilemma.

The Kempsey Shire Council has established within its GIS approximately 100 map layers. Information is layered over base maps covering data from dogs to flooding to asset management. In fact there are very few applications within the spectrum of local government that cannot be included in a system of this sort. The ability to obtain information, not just quickly, but in a form that is understood and analysed easily, has huge benefits in the day to day management of a local authority.

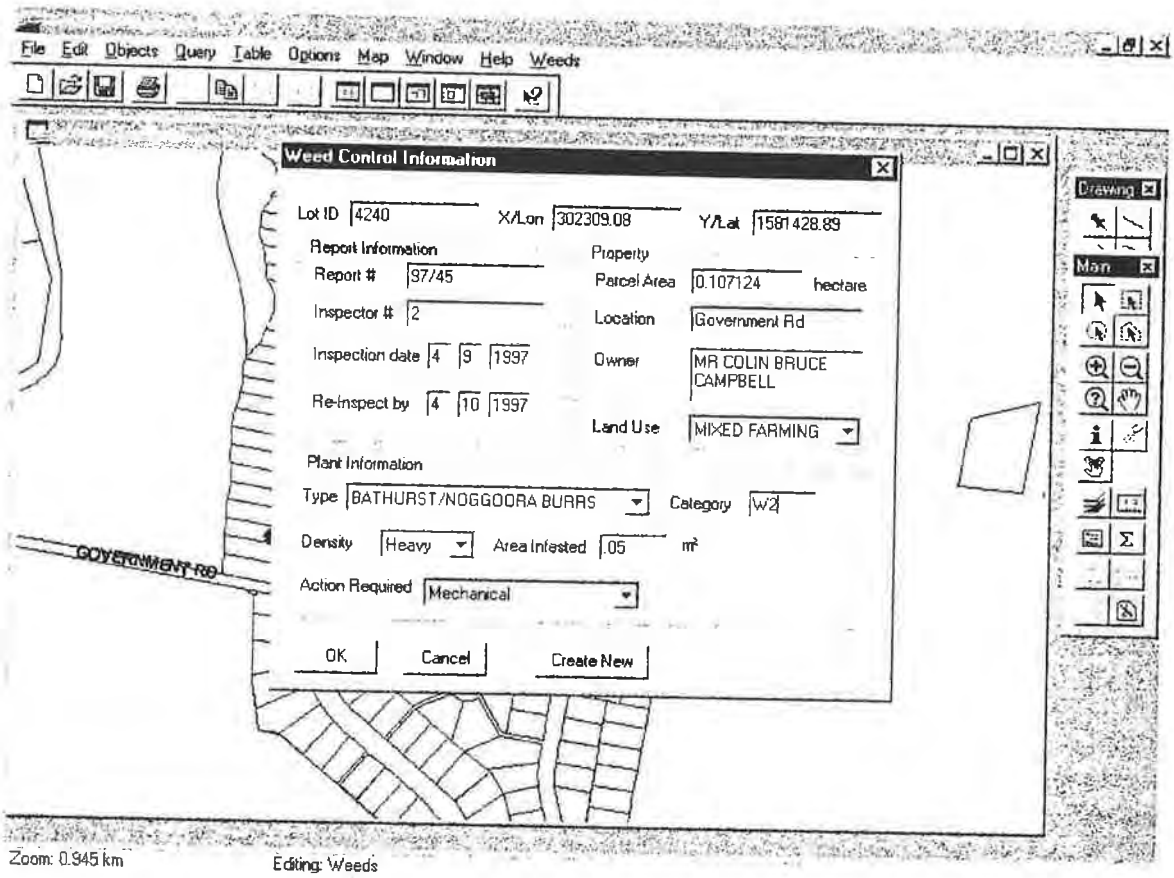
Basic structuring

The Computer Services Manager at Kempsey Mr Campbell Petterson emphasises the importance of getting the basic structure right in establishing a PC based Geographic Information System, Failure to set the system up correctly reduces greatly the product's results potential. Many councils have outlaid substantial sums of money with very poor results because of inattention to the basics of implementation.

The Kempsey Shire Council has received an award for innovation in local government management for the manner in which it has established its GIS.

CivicView Noxious Weeds

The identification of property details and ownership coupled with a drop down option box enables on-site entry of the details required to generate notification of noxious weeds. Give your noxious weeds officer a laptop and this software and his productivity will increase significantly.

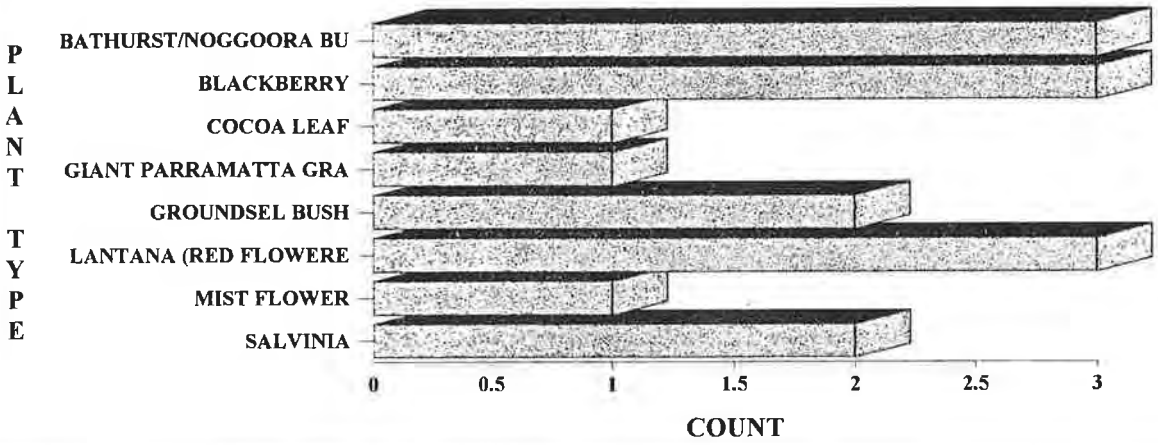


Noxious weeds notice generation and the standard drop down entry box to simplify entry.

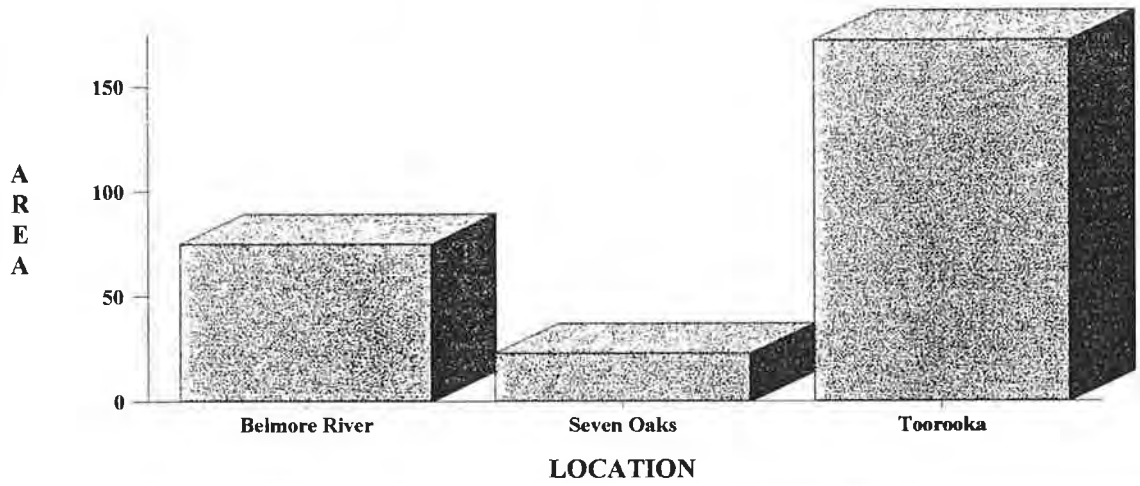
This software also includes PresenTable – a simple to use report writer for MapInfo.

Create your own graphs and reports or produce letters this simple application can do it all.

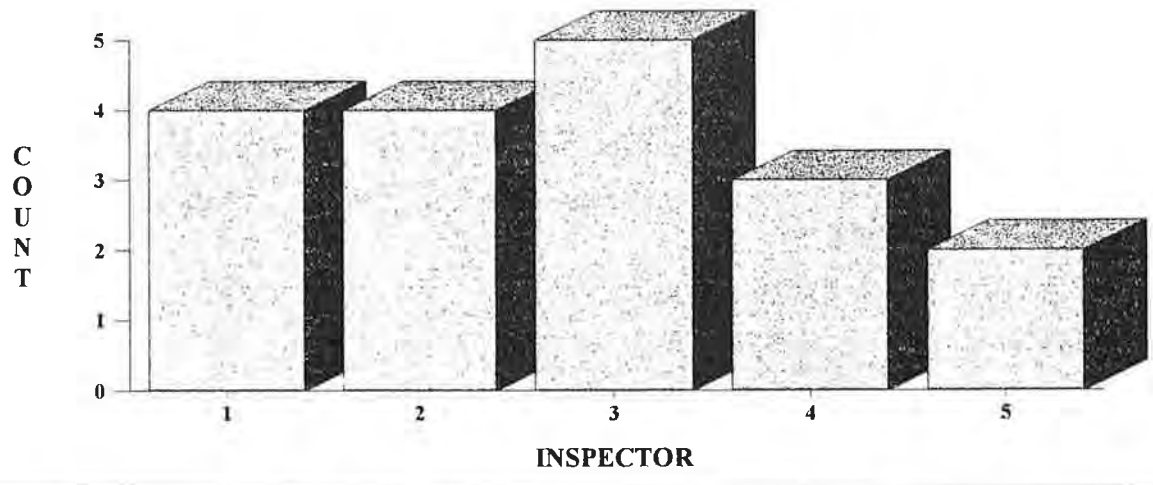
Inspections by Weed



Total Area by Location



Inspections by Officer



CivicView - Inspections Report

Inspector - 1

Report	Owner	Location	Inspection	Reinspect	Land Use	Plant Type	Density	Area (Ha)	Infested%
3	MS NITA LOUISE THOMAS	Seven Oaks	09/13/97	10/13/97	DAIRY	SALVINIA	Medium	2	15.14
6	NATIONAL BROADCASTING	Seven Oaks	09/13/97	10/13/97	GRAZING	COCOA LEAF	Heavy	4	18.32
16	MR DAVID NEIL DUFF	Toorooka	09/13/97	10/13/97	CLASS A RESERVE	GROUNDSEL BUSH	Light	45	50.15
34	MR JAMES ROSS KESBY	Belmore River	09/13/97	10/13/97	MIXED FARMING	BATHURST/NOGGOORA BU	Medium	20	61.17
								71	

Inspector - 2

Report	Owner	Location	Inspection	Reinspect	Land Use	Plant Type	Density	Area (Ha)	Infested%
2	MRS CECILY FORDYCE WAR	Seven Oaks	09/13/97	10/13/97	MIXED FARMING	GIANT PARRAMATTA GRA	Heavy	8	22.44
15	MR FRANCIS MAHONEY	Toorooka	09/13/97	10/13/97	MIXED FARMING	BLACKBERRY	Heavy	6	24.67
23	MR JAMES NEIL DUFF	Toorooka	09/13/97	10/13/97	MIXED FARMING	BATHURST/NOGGOORA BU	Heavy	20	29.4
33	MR WARREN WILLIAM BLAC	Belmore River	09/13/97	10/13/97	GRAZING	BLACKBERRY	Light	30	12.74
								64	

Inspector - 3

Report	Owner	Location	Inspection	Reinspect	Land Use	Plant Type	Density	Area (Ha)	Infested%
4	MR REUBEN PHILIP SUTHE	Seven Oaqks	09/13/97	10/13/97	MIXED FARMING	SALVINIA	Heavy	4	20.04
5	MRS EVEON GENEVIEVE RO	Seven Oaks	09/13/97	10/13/97	DAIRY	GROUDSEL BUSH	Light	5	29
12	WARBRO PASTORAL CO PTY	Toorooka	09/13/97	10/13/97	GRAZING	GROUDSEL BUSH	Heavy	3	0.94
17	MR MAXWELL FRANCIS MAI	Toorooka	09/13/97	10/13/97	MIXED FARMING	GROUNDSEL BUSH	Heavy	23	32.88
24	MR RICHARD JOHN EAKIN	Belmore River	09/13/97	10/13/97	none	MIST FLOWER	Light	2	5.01
								37	

Inspector - 4

Report	Owner	Location	Inspection	Reinspect	Land Use	Plant Type	Density	Area (Ha)	Infested%
9	MR JAMES NEIL DUFF	Toorooka	09/13/97	10/13/97	GRAZING	LANTANA (RED FLOWERE	Heavy	20	16.23
10	WARBRO PASTORAL CO PTY	Toorooka	09/13/97	10/13/97	GRAZING	LANTANA (RED FLOWERE	Heavy	5	15.32
36	MR JOHN BURDETTE SCOTT	Belmore River	09/13/97	10/13/97	GRAZING	BLACKBERRY	Medium	20	24.93
								45	

Inspector - 5

Report	Owner	Location	Inspection	Reinspect	Land Use	Plant Type	Density	Area (Ha)	Infested%
8	MR DAVID NEIL DUFF	Toorooka	09/13/97	10/13/97	MIXED FARMING	LANTANA (RED FLOWERE	Heavy	50	22.99

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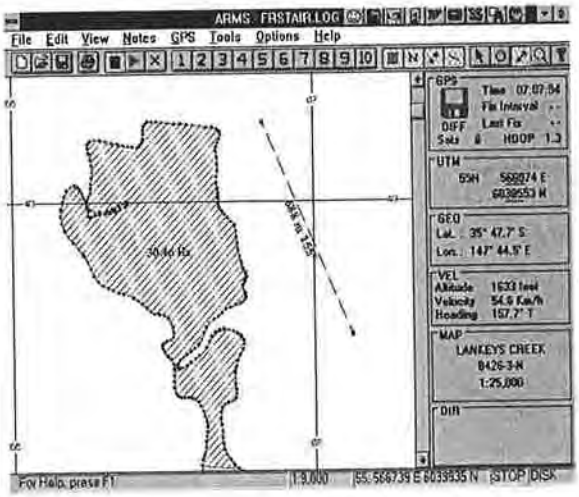

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COMMUNITY PARTICIPATION MAXIMISING ITS VALUE

Judith Rawling
Managing Director
Urban Bushland Management Consultants Pty Ltd, Sydney
3/31 Terminus Street, Castle Hill 2154

INTRODUCTION

This paper examines the current trend towards utilising community volunteers to carry out 'hands-on' bush regeneration, tree planting and other environmentally-based activities. Community participation is also encouraged by local government, with many groups acting in a watchdog or advisory capacity on environmental and related issues.

Government at all levels is committed to community participation, and nowhere is this better illustrated than through the Landcare Program managed by the NSW Department of Environment and Planning. At the National level, the Natural Heritage Trust is a new community-based grants program developed to identify worthwhile projects in the environmental arena, and to provide funds for their implementation.

For some years, funds have been available from State and Commonwealth government agencies for planning, research, education and field-based activities . Grants have been made available to government agencies, local councils and to Landcare, Bushcare and other community-based groups, as well as to individuals willing to accept the challenge of reversing land degradation in their local communities.

Community Participation – maximising its value is based on a paper delivered to a conference entitled Science and Technology in the Environmental Management of the Hawkesbury-Nepean Catchment, which was organised by the Institute of Engineers and held at the University of Western Sydney (Nepean) in July 1997.

This paper presented the results of a Community Action Database Survey by the Hawkesbury-Nepean Catchment Management Trust (the Trust), with supplementary information prepared by the author.

BACKGROUND

The Hawkesbury-Nepean Catchment is one of the most complex in Australia, covering 25,000 km2, and extending south from the Hunter Valley to Lake George, and west from the Sydney Basin to beyond Lithgow. The Catchment, which is home to 1 million people, is partly urbanised, but remains substantially rural.

When the Trust was established in 1993 by the State Parliament, there was a tremendous amount of community goodwill focused on improving the Catchment. Although its designated role was one of co-ordination (and not funding), the Trust resolved to 'kick-start' the vegetation rehabilitation process by establishing 'Operation Healing' – an $800,000 grants program available to the community and to local government which focused on much-needed remediation works, and on developing best management practices. Since that time, many

community groups have been formed within the Catchment through Landcare, Council's Bushcare programs, and through the various Catchment Management Committees. In an attempt to identify all individuals, groups and organisations carrying out vegetation management activities within the Catchment, the Trust prepared a Community Action Database Questionnaire (late 1996) which was widely distributed.

The community response confirmed that a large number of people were working as volunteers in a variety of capacities – as bush regenerators, seed collectors, propagators and tree planters. Volunteers are also preparing educational material, raising community awareness through newsletters and field days, and carrying out regular monitoring activities. School groups were particularly well represented (e.g. Streamwatch).

To complete the picture, the author undertook to contact by telephone, all councils and agencies which had not responded, to contact groups/organisations whose responses were ambiguous or unclear, and any bush regeneration contractors and volunteer groups known to be working in the Catchment.

SURVEY RESULTS

Focus Of Activity

Rehabilitation and bush restoration programs in the Catchment revolved around a number of foci. These can be divided as follows:

Community Volunteers	Bushcare, Landcare, Rivercare Groups Progress Associations, Tidy Towns Environmental/Conservation Groups Special Interest Groups
Local Councils	Council-funded bush regeneration contractors Council bush regeneration crews (in-house) Council supported Bushcare/Landcare Groups Reserve Management Committees
Government Agencies	National Parks & Wildlife Service Department of Land & Water Conservation (Landcare)
Other Relevant Bodies	Hawkesbury-Nepean Catchment Management Trust Catchment Management Committees Greening Australia Australian Trust for Conservation Volunteers Men of the Trees

It is obvious from reading survey responses, that the general community see many and varied ways of contributing to bushland conservation and management - not everyone has the capacity or desire to be a 'hands-on' bush regenerator or tree planter. Community groups (and government agencies) involved in education, facilitating, monitoring and in general 'lobbying' activities must be seen as active workers for the cause of bushland conservation. These activities deserve our political, financial and, wherever possible, 'hands-on' support.

What We Learned

There is no doubt that a large sector of the community is willing and able to help government and agencies such as the NPWS in the care and management of native bushland: to work hard clearing weeds and replanting degraded areas, and in re-creating habitat for native wildlife. Expanding community-based programs in all parts of New South Wales are ample proof of this commitment, and while the community retains its enthusiasm, our political masters will be forthcoming with grants and other forms of support.

In return for their efforts, the community make some requests. All these requests are eminently reasonable, but possibly because some items are so mundane, or commonly available to paid workers, they are often overlooked. Responses (written and oral) were grouped, and generally fall into the following categories:

- funding (discounts available to group, security of on-going grant programs)
- practical back-up support (eg: materials, tools, plant material [seed, tubestock], attention to point-source impacts)
- labour/members (everyone wants more!)
- technical advise (educational material, field days, database information , 'someone to ask')
- community nursery facilities, a workspace, or just 'somewhere to meet'.
- better management 'from above' (eg management plans & strategies to establish project goals and future directions)
- on-site leadership/direction to keep group activities on track, to train new workers, and provide enthusiasm
- help with group dynamics (to keep it going), financial management of grant funds
- moral/political support from council, government agencies and community in general
- networking between groups (sharing information, resources, experiences)
- recognition (a bit of thanks from time to time)

Looking at the wish list above, it is possible to pick out some items which are already catered for by various groups/agencies and by existing conservation-based programs. These are: funding sources, technical advise and networking, Indeed, there is a plethora of co-ordinators, facilitators and liaison officers around whose job is to do just that. How well this is done, or how much they interact is another issue - and one we cannot address in this forum.

Issues such as practical back-up support, access to facilities, and (in part) help with group dynamics are provided by councils with well structured Bushcare/Landcare programs or by related groups/organisations within the Catchment.

From the author's experience with community groups and with local government, I suggest that we often fail to address other issues which, if ignored, can and do lead to the demise of the best-intentioned community group. These include:

- lack of leadership and direction from council - enthusiastic groups are formed (often after a public meeting) and set to work by council officers who have not thought through their commitment, or considered the negative effects of 'setting a group loose' on a patch of bush, (eg. we have 20 people for a working bee on Saturday, where shall we put them?)

- failure to develop reserve management plans or rehabilitation strategies to give the group a firm direction, to streamline work activities in order to achieve sustainable results (eg first

we grow the trees because everyone wants to grow trees, then we have to look for somewhere to plant them!)

- failure to provide on-site leadership - a team leader or supervisor who can direct activities to the works plan, manage group dynamics, resolve conflicts, organise appropriate materials and other backup support and provide (correct) technical advice (eg. overheard at a local council - "we have a group working next weekend – is anyone free to look after them?").

CONCLUSION

While there are many community groups willing to give time and resources to restoring and managing native bushland reserves and parkland, there is an untapped resource, not only of labour but of goodwill and enthusiasm, waiting to be mined.

However, before that happens, agencies and organisations specialising in conservation-related programs must address the problems raised by those people already involved and remedy those omissions identified by the Community Action Database Survey and similar survey programs. While it is highly commendable (and necessary) to have a whole network of co-ordinators, facilitators and liaison officers, what the community wants is an increased commitment, better practical support and a presence at the coalface.

TAKE HOME MESSAGE

The message sent by existing community groups is clear.

- WORK WITH US!
- DON'T TELL US, SHOW US!
- BE THERE!

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NSW NOXIOUS WEEDS OFFICERS ASSOCIATION REPORT 1997

Bryson Rees
Wellington Council
Wellington

Following the Annual General Meeting a full new executive was elected along with regional delegates. Some fourty (40) officers attended the meeting with some complaints and successes being discussed.

To the outgoing committee, thank you for your work and efforts over your term in office.

The aims of the new committee will be to rebuild member numbers, coordinate training into one with two of the new committee currently working on a training program that will go to NSW Agriculture. A move will be made to speak with Local Government and Shires Association to seek recognition of our trade and not push it under "Truck Drivers" or "Beach Inspectors", etc.

Over the next twelve months a move will be made to have a representative from the local Government and Shires Association speak to us at our AGM in September 1998. Another high priority will be to have newsletters and other information coming to us, it has to be a two-way street.

One of the big incentives that is being worked on for financial members is exchange - six weeks working Study Tour to American in the winter of 1999. This will be done by a draw for financial members only with the draw being carried out at the AGM in September 1998. At this point, I must congratulate and thank past President, Kim Belairs for her work in this area and I hope that Kim's hard work will see the exchange program up and running. We will keep you informed on the progress.

Annual subscriptions are now due at $20 per year and it would be appreciated if these were paid by the end of November 1997, please. Just remember, you must be financial to be in the draw for the American trip. For those who are unaware, Ron Baker from Narrabri Shire was made a life member at the last meeting - congratulations Ron!

Another idea of the new committee is to look at the purchase of a tie for members to purchase, as there are no badges remaining. The full list of office bearers is:

President:	**Bryson Rees** 35 Oxley Circle Dubbo NSW 2830 Ph: (014) 636655	**Treasurer:**	**Kevin Nelligan** 98 Darling Street Cowra NSW 2794 Ph: (02) 63410100
Secretary:	**Roger Smith** "Mandalay" Ophir Road Orange NSW 2800 Ph: (019) 157895	**Publicity Officer:**	**Val Stubbs** 6 Burgundy Road Mudgee NSW 2850 Ph: (02) 63721300

Regional Delegates:

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The Rocks NSW 2655
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Ken Hayes
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Kevin Burton
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The Oaks NSW 2570
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Ian Borrowdale
77 Boorawine Terrace
Callala Bay NSW 2541
Ph: (02) 44293468

Jim Cherry
"Beaudell"
Quipolly NSW 2343
Ph: (02) 67461755

Val Stubbs
6 Burgundy Road
Mudgee NSW 2850
Ph: (02) 63410100

TAKE HOME MESSAGE

Communication creates happiness and growth, it takes all of us to make this happen. Be a part of it!

BIOLOGICAL WEED CONTROL AS A PART OF OVERALL WEED MANAGEMENT

D T Briese, W J Pettit and T L Woodburn
CSIRO Entomology\CRC Weed Management Systems, Canberra, ACT
J Fisher
NSW Agriculture\CRC Weed Management Systems, Orange, NSW

INTRODUCTION

In its early days biological control tended to be viewed as a panacea for weed management - a permanent solution that would replace other costly, time-consuming and environmentally-unfriendly means of control. This view was reinforced by well-known cases such as prickly pear, and more recently the narrow-leaf form of skeleton weed and the aquatic fern, salvinia, where introduced control agents were responsible for the reduction of enormous areas of weed infestation. However, such dramatic successes represent a small proportion of the 50-plus control projects that have been or are being undertaken against weeds in Australia. The more common story is for agents to make an important contribution toward the control of the target weed, but not to be able to reduce it to non-damaging levels at all times and in all places (e.g., St John's wort (Briese, 1997) and blackberry (Bruzzese & Lane 1996)). This is particularly so for terrestrial weeds that have long-lived seed banks, and increasingly weed biological control is being viewed as one of a number of options for managing weed populations.

Both the recent National Weeds Strategy (1997) and the NSW Weeds Strategy (1997) point out that, in most cases, the only practical sustainable options for managing weeds will involve an integrated approach using all available technologies. To date, however, there has been little conscious effort to incorporate biological control into overall weed management (but a notable exception is management of salvinia in Kakadu (Julien & Storrs, 1996)). It is more often considered a bonus that occurs independently of active weed control programs. The challenge for weed control practitioners is to build biological control, where it exists, into integrated approaches to maximise its impact and benefit from possible synergies with other control methods. However, because the life-cycles of biological control agents are no longer determined by human intervention once they have become established, such integration requires one to build the other control options, such as grazing management and herbicide usage, around the activities and impact of the agents.

This paper attempts to put biocontrol of weeds into a framework to develop an understanding of the potentials and limitations of biocontrol in agricultural systems, and to suggest what is needed in the way of research and weed control practice to maximise this potential. The paper addresses a number of topics:

- the legislative framework in which biological control must operate
- the scientific framework required to develop workable weed control strategies
- the practical aspects of delivering weed biological control
- realistic expectations of biocontrol agents and the role of landholders in maximising their impact
- integration of biocontrol with other weed management methods

THE LEGISLATIVE FRAMEWORK OF BIOLOGICAL CONTROL

The Australian Weeds Committee, members of which are drawn from Federal, State and Territory departments, is the body that declares a weed as a target for biological control. This recommendation then needs to be ratified by the Standing Committee on Agriculture and ultimately the Australian Agricultural Council before approval to implement biocontrol may proceed. The provisions of the Biological Control Act 1984 (Anon. 1984) also allow for declaration of target weeds, as well as providing a mechanism for the resolution of conflict of interests (see Cullen & Delfosse 1985).

The Noxious Weeds Act (Anon. 1993) makes no mention of the use biological control agents in the control of noxious weeds. However, policy is outlined in the Noxious Weeds Advisory Committee Policy Paper 4 (Anon. 1995) on the use of biological control in response to a notice to control a noxious weed. Landholders have a 'duty of care' towards their neighbours, and it is the responsibility of local control authorities (LCAs) to enforce the provisions of the Noxious Weeds Act and to prevent weed spread to other properties. The policy reiterates that biocontrol agents take time to build in numbers and to exert an influence on a weed population. Furthermore, it encourages the use of biological control in appropriate situations, and gives authority to the LCAs to decide at the individual property level whether biocontrol is appropriate or not. It does, however, state that landholders may not use it as an excuse for not carrying out their responsibilities under the Noxious Weeds Act. The policy recommends:

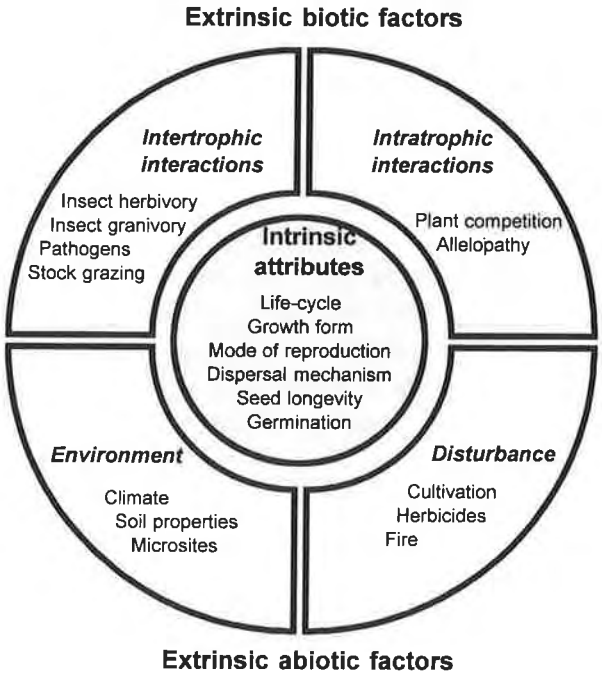
1. the use of a buffer zone between properties to protect neighbours,
2. that the time period for the continuance of this zone be specified, and
3. that regions be zoned into areas suitable or otherwise for implementation of biocontrol.

THE ECOLOGY OF WEED SYSTEMS

As well as a legislative framework, it is important to the success of biological control (and particularly to its incorporation into overall weed management strategies), that there is an appropriate scientific framework. The key to effectively manage weeds is an understanding of how the target weed affects and is affected by the system in which it occurs. This not only involves knowledge of intrinsic biological attributes of the weed, but also they way in which external factors, both biotic and abiotic, influence the dynamics of weed populations (Fig. 1).

Weeds have a range of intrinsic biological attributes, which are particularly important for biological control, as the life-cycle of the control agent is tightly linked to that of its host weed (see Briese 1993). Weeds may be annual, biennial or perennial; they may have grassy, herbaceous, shrubby or woody structures; they may reproduce vegetatively, by seed or both; they have different ways of dispersing and some may form large long-lived stores of viable seed in the soil. All of these properties need to be considered when selecting potential biological control agents and will have an influence on how successful an agent might be. For example, short-lived annual plants, such as heliotrope, may be particularly difficult targets for biological control. For this type of plant it is necessary to find an agent that can respond rapidly when plants germinate and build-up to effective densities within a season before the plants can set seed. Many insects are not capable of such a rapid response and the most likely candidate agents are pathogens. Some weeds that reproduce through seed alone (e.g., thistles) can be controlled by cultivation and cropping, whereas others that can reproduce vegetatively (e.g., skeleton weed) will only be spread by this means. Skeleton weed provides a good example of a biocontrol agent, the *Puccinia* rust fungus, with high powers of dispersal and increase that has been able to control a weed which does not have long-lived dormant stage.

Fig. 1. Schematic life-system of a weed showing factors that need to be considered or understood when developing control strategies.



Many weed species, such as Paterson's curse and the *Carduus* and *Onopordum* thistles, do have such a stage, in the form of a long-lived seed bank. This makes them particularly intractable for long-term control. Studies on the longevity of seed banks suggest that even with no further seed input it will take many years to exhaust seed reserves already in the soil. It takes four years for a 50% reduction in viable *Onopordum* seed in the soil, and if control is lifted and plants allowed to seed during that period the soil reserves are rapidly replenished (Allen & Holst 1996). Biological control, once in place, probably offers the surest way to maintain pressure on soil seed reserves, as it is the only option that will work independently of human intervention.

The biotic external factors may operate on the same trophic level, like plant competition, or may operate between trophic levels, in the case of herbivory. Both are amenable to manipulation; through pasture management / vegetation composition and stock grazing / biocontrol, respectively (Fig. 1). Abiotic factors fall into two types; environmental, such as soil properties and rainfall, which are not amenable to human modification, and disturbance, where humans can most directly intervene through herbicide applications, cultivation and/or fire (Fig. 1). In natural environments, some of these options are not appropriate (e.g., grazing management, broadacre herbicide use) and biocontrol becomes an even more important component of management strategies.

The life-cycles of weeds can have varying levels of complexity, and two extremes of this are given in Figs 2 and 3. Species with simple annual life-cycles (Fig. 2) generally germinate over a short period and develop as a single cohort thus allowing the use of control options such as well-timed herbicide applications or grazing management (e.g., restrict grazing prior to the germination period to enable competition from other pasture vegetation to reduce weed seedling numbers and vigour or graze strongly when plants are young and palatable). Often these individual methods are insufficient on their own, but combining these practices with

biological control may well enhance the effectiveness of agents that reduce vigour but do not kill plants (see Groves 1996).

Fig. 2. Life cycle of an annual weed without a long-lived seed bank and which does not reproduce vegetatively. (+ indicates a positive effect and - indicates a negative impact on the weed. Factors in grey are amenable to management intervention, those in black are not)

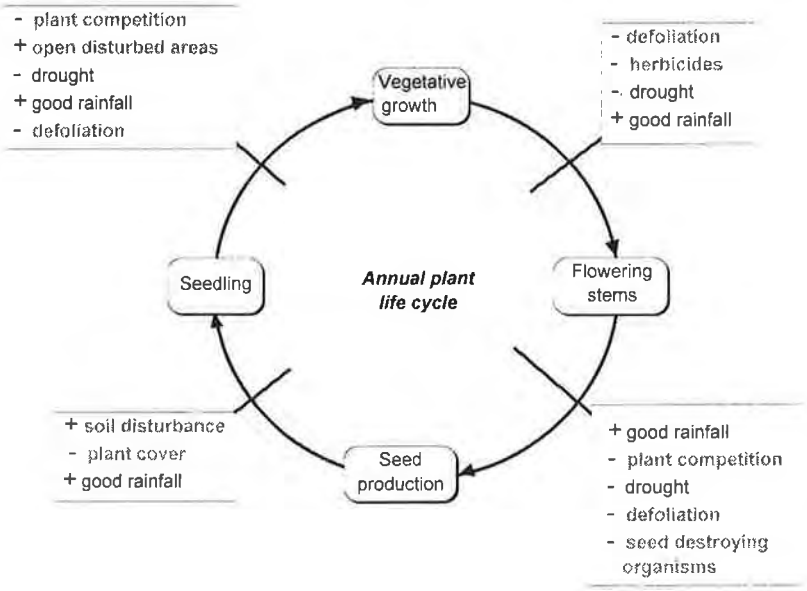
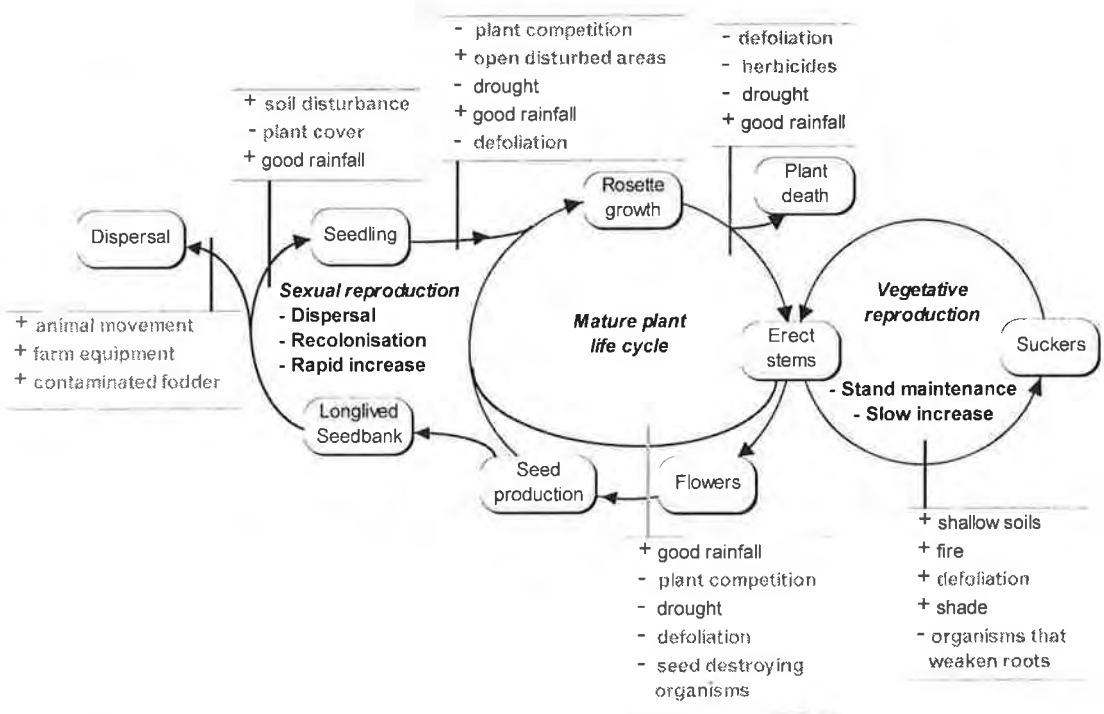


Fig. 3. Life cycle of a perennial weed with both vegetative and seed reproduction and a long-lived seed bank (e.g. St John's wort). (symbols same as for Fig. 2)



Complex life cycles (Fig. 3) need not necessarily make a weed more difficult to control. Although the weed has more ways of escaping from control methods (e.g., stimulation of vegetative reproduction by herbivory) or avoiding them (e.g., seed dormancy and soil-seed

banks), there are more possibilities for intervening in the life-cycle of the weed (Fig. 3). Many biennial and perennial broadleaf weeds spend a large part of their life-cycle as rosettes, which makes them vulnerable to a guild of meristem- and root-feeding biocontrol agents, as well as being susceptible to competition over a longer period. Failure to control the weed through attack at one point of its life-cycle should lead to research on its vulnerability at another. For example, while herbivorous *Chrysolina* beetles have had some impact on St John's wort, they have not been able to offer long-term or widespread control of it, as the weed can recover from defoliation due to large nutrient reserves in its roots and a capacity for suckering. This led to research for agents that could exhaust these root reserves and slowly kill the plants, resulting in the release of the highly promising *Aculus* mites (Briese 1997). Long-lived soil seed reserves pose a special problem, but can be attacked from two aspects; prevention of germination through pasture management and plant competition, and long-term reduction, through the prevention of seeding. It is here that biological control agents can be particularly useful.

Germination requirements can have an effect on the success of different control methods. For example, *Onopordum* thistles can germinate in several flushes over much of the year (Pettit *et al.* 1996), producing stands of varying age and herbicide tolerance, thus making control difficult. However, if the trigger for germination is known, such as the case of fire and bitou bush, this can become a management tool, by stimulating massive germination and then applying a second control measure at the vulnerable seedling stage (see Holtkamp, Vol 1 pp 74-77 of these proceedings).

A thorough understanding of weed ecology is not only necessary for improving the success of biological control, it is critical for any integration of biological control into weed management strategies. It is not only important to identify where in the life-cycle of the weed a control option can be successfully applied, but to know whether intervening at that stage is going to be effective in the long-term, i.e., does it matter if we can kill 90% of seedlings if most would have died through plant-thinning anyway and the remaining ones can still form an infestation that causes problems. One way to do this is by modelling the weed population dynamics (see Shea 1996). This can enable the critical transitions in a weed's life-cycle to be identified (e.g., is it more effective to reduce seed output directly or to target the young or mature rosettes in a broadleaf weed). It can also determine the target control levels needed and predict how well agents are likely to achieve these. For example, a model by Shea & Kelly (see Shea 1996) predicted that in New Zealand, seed reduction levels of 65% would be necessary to cause decline in nodding thistle densities. Such models are also useful tools for studying the impact of other weed control options, such as grazing management and tactical herbicide usage. A detailed understanding of weed ecology is, therefore, the key to integrating the various options and producing more effective management strategies.

RELEASE AND ESTABLISHMENT OF BIOLOGICAL CONTROL AGENTS

All biological control of weeds projects have several common sequential stages. These are:

1. the initial exploration phase, in the target weed's native range, for potential pathogens/arthropods;
2. the quarantine phase, where the selected agents undergo host testing to demonstrate their specificity;

3. the release and redistribution phase which can be subdivided into 3 stages of varying duration: years 1-3, the initial releases, usually of a research nature: years 2-4, releases made by State collaborators: years 3-6, rapid expansion of redistribution networks; and
4. the monitoring of agent performance phase.

The initial exploration phase

The underlying philosophy of both weed and insect biological control is that an exotic pest is such because it has been introduced to its new environment free from those organisms that limit population growth in its native range. Biocontrol science endeavours to restore an ecological balance in the new environment that existed in the native one. The selection of potential biocontrol agents is a crucial part of any biocontrol project. Such selection is made, not only in the target weed's native range, but if possible in the centre of origin of the weed, e.g., whilst skeleton weed occurs throughout Europe, north Africa and western Asia, its centre of origin is in Turkey, where the search for strains of the rust fungus *Puccinia chondrillina,* that would infected unattacked strains of the weed found in Australia, has been concentrated in recent years. The prime consideration of strict specificity greatly reduces the number of potential agents.

Selection of potential organisms is helped by detailed, intensive study and sampling of the weed. This leads to an understanding of its life cycle and the influence of arthropods and/or pathogens on limiting weed population growth. Recent European studies on thistles illustrate this point well. Seed production in nodding thistle, *Carduus nutans*, which is (mostly) a biennial species, was reduced by up to 99% by four insects that attacked the seed heads (Sheppard *et al.* 1994). Soil seed banks were found to be an order of magnitude lower in Europe than in Australia, hence the decision was made to initially concentrate on insects that limited seed production (Woodburn 1993, Woodburn & Cullen 1995). In marked contrast, a similar study on the annual slender thistle, *Carduus pycnocephalus*, found no evidence that insect herbivores were limiting seed production in this system, although these two thistle species overlap in Europe and share over 90% of insect species (Sheppard *et al.* 1991). However, the latter study identified a rust fungus, *P. cardui-pycnocephali*, as the agent that offered the most potential, and this was eventually imported into Australia (Chaboudez *et al.* 1993) and released.

When potential agents have been identified in the home range of the weed, basic studies on their biology are carried out, if these are poorly understood, in order to facilitate rearing under quarantine conditions in Australia. Preliminary host specificity testing against closely related plants of economic importance may be undertaken at this stage, e.g., testing globe artichoke in thistle biocontrol projects.

The quarantine phase

Permission to import a biological control agent into quarantine must be obtained from the Australian Quarantine and Inspection Service (AQIS) and Environment Australia (EA). Insects that originate from the northern hemisphere require synchronisation with the season in Australia. Insects shipped in diapause must spend several months at low temperatures to simulate a European winter. Conversely, if ovipositing adults are shipped, plants at the right stage need to be provided, e.g., when *Melegethes planiusculus* was introduced, flowering Paterson's curse had to be provided during the Australian winter.

The quarantine phase has three very important functions. Firstly the agent, be it arthropod or fungus, must be reared through at least one generation to ensure that it is free of its own pests and diseases, e.g., *Rhinocyllus conicus* release was delayed for 12 months whilst the culture was screened of the debilitating protozoan disease *Nosema* sp. (Woodburn & Cullen 1995). Secondly, it is necessary to demonstrate that the agent has a very limited host range, preferably restricted to the target weed and its close weedy relatives. The importing organisation draws up a host test list, incorporating plants of both economic and conservation importance. This list must be agreed to by 21 federal, state and territory agencies drawn from both agriculture and conservation areas. Test plants are, in the first instance, those that belong to the same genus as the target, then representatives of the same tribe, and other tribes, within the same family. Plants may also be included from closely related plant families. Commonsense applies to the inclusion of each species, i.e., if testing a stem boring insect it is pointless to include plants that never form a stem.

Testing of arthropods is usually done first with 'no choice' tests, where sexually mature insects are introduced into cages containing the test plant. In some cases there can be adult feeding damage and/or egg laying under such a severe test. When this happens 'choice' tests are used, where the test plant and the target weed are offered in the same cage. In practice if a confirmed positive test is observed in very closely related plants, testing will cease and the insect colony destroyed. Host testing is very demanding on both labour and time, but is absolutely essential to ensure the safety of weed biocontrol. The host testing method is very artificial and can indicate a wider than expected host range. Testing of the leaf hopper *Tettigometra sulphurea*, a potential agent for *Onopordum* thistles, showed that oviposition and larval development occurred on globe artichoke, which is a commonly cultivated in Europe, but has never had this insect recorded as a pest. Once it has been established that neither plants of agricultural or environmental importance are under threat, permission is sought from AQIS and EA, via the 21 reviewers, for its release. The rigour of host testing is attested to by the fact that so far there has not been, anywhere in the world, attack on non-target plants that had not been foreseen and deemed acceptable by reviewers. Finally, the founder culture of the agent must be reared for release into the environment. This is usually achieved in conjunction with the host testing, since the agent is returned to its weed host between individual tests to ensure that the insects are still reproductive.

The release and redistribution phase

The initial release of an agent is generally done with very low numbers of insects, since rearing conditions in quarantine are of necessity artificial, and often far from ideal. The agent is usually caged over the target weed to prevent early dispersal and allow the insects to easily find mates, and also to help the researcher monitor the progress of the release. Field establishment of the agent and build up in numbers sufficient to permit redistribution may take from one to several years. This time lag is mainly due to biological attributes of the control agent, i.e., the egg laying potential and the number of generations per year. Biotic factors such as availability of the weed and rainfall at the right time may also be important.

The next phase in release and redistribution is the provision of starter colonies to State collaborators, such as Departments of Agriculture and Departments of Conservation, for them to establish nursery sites. This technology transfer involves more than just handing over the control agent. The researchers involved in the initial part of each project prepare detailed notes on all aspects of agent rearing and establishment. These include the biology of both weed and insect, with emphasis on the critical part of these cycles for intervention by the

landholder. Information is also included on current best practice for managing the nursery site to ensure a regular supply of the weed.

Increasingly over recent years there has been a tendency to form redistribution networks to systematically redistribute the biocontrol agents, initially at strategic points within the range of the weed. These networks are developed by CSIRO, the State agencies and Shire Weed Officers and usually rely on the involvement of community based organisations such as Landcare. The role of community involvement in these redistribution networks has recently been extensively reviewed by Briese & McLaren (1997). The third phase of redistribution is at this local level, with the State collaborators harvesting agents from their nursery sites and passing them on to the community based groups. Here the emphasis is on establishing release sites on individual farms for further rearing and local dispersal within and between farms.

The monitoring of agent performance

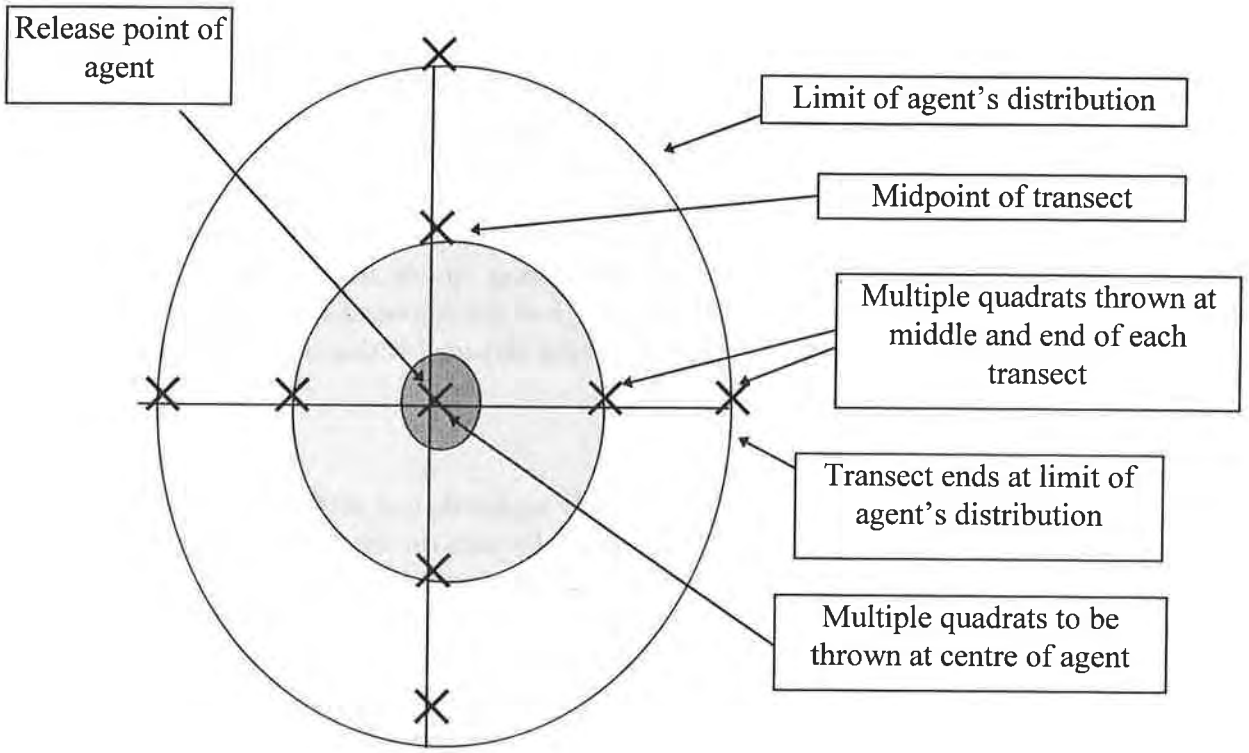
This crucial part of a biocontrol project is typically undertaken at different levels of intensity. Initially, detailed assessment by the research team focuses on the impact of an agent at the micro level e.g., extended regular sampling of individual weeds or small weed patches. This detailed study is expanded to the plant population level as agents begin to disperse. Such studies involve regular sampling of the target weed to document the interaction between weed and agent. Emphasis is placed on such parameters as growth and development of the weed and whether its reproductive potential is limited by the released agent. In those systems where it is appropriate the soil seed bank is also closely monitored. Two examples of agent performance on St John's wort and nodding thistle are reported by Jupp & Cullen (1996) and Woodburn (1996), respectively.

The second level of monitoring occurs at the State level by the State collaborators, where an annual measure of spread and impact is assessed at a few selected sites over the range of the weed infestation. The aim here is to obtain quantitative data on the spread and number of the agent present at 10 representative sites throughout the weed's range. Spread is assessed by recording the distance from the release site to the furthest attacked plant in the four compass directions Fig. 4). Severity of attack is recorded by counting attacked plants in randomly placed quadrats at the release site, at the limit of distribution of the agent and at a point midway between. Ideally at least 10 counts should be taken at each site and records are entered onto a data base by the collaborators.

The third level of monitoring is simpler, and data on establishment and spread are recorded as above, but without plant counts. This level of monitoring, designed to monitor agent establishment, should be undertaken at all initial release sites on any given farm or conservation area. Records are collected by the collaborators and similarly entered onto the data base.

This sampling protocol has been designed to assess agent impact over the range of the weed in Australia. Estimates of insect numbers and attack rates at all sites for which establishment is noted can be inferred from the more detailed data collected at the selected monitoring sites. Similarly assessments of agent impact on weed performance can be made by using the detailed data collected from the research sites.

Figure 4. Schematic diagram of transects running through biological control agent release site for monitoring purposes



LANDHOLDER COMMITMENT AND CONTRIBUTION TO BIOLOGICAL CONTROL

There is enormous potential for biological control agents to reduce the significance of certain weeds in pasture situations, since, in the absence of natural predators and parasites, they have the potential to establish populations that are much larger than any to be found in their native range. When a number of biocontrol agent species that attack different stages of a target weed's life-cycle are established, this potential for impact on the target weed is even greater. As more agents are released through New South Wales for the control of weeds, landholders, county council weeds officers, district agronomists and Landcare groups will increasingly become more involved in the redistribution of biological control agents around the state. What then must landholders do to maximise the impact of control agents on individual weed species, and what are the realistic outcomes of biological control projects?

Agent impact on the weed

Biological control agents are released in the hope that they will establish at a release site, that their population will increase locally to a level where damage will impact upon the weed infestation, and that the population will gradually spread out into the surrounding weed infestation. At low numbers, it is likely that a population of biological control agents will impose a very small stress on their host plant and do little to change the dynamics of the plant's life cycle. At high numbers, biological control agents can impose major stresses to a plant at different stages of its life-cycle. Such stresses can compromise a plant's ability to set seed, reduce plant vigour making it less competitive with beneficial pasture species, or even kill the plant. It is therefore essential that a large effort is invested in establishing agents throughout the range of the target weed and in ensuring that established agents are given the best conditions for spreading through local weed infestations.

Assisting establishment

In the early stages of release and establishment a very small population of an agent (often less than 100 individuals) is surrounded by large infestations of its host plant. Dispersal from the release site into the surrounding weeds can mean that males and females cannot locate each other to mate. Alternatively, egg laying may be so dispersed that the resulting progeny will have difficulty in locating mates.

To assist establishment at release sites, shadecloth field cages are often used to prevent initial dispersal of agents. Once egg laying has been observed on plants within the cage, it is often then removed to allow the agents to disperse. As a further measure of protection, the release site must be fenced to provide the agents with an area of weed infestation that will be undisturbed by the activities of stock or the landholder.

Giving the agents a chance to spread

Allowing a small population of biological control agents to establish in a fenced area will amount to very little if there is no surrounding weed infestation for the agents to colonise. The release site and its immediate surrounds should be treated as a sanctuary for biocontrol agents. Rocky headlands, hillsides or lightly timbered areas are often areas that are not priorities for weed control by a landholder. It is likely that such areas would have been given a low priority for weed control for many years and are unlikely to see improvement by cropping or herbicide application in the future. Such sites are ideal for agent release and local build up of the population. However, successful establishment and spread often requires active participation of the landholder to ensure a continued supply of the weed in and around the nursery site.

Information kits are prepared for each biological control agent that is released. These kits provide information on the ecology of both the agents and the weed, and include specific instructions on how to manage the release site to maximise agent establishment and spread.

Redistribution of agents

Although all biological control agents are capable of dispersing by themselves, a faster coverage of the local weed infestation can be accomplished if landholders set up new release sites about their property. Without an active redistribution effort, agents may take many years to spread from a single release site to all infestations on a property. Land-use differences between paddocks may provide natural barriers to dispersal of agents to distant infestations, and prevailing winds may play a part in limiting spread in a given direction. By setting up multiple release sites on a property, a landholder effectively reduces the amount of time that it would otherwise take for an agent to disperse over target weed infestations.

Availability of agents

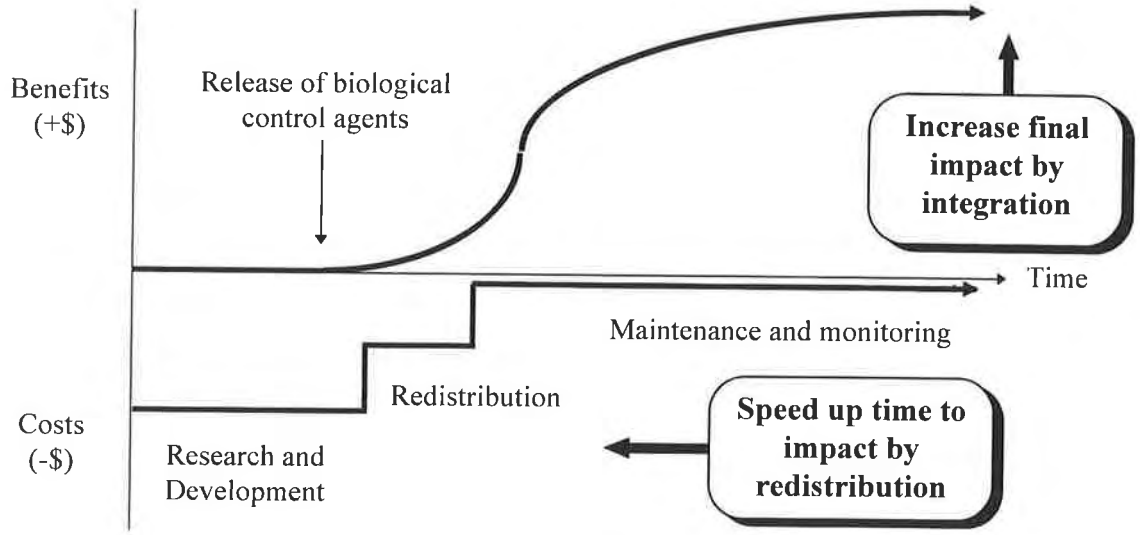
As described previously, host-specificity testing is logistically difficult and very time consuming, so that the testing of all the potential agents for a given weed cannot be done concurrently. What this means for the landholder is that not all agents are necessarily available for redistribution at the same time. For example, while a number of agents are being actively redistributed, some may still at the establishment phase and yet others in quarantine undergoing testing for their specificity. In the case of *Onopordum* thistles, the first agent (the seedhead weevil *Larinus latus*) was released in 1992. A further two agents have been released

and another is approved for release in 1997. Additionally, three potential agents are currently undergoing testing in CSIRO quarantine facilities and will hopefully be released into the Australian environment in 1998 and 1999.

The best chance for maximum impact

Biocontrol agents may reduce plant vigour or even kill their host plant and, in doing so, improve the productivity of the pasture or biodiversity of the natural environment. Others may reduce seed set, leading to a long term reduction of germinable seed in the soil for those plant species with long lived seeds (e.g., *Onopordum* and *Carduus* thistles, scotch broom, Paterson's curse). However, these benefits of biological control programs are never available immediately upon release of the first agent. The maximum impact on a weed species can often only be realised when all potential agents are distributed and well established over its range.

Fig. 5. Schematic diagram showing how the costs and benefits of a biological control project accrue over time and the two main ways of maximising benefits from the project.



Clearly, expectations of impact of biocontrol agents may vary between practitioners of biocontrol and landholders. The principal difference in expectations is likely to be the amount of time that it will take to establish a number of different agents at a release site, and the amount of time it will then take for those agents to increase in population and spread in order to have broad scale impact upon the target species. Biological control is not, and indeed cannot be, a short term control option for control of weed species. As has been stressed elsewhere in this paper, it is a very useful and powerful part of any weed management program that must be incorporated with other management practices to control weed infestations. Nonetheless, this weed management tool has the potential to greatly reduce, or to even eliminate, a landholder's reliance on chemicals to control targeted weed species in land under their care. An idealised representation of these processes in terms of costs and benefits is presented in Fig 5. Obviously, as illustrated here, landholder participation is an essential component in the accrual of benefits. Contacts for obtaining biological control agents for a number of weedy species in New South Wales are given in the Appendix.

INTEGRATION OF HERBICIDES, GRAZING AND BIOCONTROL

To date biological control of weeds has been used as a 'stand alone concept'. In reality this mentality is putting excessive strain on what is already a delicate balance. To exploit biological control agents (insects, mites and plant pathogens) to their full potential, consideration must be given to a fully integrated approach incorporating grazing livestock, perennial pastures and herbicides (Fig. 5). Already the spray-graze technique is utilised by farmers to capitalise on grazing stock, sublethal herbicide rates and competitive crops or pastures to obtain superior and cheaper control results. Readers are referred to Dellow in volume 1, pp 78-80, of these proceedings for a detailed discussion of the spray-graze technique.

The next step is to incorporate biocontrol agents into the system. However, the possible harmful affects of herbicides on the efficacy of biocontrol agents needs to be assessed as well as the timing of strategic grazing of livestock to avoid averse results. Preliminary studies by Smyth & Sheppard (1996) indicate that herbicides did not affect rosette feeding biocontrol agents of Paterson's curse, while simulated grazing did reduce their numbers, though to a lesser extent once more mature larvae had reached the rosette crown. The implications are that, to maximise the survival and impact of biocontrol agents in the field spray-grazing would need to be delayed to the end of the period in which it is considered effective (i.e., until late June). Field experiments are clearly needed to see if the combination of these techniques does give improved control. However, it is also critical to remember that it is not easy to manipulate the numbers of control agents; they cannot just be added to an integrated weed management recipe. For benefits to be obtained, it is necessary that the agents are already in place and are having a measurable impact. Through research such as described above, other management options, such as timed herbicide applications and timed grazing, can be built around agent activity to complement it and augment the degree of control.

TAKE HOME MESSAGES

- Biocontrol is a target specific, environmentally friendly means of reducing specific weed populations - it does not eradicate them over wide areas.
- Biocontrol and the Noxious Weeds Act are compatible
- Biocontrol is not a panacea - in most situations the only practical sustainable option is an integrated approach using biocontrol, herbicides, grazing management etc.
- To achieve a good integrated weed management strategy you need a good understanding of the weed's ecology.
- Integrated strategies involving biocontrol need to be designed around the agents - they cannot be added like a recipe, as they must be actively in place and that requires time.
- The final impact of agents can be maximised via integration and the time to achieve this can be sped up by effective redistribution.
- Landholder cooperation is essential to speed up the redistribution and hence time to impact of agents.
- Monitoring of spread and impact of biocontrol agents is as necessary a part of the process as distribution of the agents.

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APPENDIX: Primary contacts in CSIRO and NSW Agriculture for obtaining biological control agents

Contact	Address	Area covered	Weeds for which agents may be available
Barry Sampson	PMB Yanco 2703	Riverina, South and Central Western Slopes, Southern Tablelands and South Coast	Paterson's curse St John's wort Spear thistle
Paul Lutschini	PO Box 174 Mudgee 2850	Central Tablelands NSW	St John's wort Nodding thistle *Onopordum* thistles
Bob Smith	PO Box 1 Bingara 2404	New England, Western Slopes	Nodding thistle Paterson's curse
Paul Sullivan	PMB 994 Tamworth 2340	North Western Slopes, North Coast	Nodding thistle Paterson's curse Bitou bush
Anthony Swirepik	GPO Box 1700 Canberra 2601	Central and Southern Tablelands	*Onopordum* thistles

ALLIGATOR WEED

IT CHOKES RIVERS AND IRRIGATION SYSTEMS AND IS EXTREMELY DIFFICULT TO CONTROL

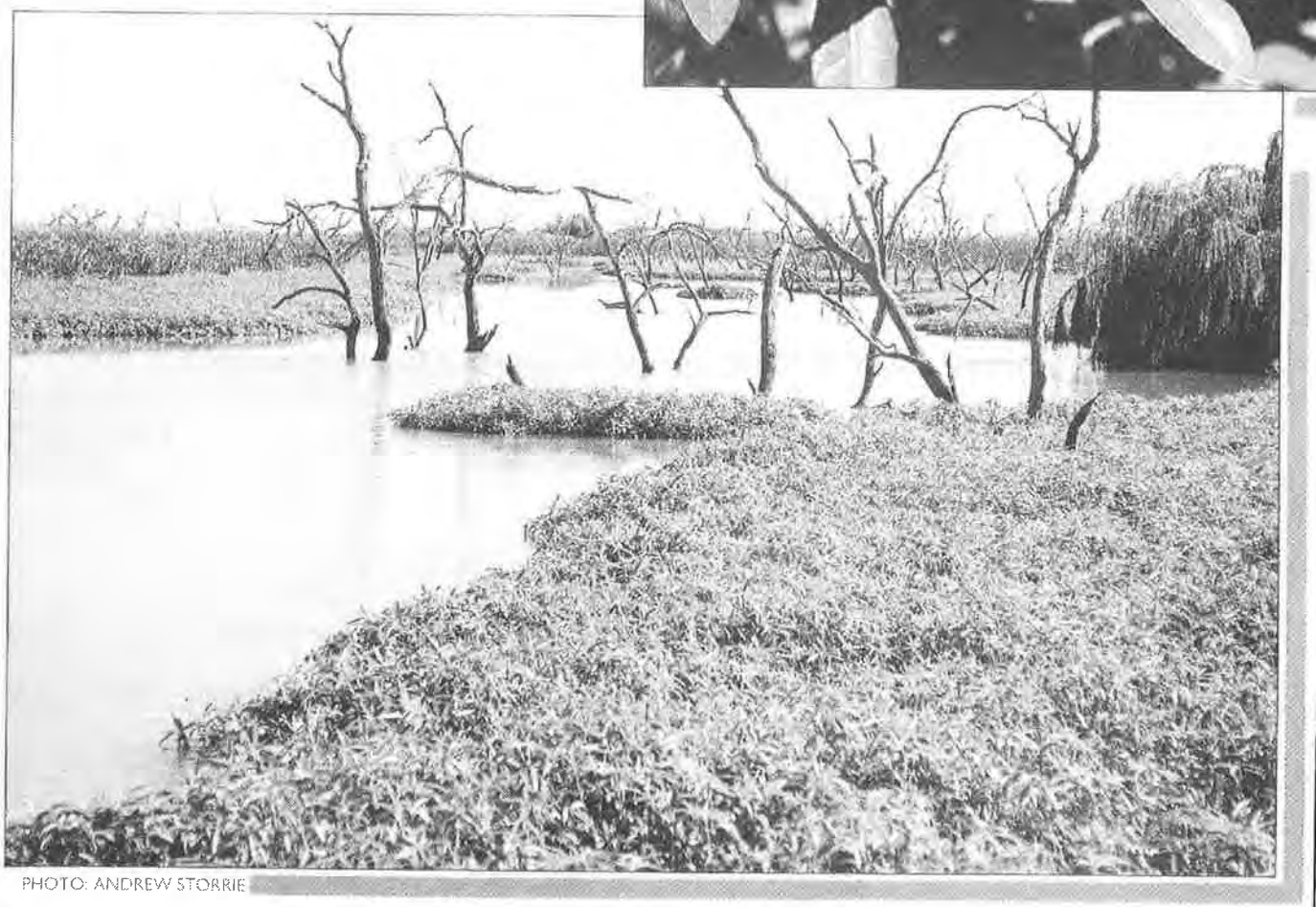


PHOTO: ANDREW STORRIE

"CAN YOU IDENTIFY IT?"

If you see any plant that looks like this contact NSW Agriculture or your Local Council *IMMEDIATELY*

NSW Agriculture
Alligator Weed Taskforce

MURRAY-DARLING BASIN COMMISSION

CHANGING COMMUNITY ATTITUDES

Graham Matthews
Bellingen Shire Council

INTRODUCTION

I have been involved with the Bellingen Shire Council's Noxious Weed Control Program for a period of 18 years. I have not attained the positon of Chief Noxious Plants Officer. During this time I have witnessed the arrival of many settlers to the Shire and noticed vast changes to both farming activities and noxious weed control methods.

HISTORY

Up until 1982 noxious weed control was relatively simple, main concerns being woody weed control such as lantana, blackberry, English broom and groundsel bush.

In 1992 Coffs Harbour City Council, Nambucca Shire Council and Bellingen Shire Council requested that Giant Parramatta Grass (Sporopolus indicus var. major) be declared a noxious weed.

Council and some landowners were then confronted with a new problem - as this was a pasture weed there were no simple control methods, thus forcing a greater reliance on agronomy. Agronomists Dick Latham from Coffs Harbour, and Max McMillan from Glen Innes had carried out some limited control work but there were still many unanswered questions.

In my capacity as Chief Noxious Plants Officer, I then proceeded to organise a public meeting in Bellingen to discuss Giant Parramatta Grass control measures. Invitations were extended to agronomists and chemical companies, as well as to Dr Surry Jacobs, Taxonomist, Royal Botanic Garden, Sydney; and Mr Harvey Baker, former Residue Chemist, Rydalmere Research Station, both leading experts in their fields.

Over three hundred people showed their concern by attending the meeting. The consensus of opinion at this meeting from the experts was that the most efficient and effective control method was the use of Frenock as part of an integrated pest management program, which includes pasture improvement. (A book of these proceedings has been published.) The main problem then, as is now, is the withholding period of Frenock.

A search was then mounted to attempt to find a suitable alternative for a mechanical/physical/ quarantine control method which could be implemented by both Councils and landowners.

LOBBY GROUPS

Pressure was being applied through landowner groups to the Department of Agriculture and the Government. The Minister agreed to appoint two agronomists each spending 50% of their time of Giant Parramatta Grass research - Dr Peter Mears and Mr Terry Launders. Council then conducted a series of public meetings, field days, trials, and a committee was formed.

ENVIRONMENTAL GROUPS

Environmental groups began to emerge and to lobby. In the Bellingen Shire groups such as the Toxin Action Group (TAG), Kalang Environment Group (KEG), and the Bellingen Environment Centre (BEC) started to apply pressure on Council, requesting detailed information on toxicity of the chemicals, advertising of spray operations and information on environmental and health aspects of the chemicals used.

Council responded by obtaining all available information from the National Registration Authority and other bodies and notified all landowners of spray operations through the local radio station 2BBB. The announcements were to be made the morning of spraying, advising the location of spraying, the chemical used and the withholding period. When environmental groups requested additional information on the chemicals used, a copy of every label and material safety data sheets (MSDS) were supplied to the local radio station to broadcast any information that they saw as relevant.

ADVERTISING PROBLEMS

Early in the morning when the decision was made where and when to carry out the control spray program, I would telephone the radio station and talk to the operator. If she/he were on air, I would leave a message on the answering service. After I had been accused of not leaving messages on the answering service, it was resolved that faxes be sent to the radio station; I was also accused of not sending the faxes. Now faxes are transmitted and recorded by an independent person.

PRESSURE

Additional pressure was also being applied by farmer groups through the media and local members. The NSW Noxious Plants Advisory Committee allocated a grant of $50,000 to Giant Parramatta Grass research.

Agronomists on the North Coast were galvanised into action and conducted meetings, field days and trials, advertised extensively on radio, in the newspapers, on TV and printed brochures and posters. Additional money provided by local councils and private enterprise was spent on research and a committee was formed. This committee still exists today and is known as the NSW Northeast Noxious Weeds Advisory Committee.

MORE PRESSURE

Environmental groups began to apply additional pressure on Council. Council responded by inviting members of the NSW Noxious Weeds Advisory Committee to hold meetings with both Council and environmental groups in the Bellingen area. Mr Roger Toffolin, Registrar of Pesticides was also invited to attend a meeting with Council and environmental groups.

EVEN MORE PRESSURE

As pressure was now also being applied by farmer groups through the usual channels, it was decided that Mr Terry Launders, Agronomist, Taree be put in charge of the Giant Parramatta Grass Program and Council conducted meetings, trials and field days, etc.

PRESSURE FROM ALL ANGLES

The Giant Parramatta Grass issue, along with the withholding period of Frenock and the search for alternate control methods was becoming a powder keg on the North Coast. It was decided that a delegation of noxious weeds inspectors hold discussions with Mr Doug Hocking and Mr John Fisher from the Department of Agriculture at the 1995 Eighth Biennial Conference at Goulburn.

It was not until it was brought to the attention of Mr Hocking and Mr Fisher that environmental groups had combined and threatened an injunction to stop the use of herbicides, particularly Frenock in noxious weed control in the Kalang valley, that action commenced in the form of an injunction. The legislation being used to push for the injunction was the NSW Clean Waters Act.

ACTION

Mr Doug Hocking and Mr John Fisher met with Council and environmental groups. The statement causing most concern was made by Mr John Fisher who said that Council would require a licence under the Clean Waters Act before they could use herbicides in the Kalang valley.

NEW AGRONOMIST

The Department of Agriculture then appointed another agronomist, Mr Andrew Storrie from Tamworth to work on the problem. Following several meetings, a committee was formed, conducted trials and then formed a sub-committee. This sub-committee is overseeing a roadside management plan that is, at present, being prepared to be submitted to Council.

NEW ADVERTISING PROCEDURES

Council has now adopted a new advertising procedure and issues the following brochure:

"BELLINGEN SHIRE COUNCIL

NOXIOUS WEEDS ACT, 1993

The objects of the Noxious Weeds Act, 1993 are as follows:

- *To identify weeds in respect of which particular control measures need to be taken;*
- *To specify those control measures;*
- *To specify the duties of public and private landholders as to the control of those noxious weeds; and*
- *To provide a framework for the Statewide control of those noxious weeds by the Minister and local control authorities.*

Unlike the Act that if replaced, the Noxious Weeds Act has control categories that apply to each noxious weed. The categories are W1, W2, W3 and W4, with W1 being referred to as a 'notifiable weed'.

The action required to be taken under the Act to control a noxious weed for which a particular control category is specified is set hereunder:

- *For a W1 noxious weed, the presence of the weed on land must be notified to the local control authority and the weed must be fully and continuously suppressed and destroyed;*
- *For a W2 noxious weed, the weed must be fully and continuously suppressed and destroyed;*
- *For a W3 noxious weed, the weed must be prevented from spreading and its numbers and distribution reduced; and*
- *For a W4 noxious weed, the action specified in the declaration must be taken in respect of the weed.*

The Act stipulates that occupiers (or owners) of land have responsibility for controlling noxious weeds on their land whilst Councils are responsible for controlling noxious weeds on their Public Roads.

Councils traditionally have controlled noxious weeds with herbicides because that was considered to be the most cost effective way to solve the problem.

In recent years, there has been increasing expressions of community concern about the use of herbicides and Bellingen Shire Council, with the assistance of its Noxious Weeds Advisory Committee, has been reviewing Council's roadside spraying policies and practices. This brochure sets out some of the current policies for your information and assistance.

Notification of Noxious Weeds Spraying

The Council acknowledges that many of its residents are opposed to Council's practise of using herbicides on road reserves and is now actively encouraging these residents to control noxious weeds on the road reserve using alternative methods.

Council has adopted a policy which, put simply, requires it to advertise its intention to spray herbicides along a public road for a two week period prior to the proposed operations.

As well as the advertisements, Council erects signs which are red on white, which indicate the date the road is to be sprayed, the chemical proposed to be used and the withholding period.

this notification process provides adjoining property owners with an opportunity to let the Council know that they are prepared to control noxious plants without using herbicides.

Once Council is notified, a sign (black on white) is supplied for erection adjacent to the property and it is then the property owner's responsibility to control the weeds within two months. Failure to do so will lead to Council taking action without further notification.

Liability of Land Owner/Occupier

If the property owner or occupier notifies Council of their intention to control noxious plants on the road reserve, the following requirements apply:

a) Purchase that number of signs from Council which you require for your road frontage(s), i.e., each end of each property. The signs cost $5.00 each.

b) Erect the signs as in (a) on your property fence(s), or in a visible location clear of the roadway and table drain, and maintain these signs during the advertised period plus two (2) months.
c) After advertised period and as in (b) above, remove the signs and store for future use.
d) Suppress and destroy the noxious weeds on those road frontages, particularly during the advertising period. Should you have any doubts, please contact Council's Noxious Plants Officer, Mr Graham Matthews.

Roadside Management Plan

Council is striving to attain Best Practice in all its operations and weed control is no exception. Council is committed to a Roadside Management Plan utilising integrated methods of controlling noxious weeds and unwanted vegetation whilst optimising the value of roadsides throughout the Shire.

The Council is currently seeking funding to employ a coordinator to prepare the Bellingen Shire Roadside Management Plan and it is anticipated that it will take some months to complete."

Many problems still exist:

- Weather conditions;
- Machinery breakdowns;
- Advertising required on roads when there is minimal work to be done;
- People stealing signs;
- Signs being erected on land people do not own;
- Insurance problems, etc.

ENVIRONMENTAL PROTECTION AUTHORITY (EPA)

The Environmental Protection Agency held meetings with the representatives from both Council and environmental groups. It was decided to carry out chemical trials on roadsides using worse case scenario conditions to monitor herbicide movement.

PRESENT POSITION

The EPA results have been released but not at a press conference as originally promised. This has allowed environmental groups to lobby the media with their own interpretation of the results, which may be misleading. Council has received a letter from Legal Aid on behalf of environmental groups stating that they have instructions to proceed with legal proceedings if Council breaches the Clean Waters Act.

Council resolved not to carry out any work on vacant Crown land.

Council has resolved to adopt a twelve-point plan as follows:

1. *"That Council recognises its responsibilities under the Noxious Weeds Act.*
2. *That Council acknowledges that there is concern regarding the use of herbicides within the community.*

3. *That Council gives an undertaking to reduce the use of herbicides within its weeds management program and to introduce integrated management.*
4. *That the Weedbug Wickwiper be trialed in the valley on Waterfall Way.*
5. *That discussions be held with the Department of Agriculture regarding the future of roadside weed management.*
6. *That Council states that it supports the Roadside Management Plan and gives an undertaking to ensure its implementation.*
7. *That Council investigates the use of dyes to indicate the areas sprayed and bring a report to Council.*
8. *That Council cease roadside spraying in the Bellingen Valley until the Roadside Management Plan is in place and until the EPA provides Council with regulations for spraying near waterways.*
9. *That herbicide usage be permitted in the urban areas only by means of a hand-held ropewick applicator.*
10. *That Certified Organic Farmers be invited to register their location with Council.*
11. *That Council request the Department of Agriculture to give advice on acceptable levels of control of Parramatta Grass on roadside verges.*
12. *That the General Manager bring a report to Council on the possibility of contracting out Noxious Weeds Control within the Shire."*

Newspaper articles and letters to the editor have almost dominated newspapers in this area for years.

TAKE HOME MESSAGES

If there are any health risks or contamination risks to produce or the environment, we, as weed inspectors need to know. If there are no risks, Council needs assistance from relevant authorities to be able to carry out efficient and effective control methods under all relevant legislation.

The Department of Agriculture has to take its responsibility under the Noxious Weeds Act seriously and remember what the word "agriculture" means.

The EPA has to solve the problems with the Clean Waters Act and come up with workable guidelines based on scientific facts not political???.

Every inspector is required to carry out noxious weed control in his/her area to the best of his/her ability and help eliminate the spread to other areas. Councils sometimes do need assistance, guidance and leadership, not just another agronomist.

We already have the best agronomist in NSW - his name is John Betts.

Noxious Weed Inspectors must drink plenty of red wine because it is going to be a tough couple of years.

DOW ELANCO PRODUCT UPDATE

Chris Love
Product Development Manager
Dow Elanco
Kenmore, Qld

LABEL UPDATE: GARLON 600 HERBICIDE (600 G/L TRICLOPYR)

- New label to be registered late 1998.
- Formulation change allows improved packaging options and further reduces volatility of formulated product.
- Will be identified by "Easy Pour" 20L HDPE jerrycan.
- Formulation has been commercially sold in NZ with equivalent bioequivalency.
- New easy-to-read Woody Weed Label.
- Updated general instructions section (description of application methods).
- Woody weeds #:
  * Basal Bark (fencelines and fire trails) (NSW only) at 1:60
    - broadleaf hopbush
    - narrowleaf hopbush
    - turpentine bush
- Cropping #:
  - Compatibility with Roundup CT
  - Addition of crop sorghum

LABEL UPDATE: STARANE 200 HERBICIDE (200 G/L FLUROXYPYR)

	mL/100L
• High volume application #	
– Bathurst burr/Noogoora burr	75
– Climbing buckwheat	300
– Common sensitive plant (plus Uptake Spraying Oil)	333
– Blackberry nightshade/Bokhara clover/Caltrop/ Docks/Flannel weed/Hexham scent/Honey locust/ Small flowered mallow/Yellow flowered devil's claw/ Cockspur thorn	500
– Mother-of-millions	600
– Prickly acacia/Snakeweed	750
– Common sowthistle/Tree violet	1000
– Wandering jew	1500

• Basal bark & cut stump #		100L diesel
– Chinee apple		3.0L
– Honey locust	- up to 10 cm	1.5L
	- up to 20 cm	3.0L
	- > 20 cm & CS	5.0L
– Sisal hemp		3.0L (bb) or 10mL neat/stump (cs)
– Chinese celtis		3.5 L (bb only)
– Cockspur thorn		1.5L (bb only)

Established grass pastures # (NSW only)

- Silverleaf nightshade
  - 0.75 L/ha + uptake or
  - 375 mL + 1.2 L 2,4-D amine + uptake

- St John's Wort 3 L/ha

HERBICIDE UPDATE: GRAZON DS HERBICIDE
(100 g/L picloram + 300 g/L triclopyr)

Grazon DS Herbicide (1995 Update - Southern Areas)

Weeds Controlled	Rate mL/100L water
Docks	350-500
Galenia	500 or (5 L/ha)
Manuka	500 (Vic only)
Ragwort	350-500
St John's Wort	500
Thistles	350-500

Grazon DS Herbicide (Proposed 1998 Update #)

- Lantana: 350 mL rate
  - * addition of adjuvant
    - Update Spraying Oil
    - Pulse Penetrant

- Compatibility with metsulfuron
  - bracken fern in association with blackberry

Weeds controlled	Rate/100L
Mother-of millions	500 mL
Blue heliotrope	500 mL
Horehound	350 mL
Japanese Sunflower	500 mL

PRODUCT UPDATE: ACCESS HERBICIDE
(120 g/L picloram ester + 240 g/L triclopyr ester)

- Specialised product
  - basal bark and cut stump application
  - mixes with diesel only
  - one use rate (1:60)
  - use all year round
  - controls a wide range of species

Southern Areas

* Angophora regrowth
* Australian blackthorn
* Brush and swamp box
* Camphor laurel
* *Eucalyptus* regrowth
* *Grevillia* spp.
* Groundsel bush
* Guava
* Hawthorn
* Lantana
* Red ash (White myrtle)
* Sweet briar
* Teatree
* Tree of heaven
* Tree pear
* Wattle regrowth

Western Areas

* Algaroba (Mesquite)
* Ellangowan poison bush
* False sandalwood (Budda)
* Heartleaf poison bush
* Narrow leaf hop bush
* Needlewood
* Parkinsonia
* Prickly acacia
* Punty bush
* Rubber vine
* Turpentine
* Turpentine bush
* Wilga

3 CYCLE PLAN

Access Herbicide can be an integral component of a programmed approach to woody weed control. Remember to use a 3 Cycle Plan for optimum woody weed control.

SUMMARY

- Proposed label updates:
  - Garlon 600
  - Starane 200
  - Grazon DS
- Registration by end 1998
- Future Development Work
  - Watch this space!

MACSPRED PTY LTD - NEW PRODUCTS

Kel Stokes & Geoff Keech
Macspred Pty Ltd

WHAT IS MACSPRED?

Macspred is a small privately owned company, specialising in the manufacture and supply of a range of specialist herbicides and delivery systems for the forestry and industrial weed control market.

Originating in 1985, Macspred originally had a products arm, founded by Stan McFadzean, who left DuPont to pursue his dream of the development of granular herbicides, and a marketing arm run by Ray Nightingale.

Macspred Infrastructure

In 1990 Macspred as we know it today expanded to national distribution with offices in Victoria, New South Wales and Queensland with appointed distributors in Tasmania, South Australia and Western Australia. Each Eastern sales office has a business manager, sales supervisor, administrative support staff and its own warehouse facility.

1996 saw the opening of a new manufacturing and head office facility in Ballarat, which allows us to formulate all of our granular products "in house".

Macspred Focus

The development, manufacture and sales of granular herbicides remains our core business, which is strongly supported by a complete range of forestry and industrial herbicides from manufacturers such as DuPont, Dow Elanco, Monsanto, CropCare and Nufarm and other prominent research and development based companies.

In support of our granular product range, it has been necessary to develop specialised product delivery systems as well as adapt some overseas technology. Accurate metering and placement of herbicides is a need common to granules as well as liquid based compounds.

Specialised on track rail systems, linkage forestry units and motorised back pack equipment is complemented by hand operated broadcast and spot treatment machinery. All of these units are setting the standard for safe and cost effective herbicide application.

Macspred Field Operations

Macspred has a unique commitment to in field service and technical backup for our entire product range. We offer competitive but not necessarily the cheapest pricing which is still backed up by our guarantee of service.

As part of our in field service, we carry out trial work with our customers to evaluate new and existing products to match their particular needs.

Why Granular Herbicides?

Granular herbicides are manufactured to be applied directly to the soil without the need to mix with water. They should not be confused with the wettable dispersible granules such as the newer formulations of atrazine and simazine, or the Dry Flowable technology of Brush-Off, Oust DF or Roundup Dry.

Many of you are familiar with granules and the reasons why people are switching to this concept. The following list nominates some of the reasons.

- Reduced environmental impact - fewer and more readily disposed of containers.
- Reduced cost of application - same area covered in as little as 25% of the time required for liquids.
- Improved operational efficiency - no need to cart water, larger application window.
- Improved user safety - no splashing, fumes or fine droplets, not a dangerous goods.
- Improved public relations - no booms or bad odours.
- Improved residual performance - no foliar tie up of the active.
- Low toxicity rating - no solvents, no volatilisation.
- Low drift hazard - no small droplets, minimal wind effect on granules.

Research and Development

As part of our ongoing pursuit of excellence in meeting the demands of the industry we service, Macspred conducts research into new compounds and combinations of existing compounds to cover the complex needs of our customers. It was from this research that the Eucmix ™GR granular herbicide was discovered some 5 years ago.

In 1992 Macspred began trial work to evaluate 30 different herbicide combinations for weed control in Eucalypt plantations. From this 2 year initial screening work emerged a product which demonstrated early post emergent and residual control of herbaceous weeds in one year old Eucalypts.

Eucmix ™GR contains an active ingredient combination of Terbacil and Sulfometuron Methyl. Macspred applied for registration in October 1996 and all indications are that the product will be finally registered and available for use in 1998.

Initially registration will be for use in *Eucalyptus nitens, E. regnans* and *E. globulus*. The future may hold value for many other species and situations such as amenity horticulture, Landcare plantings and farm forestry woodlots.

Development Trials

Macspred and various researchers around Australia have conducted a series of further trials. The results to date have shown excellent weed control, knockdown and tree tolerance. Weed control was still evident 12 months after treatment. It should be noted that liquid formulations caused severe phytotoxicity to the trees. At the end of the second year of the trials the trees are measured. The Euc Mix™GR treated trees showed significant increases in wood production over the untreated control.

In more recent trials in 1996 where Eucmix ™GR has been tested over the top of young Eucalypt seedlings, that is 2-4 months after planting, it was found that the following criteria must be followed to obtain consistent results.

1. Excellent soil moisture at the time of application.
2. Good follow-up rainfall to incorporate the product.
3. Susceptible weed spectrum.
4. Weed growth less than 10cm in height and diameter.

Weed Control Performance

Weeds controlled (as listed on the label):

Fog grass	*Holocus lalatus*
Capeweed	*Acrtotheca calendula*
Annual ryegrass	*Lolium rigidum*
White clover	*Trifolium repens*

Weeds suppressed:

Sorrel	*Rumex acetosella*
Flatweed	*Hypochoeris radicata*
Sweet vernal	*Anthoxanthum odoratum*

Weeds not known to be controlled:

Paspalum, Woody Weeds including blackberry, bracken, acacia species, perennial phalaris, radiata pine*, spear thistle*.

* Although not controlled, severe phytotoxicity can be caused.

N.B. Eucmix ™GR may be active on other weed species which have not been present in trials to date.

VISUAL EXPECTATIONS

Eucmix ™GR Granules

- Slower than liquid sprays.
- 6 - 8 weeks 'brown out' given moderate rainfall.
- Less residual in sandy soils.
- 6 - 9 months residual activity demonstrated in trials, depending on soil type and climatic variables.

Application and Application Equipment

Eucmix ™GR can be used for spot, mound (strip) or broadcast application to control weed competition.

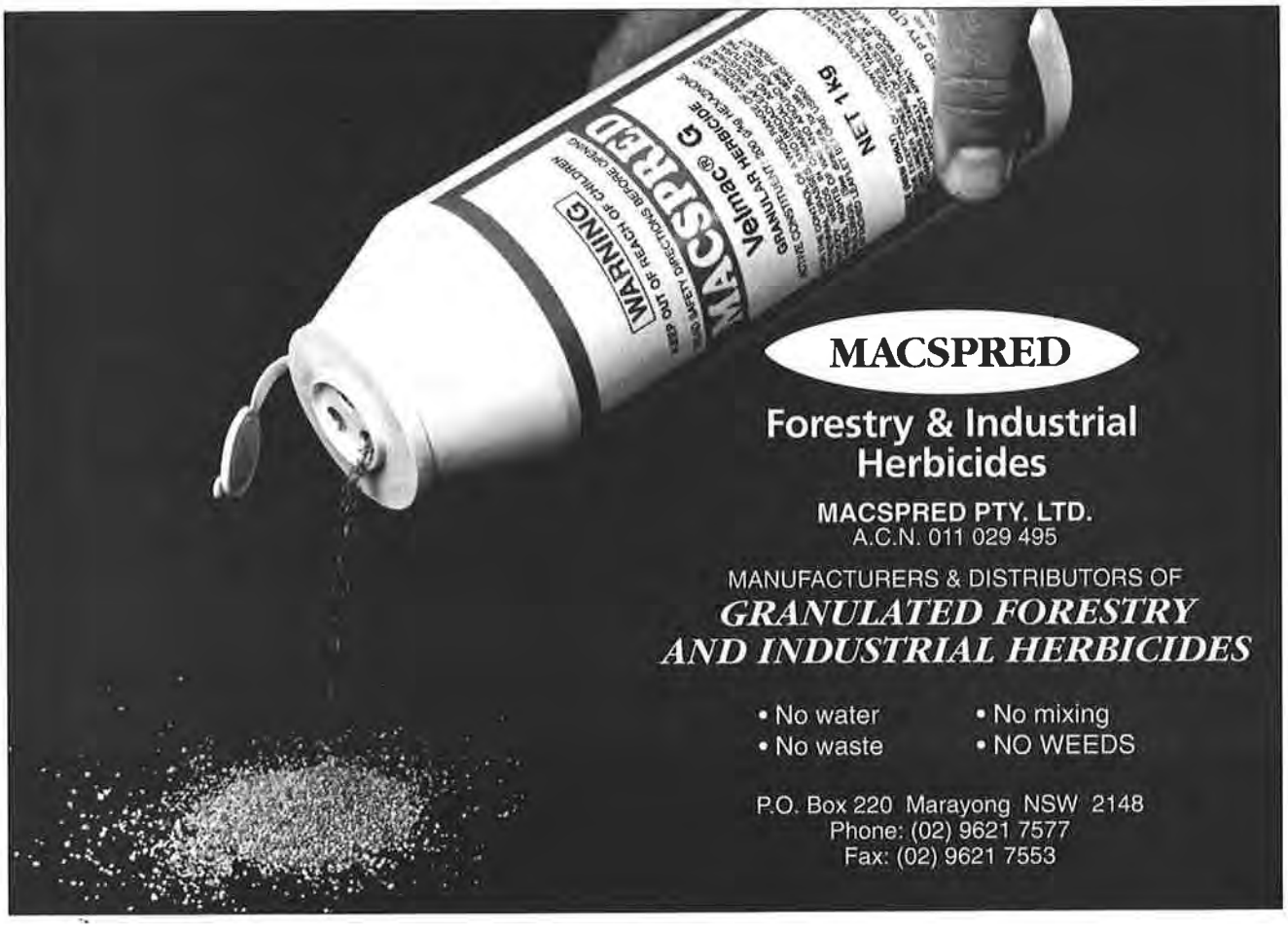
Broadcast and mound application methods, where possible, provide the best growing conditions for eucalypts by reducing the weed competition for soil moisture and nutrients. Application can be carried out using purpose designed Macspred tractor mounted or motorised back pack granular herbicide application units.

Accurate spot application is possible using a hand held Weed-a-metre unit designed to distribute a measured dose of granules over a 1 metre diameter spot. This can be applied at 1 metre spacings around a tree (i.e., 4 spots) to provide an approximate 2 X 2 metre area of weed control.

SUMMARY

Macspred's Eucmix™GR when registered will offer Eucalypt plantation managers a new (and needed) post planting weed control option.

Eucmix ™GR will be registered only for the three species mentioned previously, with further screening for selectivity required before other species can be added to the label.



ROADSIDE VEGETATION MANAGEMENT - THE NSW ROADSIDE ENVIRONMENT COMMITTEE - THE PICTURE SO FAR

Carolyn Woods
Executive Officer
NSW Roadside Environment Committee, Sydney

This paper outlines a brief history of the NSW Roadside Environment Committee (NSW REC), why roadside conservation is important and the three step procedure which guides better roadside management. It will discuss the importance of an integrated and planned approach to weed control that will enable more effective use of time, money and resources for the long-term management of the roadside environment.

BACKGROUND

The NSW REC was formed in June 1994 and is a group of people and organisations working with the road and rail authorities, that is the Roads and Traffic Authority (RTA), Local Government, Rail Access Corporation (RAC), Rural Lands Protection Board (RLPB) and State Rail Authority (SRA), and the community to encourage the better management of NSW roadsides and linear reserves. This group of fourteen is funded by the NSW RTA and the Department of Local Government (refer Appendix 1). Additional to these direct contributions, representatives on the Committee have committed time and effort to our Mission of "facilitating the management of roadsides for the benefit of the environment and the people of NSW. The NSW REC undertakes this role through the work of the Executive Officer who is guided by the goals and objectives set by the Committee.

The Committee has developed a range of publications to assist in roadside management planning including a roadside video, handbook on best practice for construction and maintenance workers, information sheets and a series of booklets to assist in developing and implementing management plans.

Roadside managers have responded well to the efforts of the Committee so far. Over thirty Local Councils are actively working toward improved roadside management. There are also 7 Rural Lands Protection Boards (RLPB's) in central NSW who have assessed the natural resources on their stock routes and reserves, and have developed guidelines for their management.

WHY CONSERVE ROADSIDE NATIVE VEGETATION ?

Weed invasion, vegetation clearing, land degradation including soil structure decline, erosion, acid soils, dryland salinity and increased soil nutrients; grazing, inappropriate road construction and maintenance and other influences have effected the health and extent of native vegetation across the State.

Roadsides and Travelling Stock routes make up five percent of the area of the state, which is equivalent to the area of national parks and nature reserves. In many localities in NSW, the roadside environment is the only place where native bushland remains. The West Hume landcare group, in the southern part of the State, estimates that while only three per cent of original native vegetation remains in the area, 60 per cent of it survives along the roadside.

Apart from the benefits of retaining roadside vegetation as habitat for plants and animals there are a number of important benefits. These benefits include helping to prevent soil erosion and other land degradation problems. There are a number of other social and economic features within roadsides including cultural heritage landmarks such as bridges and Aboriginal scar trees. Grazing for travelling stock, particularly during times of drought; providing fire fighters with strategic space for bushfire control and opportunities for public utilities such as electricity, gas and telecommunications equipment are important economic uses.

The original native trees, shrubs, grasses and other groundcovers provide other values because they:

- are easier and cheaper to maintain than introduced vegetation as native plants are adapted to the local physical environment;
- often contain rare and endangered plants and animals;
- are a vital source of local seed for replanting; and
- provide a valuable recreational resource for travellers by providing shade and contributing to the enjoyment of views within the landscape.

NSW's APPROACH TO ROADSIDE MANAGEMENT

Remnant vegetation management is all about minimising disturbance. Disturbing the soil and healthy native vegetation;

- encourages weeds, which compete with native plants and increase maintenance costs and fire-risk of roadsides;
- can prevent the natural regeneration of native plants; and
- increases the risk of soil erosion.

It is cheaper and easier for the land manager to protect existing trees, shrubs and groundcovers than it is to replant them or follow-up with maintenance. In a lot of natural areas soil and vegetation conditions have been modified by factors such as poor agricultural practices, vegetation clearing, pollution or population pressures. In many areas where soil disturbance has occurred and native vegetation has been replaced by introduced annual and perennial grasses, fire risk has become a problem during summer. Native perennial grasses, actively grow during summer and are less fire prone and provide green pick for stock during drought. Remnant roadside vegetation management, in particular, relies on appropriate decision making and planning for the local environment. This includes an integration and commitment of substantial human, machinery and financial resources over a period of time to find solutions to issues and problems facing the maintenance of these areas.

Dumaresq Shire, in the northern tablelands, has worked with a number of other local government areas to form a noxious weed County Council. This coordinated weed control over a relatively large area has created the conditions for improved planning, resource use and implementation of programs. Apart from belonging to the Noxious Weeds County Council Dumaresq and Uralla Council have both undertaken a shire-wide roadside assessment, developed roadside management plans and undertaken training in best environmental practise for roadside and construction workers.

Noxious and environmental weeds are a significant issue in terms of roadside management. Linear reserves have a large boundary to area ratio which means native vegetation is prone to

disturbance which can lead to weed invasion. Weed infestation along roadsides and linear reserves need to be identified for appropriate planning, and coordination of their control.

In response to the need for better roadside management the NSW REC has developed a three step process for tackling roadside and linear reserve vegetation management. The steps identified in the approach developed in NSW for roadsides, which covers managing existing natural areas, are broadly outlined below. These principles can be extended to weed control.

The Committee has developed a three stage process which includes assessment, planning and implementation.

1. ASSESSMENT

In order to determine baseline information on the various features of the roadside environment, Local Government, RLPB, landcare and other community groups should be involved in assessment of features including road width, condition of vegetation, introduced species, regeneration and other issues relating to the 'health' of the roadside.

This roadside assessment guides the collection of information over vast lengths of road. Vegetation communities can easily be distinguished using this method. Information collected on the relative condition of the vegetation allows roadsides to be placed in broad management categories.

The primary issues that need to be addressed for environmental management for roadside projects are:-

- Protection of good quality remnant vegetation
- Determining the grazing potential of roadsides
- Identifying areas where soil has been degraded
- Identifying priority areas for road development and location of utilities
- Identifying the potential for tourist road development
- Identifying areas for revegetation and corridor enhancement

Undertaking a roadside assessment identifies the extent of weed infestation and the pattern of weed distribution. One management tool developed through the Western Australian Roadside Environment Committee have developed shire maps, were roadside assessments have been carried out, which indicate the extent and severity of weed infestation along the roadsides. Maps are also produced for the roadside management categories and overlayed with vegetation coverage for the shire. These maps are a valuable tool for weeds officers who can identify where priority weed control should take place.

It is important that the assessment process is consistent so that there is no discrepancies in the management of roadsides across a Shire. With the move toward total catchment management the NSW RECs standardised approach to assessment can provide baseline information that is consistent for roads that cross Shire boundaries.

2. PLANNING

An important step in managing the roadside environment is the development of a plan. The collection of existing material, including topography, soils, heritage sites, land use maps and

others, will provide important additional information. After the identification of the three roadside management categories which are;

- High Conservation Value - defines areas in a relatively natural, undisturbed state. They are usually fairly stable environments, requiring low management input and therefore, costing less to maintain.
- Medium Conservation Value - defines areas which would most benefit from active management. Defined management goals will assist in determining the range of activities to be undertaken at these sites. Rehabilitation and stabilisation in these areas may be possible. Other uses may be possible, where rehabilitation is incompatible.
- Low Conservation Value - are the most modified or degraded roadsides. There is often a high prevalence of weeds or other exotic vegetation and may also be subject to erosion or be a high fire risk.

It is important to have broad definitions for the roadside management categories. These can be descriptive or issues-based, depending on the objectives of the plan. It is important to clarify what the general attributes are for these categories. Sites also need to be identified which require specific management prescriptions. For example sites which contain rare or threatened species, active gully erosion, cultural planting of trees or Aboriginal heritage items. Undertaking community consultation will identify issues and possible management solutions to be included in the roadside plan.

It is important for the RTA, Local Government, RLPB, RAC, and SRA to balance land use appropriate for the management category, taking into consideration the social, economic and environmental factors identified through consultation.

The establishment of policies and management guidelines can establish a consistent management approach to an issue. With the establishment and implementation of a policy there needs to be widespread knowledge and demand for the policy from the local community. Combining management guidelines with policies, legislative powers and a public awareness campaign will assist in the successful adoption of better roadside management. Dumaresq Shire in the northern tablelands of NSW has developed a policy which regulates the collection of firewood from road reserves and the RLPB has also adopted the same policy for its stock reserves in the area.

A plan which is prepared without community agreement and not in cooperation with stakeholders and other interested organisations is a waste of time and resources.

3. IMPLEMENTATION

How do we implement the plan and make the changes required for better roadside management ? Implementation of the plan and the introduction of effective and coordinated environmental roadside management requires a broad range of initiatives to be undertaken by the roadside manager and linear reserve . The development and use of best practice methods and management guidelines, particularly for contractors, establishing environmental roadside policy and implementation of the management plan can ensure appropriate on-ground management. It is critical for effective on-ground management that these four broad ways of implementation are undertaken and these are;

a) Training

Training can complement the objectives of the plan, and create an understanding of the plan for all staff. Training for the control of noxious weeds should include ecological principles, planning, revegetation and vegetation management. This information can empower staff to make informed decisions in regard to effective weed control but also vegetation management. Best practice improves the skill and effectiveness of the operator which in-turn saves money and time for the weed control program. Training in the objectives of the plan should be provided to all staff of the RLPB, Local Government, SRA, RAC, and the RTA.

b) Public Education and Awareness-Raising

It is important the community is aware of the value of roadsides, what their responsibilities are and what else they can do to ensure a change in the use of roadsides. Raising awareness through the media, signs, rate notices and informing local community groups can encourage involvement in roadside management. Dubbo, located on the Western Plains of NSW, has developed an adopt-a-road program where local business and the community are maintaining and replanting sections of the Newell Highway.

c) Regulation

This is a complementary method to the above which can be used to ensure compliance with environmental policies and federal and state legislation. The community should be suitably informed before any fines or legal action is undertaken under new environmental legislation. To reinforce the intentions of your organisation, any infringement can be reported publicly.

d) Follow-up

Plans need to be regularly reviewed every one to two years so they remain relevant. A review will ensure any plan remains flexible and workable. Someone specifically needs to be responsible for the plan to ensure its progress and to maintain momentum.

IN SUMMARY

Roadside environmental management requires the cooperation of all roadside managers, stakeholders, interested organisations and the community to ensure the effective management of the roadsides. Weed control is one issue in roadside and linear reserve management which needs to be carried out in consultation with other roadside managers, stakeholders and the community. Appropriate planning and good knowledge and awareness of the roadside and linear reserve environment, by everyone involved in its maintenance, and training of personnel involved in its management can only benefit this environment, particularly through effective and coordinated weed control.

APPENDIX 1

Representing the interests of roadside management are:

Roads and Traffic Authority - Policy
Roads and Traffic Authority - Environment
Institute of Municipal Engineers
Electricity Association of NSW
Rail Access Corporation
Nature Conservation Council
Rural Lands Protection Board
Local Government & Shires Association
National Parks and Wildlife Service
Department of Land & Water Conservation
Department of Urban Affairs and Planning
Department of Bushfire Services
Greening Australia, and
Department of Agriculture

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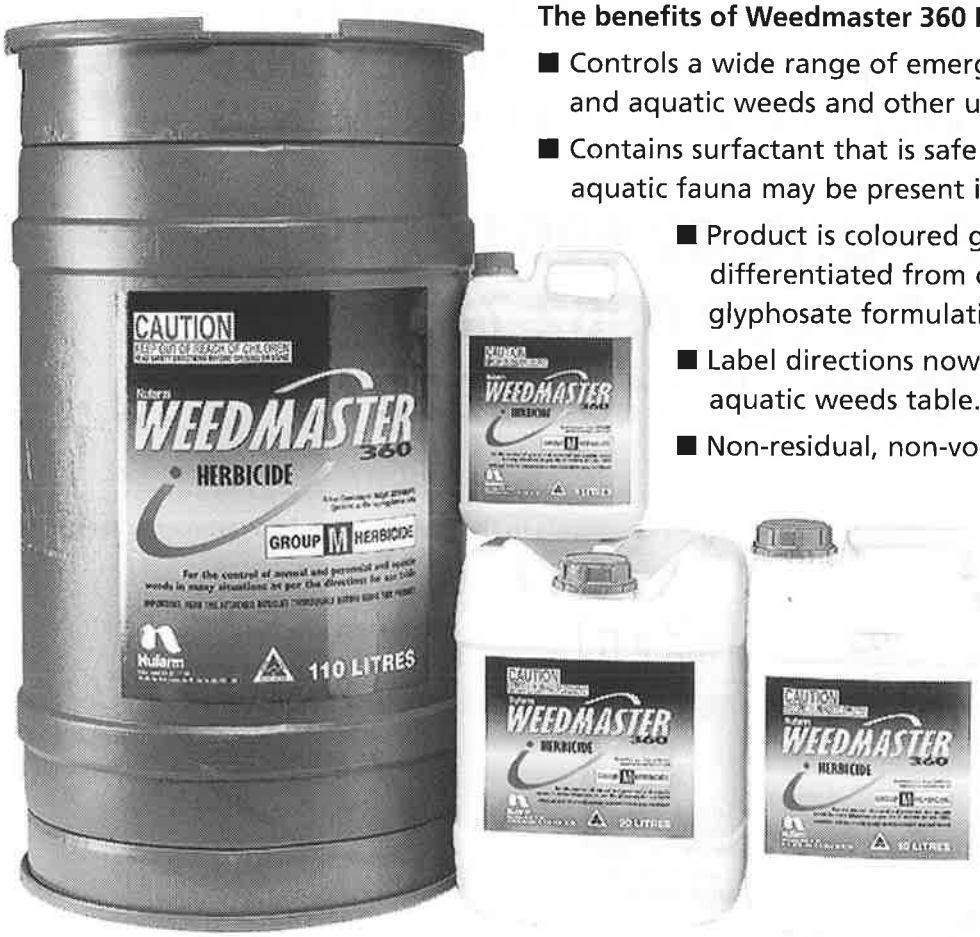

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- Controls a wide range of emerged annual, perennial and aquatic weeds and other unwanted plants.
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For further information contact your nearest Nufarm representative.

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Moree: Peter O'Keeffe 018 026 315
Cowra: Tim Perkins 018 637 310
State Office (Dubbo): Chris Ryan (02) 6884 8180

Nufarm

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USING THE MEDIA TO ADVANTAGE

Robyn Yeo
NSW Agriculture
Dubbo

INTRODUCTION

The word "media" conjures up a range of different thoughts, feelings, and attitudes in different people.

Some may say it's negative, invasive, sensationalist.

Others have a more positive view - it's helpful, thought provoking, informative.

Some say it sets the agenda for public opinion.

Others believe it reflects public opinion.

Whatever your view, there is no denying the media plays a huge role in the lives of people the world over.

Therefore it follows that if this force can be harnessed in the right way, the media can provide a useful tool for those in the community who want to get a message across and influence the way people think.

And that means media can and should play an important role in your work, in promoting effective weed management into the 21st century.

MEDIA TYPES

Media, as we know it, refers to print media like newspapers, magazines, and journals; as well as electronic media like radio and television, and increasingly, information technology or the Internet.

Each media type works differently.

Newspapers, in regional New South Wales can be printed weekly in the smaller centres like Coonamble, or daily in regional cities like Dubbo and Tamworth.
This in itself means a huge variation in deadlines which must be taken into account when planning a media campaign.

Radio, of course, is the most immediate news and information delivery service. What makes news one minute, can literally be on the news the very next. It's essentially a morning service.

Television on the other hand, tends to be the focus for night time news, although many are now turning on the box for morning info-tainment programs like Channel 9's Today.

PLANNING A MEDIA CAMPAIGN

All types of media should be used in any planned media campaign, and their different requirements must be taken into consideration in the planning process.

As an example, if we are attempting to get a message to landholders about any problem weed, say Silverleaf Nightshade, the campaign could include:

- Community Service Announcements/ads on radio and television over a two week period when the weed can easily be identified in the paddock
- A general News Release about the weed, how it grows, what harm it can do, and how to identifiy it
- Interviews with radio stations, particularly ABC Rural Reporters, regarding the weed
- A television news story on regional stations.

This may sound like a daunting task but it can be made simple by selling the message in the right way. If we focus on the potential damage the weed can do, and spell this out in monetry terms for example, it's far more likely to get a run than if we were simply to describe the weed.

A positive approach through the campaign can also be helpful. For example, the promotional material could include a message from Farmer X who has lifted his production through appropriate weed management techniques.

I believe it's always useful to remember that a farmer may be sceptical about the advice of a public servant or council official, but when the words are coming from an industry colleague, i.e. another farmer, the message is more likely to achieve a positive response.

PROFESSIONAL ADVICE

Wherever possible, I would advise you to make use of professional media services to assist in the development of media campaigns. I know some councils have their own PR/media staff, and NSW Agriculture Weeds Officers throughout the State have access to six Regional Media Officers based on the North Coast, Tamworth, Maitland, Camden, Wagga, and Dubbo. By liaising with the Department Weeds Officers, it would be quite possible to obtain the help of these Media Officers.

I recognise that not everyone will have access to professional media staff and there may not always be time to find a person who can help.

DEVELOPING LINKS WITH LOCAL MEDIA

For this reason, and to help increase awareness of your organisation throughout the community, I strongly urge you to develop links with the media organisations servicing your region.

By developing this rapport, not only is it possible to get your news message across to your target audience, but it's likely the very same media groups will start to see you as an authority on the subject and seek your comment when relevant issues arise in a general news sense.

By establishing and maintaining this good relationship with the media, you will find yourself in a good position to not only sell yourmessage, but respond in a positive way to any negative publicity which may arise in your region. For example, a local landholder complains that the Council Weeds Officers are not enforcing the law because the boxthorn on the neighbouring property has been running rampant for 20 years. Instead of approaching the Council itself, he calls the local paper which runs a front page story with accompanying photographs.

I would expect the paper to follow this story through by giving the Council a right of reply. Where the relationship with the media is already well established, this should prove a relatively simple action.

" That Weeds Officer who's always so generous with information can probably comment. " Ring him says the Editor.

The resulting headline may read " Council Acts Promptly to Control Weed Problem".

If there is no rapport or no known media contact on weeds, and Council officers appear to be avoiding the issue, the resulting story could prove very lop-sided in favour of the complainent - " Council Ducks for Cover Over Weeds Fiasco.".

A good relationship with the media doesn't buy you protection from bad publicity... but it can help.

And the more confident you become in dealing with the media, the more likely you will be able to direct the right response when the going gets tough.

Make a point of meeting local journalists face to face. Establish contact and leave your name, position title, and telephone number with them. It can certainly pay dividends.

Of course dealing with media in a regional setting is quite different from handling city-based media. However I feel in the context of this conference, it would serve little purpose to focus on the city media, when clearly the most pressing need for noxious weed promotion is throughout regional New South Wales.

TAKE HOME MESSAGE

1. Print and electronic media can be used in a positive way to get important noxious weeds messages across to a target group.
2. The special needs and attributes of each media type must be taken into account when planning a media campaign.
3. Wherever possible, make use of professional services to plan and co-ordinate media campaigns.
4. Develop a good relationship with media organisations in your region by making a personal visit to news editors or journalists.

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A.C.T. Parks and Conservation Service
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9TH BIENNIAL WEEDS CONFERENCE
Closing Address

John Fisher
Program Leader, Weeds
NSW Agriculture

The theme of the conference was improving noxious weed control for the 21st century. With noxious weeds, the whole logic of the legislation is to provide a benefit for the community. We are not doing something to benefit NSW Agriculture, we are not doing something to benefit any particular person or organisation. The objective is to satisfy the communities' needs and their weed control priorities. The first question then becomes "If we are thinking about the 21st century, what are the likely changes in what the community is going to need or expect or want from us?"

The first change is increasing environmental concern. Environmental concerns can be positive for us or they can be negative. They can assist with weed control or they can hamper it. There is certainly an increasing acknowledgment in the community that weeds not only have a big effect on production but they are having an effect on the environment. We had a number of talks, for example, Richard Groves, Kate Blood, Judie Rawling, all touching on the environmental effects of weeds. There is acknowledgment that weeds can threaten species - National Parks and Wildlife are preparing a submission for bitou bush to be acknowledged as a threatening process under the Threatened Species Act. There is also an increasing involvement from community groups. People want to be involved with controlling weeds and restoring bushland. These interests are leading to an increase in the publicity. The general media are becoming aware of weeds, for example the article in the Bulletin of 15 August 1997, a 2 page article in what's normally a business type magazine referring to the war on weeds. If we are going to use the media effectively we have to make sure that they get accurate information.

There are also a number of negative effects, and we certainly touched on those today, Graham Matthews and Harvey Baker referred to the difficulties and the frustration that are being imposed on all of you because of the way certain sections of the community are responding to weed control programs. We certainly sympathise with people responsible for carrying out public weed control programs, but there is not a great lot that we can do directly. We have to think about how to address that problem. Harvey Baker gave some good advice in his talk. Try and develop alliances where you can with groups that can be beneficial. There is no point in becoming involved in head-on conflict with people. We have to somehow pick up the more moderate ones in those groups and bring them around to our point of view and that is what Rod Ensbey was elaborating on in his talk.

When you start thinking about those groups and why they are concerned and why they don't see the things the way we see it, there are a number of reasons. Harvey touched on one - that is the Vietnam War. A lot of opposition to chemical use is still tied up with the politics that hang over from Vietnam. There is also another problem in that the credibility of governments and business in relation the health effects on people is pretty poor. If you think back over the last 10 or 20 years the number of times that people from government or people from businesses have stood up there and said "DDT is not a problem", "smoking is not a problem", "Mad cow disease (in England) is not a problem". The general public say "This is crap, we

know its a problem, they are not being honest with us". Part of the reason we have lost some of these environmental groups is that governments and business haven't been really honest with them and that's something we have to try and redress.

Sometimes there are conflicts between controlling a weed and some other aspects of biodiversity. At Homebush Olympic site there is a quarry there that is full of pampas grass. Judie Rawling would love to go in and control but the green and yellow bellfrog is in there and she has been told that she cannot remove the pampas grass. There is going to be increasingly more of this type of conflicts that sometimes inhibit your ability to control weeds. You have to try and think your way around those problems to see if you can find some sort of compromise that allows you to at least minimise the weed problems and still acknowledge that community's other environmental concerns. Judie Rawling had a good little take home message in her talk "Work with it - don't tell us, show us and be there", and whilst she was referring specifically to working with community groups it is also a message that applies to that broader issue of how we bring people on side, how we make use of the environmental movement. The environmental movement, if we get them on side can be a very powerful ally. Weeds, as we all know, do have big environmental effects, and if we can harness the environmental movement rather than conflicting with them, then we can start to have an impact with politicians.

The second group of community demands is to do with demonstrated efficiency and effectiveness. People want to know that they are getting bang for their bucks, governments want to know that they are getting value for the money they invest in anything, whether its roads or killing weeds or whatever. So the consequence of that is that we are all coming under increasing pressure for planning and for monitoring and for demonstrating the outcomes we achieve. It doesn't matter where you are, whether its government, local government or private business, the same pressure is there. So planning and monitoring need to occur at the whole range of levels. It has to be done at national, state and regional levels.

In this conference we have not talked about the National Weeds Strategy, briefly, the National Weeds Strategy has three goals:-

- First, to prevent the development of new weed problems. The Commonwealth is responsible for maintaining the quarantine barrier around Australia.

- Second, to reduce the impact of existing weed problems of national significance. To achieve that aim there will be a list of weeds that are designated as being of national significance. A consultancy has been let to develop the process, that is, list of data required, and the outcome of that process will be a score that will be used to rank weeds. The top few of that list will be declared to be of Weeds of National Significance (WONS). Obviously there are lots and lots of weeds that are very important regionally. The Commonwealth are keen to have a relatively small list so there are going to be lots of important weeds that don't make the national list. This will give us a lot of controversy which will be great for publicity. The process for prioritising weeds will be delivered to the National Weeds Strategy Executive Committee in mid December 1997. The Commonwealth have provided $24million over 5 years to assist with controlling those weeds of national significance. It sounds like a lot of money, but over the whole of Australia for 5 years it is not very much, but it will be useful for obtaining coordination between states and it could be useful for doing some biocontrol work and other research.

- The third goal of the National Weeds Strategy is to provide cost efficient and effective means for harnessing national action on weed management. That refers to research, education, training and making sure there is coordination between all the providers.

The NSW Weeds Strategy which was released shortly after the National Weeds Strategy, is linked closely with the national one. Because of this we did not produce another book, rather we just highlighted the main points, and listed the outcomes to be achieved.

- Prevention of new weed problems. Jim Dellow in his talk referred to one aspect of new weed problems, that is nurseries selling plants. Weeds moving in from interstate are another source of potential problems.
- We also have to be aware of broader environmental issues. Weeds are often symptoms of problems rather than the cause of problems. With many of our aquatic weeds, the underlying problem is nutrient levels in rivers and river flow. There is acknowledgment in the Strategy that we need to consider, environmental and community weeds, as well as production weeds.
- We acknowledge that before we can really put pressure on private landholders we have to get our act straight with public lands. At the moment there are big problems on some areas of public land and we are hoping we can use the NSW Weeds Strategy to encourage other departments to control weeds on public lands.
- Coordination and resource sharing - we are promoting the idea of regional planning, regional committees, county councils in some situations. There needs to be better coordination and sharing of resources.
- Legislation - the Noxious Weeds Act is up for review by next year. An issues paper has been prepared that covers the problems reported to us over the last few years and there will be opportunities for discussion in early 1998.

The community wants more effective weed control options from us. It has been said before, for every complex problem there is a solution that is simple, is obvious and does not work. We have to be very careful with weed control that we don't just grab a simple apparently obvious solution and so waste a lot of time and money. There are some new technologies coming that are going to be quite valuable to us. The herbicide resistant crops certainly open up a whole new range of opportunities but we must make sure that we don't squander those opportunities away. We have to learn from our past mistakes and to concentrate on integrated weed management. In Jim Morrison's talk he emphasised on competition with weeds and that is often a key element in integrated weed management. We also heard about biological control and the new work that is going on there.

Another subject we did not talk about during this conference was the Weeds CRC (The Cooperative Research Centre for Weed Management Systems). NSW Agriculture is a major partner in the CRC along with CSIRO Division of Entomology, University of Adelaide, KTRI Frankston, WA Dept and some others. The CRC is a way of coordinating our research efforts and there is additional money from the Commonwealth. We are quite confident there will be some good outcomes for you, in terms of better weed control methods over the next few years.

In conclusion, I would like to quote Todd Duffy "The significant problems that we face today cannot be controlled with the same level of thinking that created them". The aim of this conference is sharing information so that when we all go back home we can all do something better. I can go back home and have an awareness of the problems with our legislation and

the problems with how we interact with you. Hopefully you can go back home with some ideas to improve your weed control. But if we all go away from here and keep doing the same sort of things that have been done before, then this conference has been a waste of time. It might have been an enjoyable waste of time but unless you go away and do something different then we haven't achieved anything. Think about what you have heard over the last few days, in the talks, around the bar having a beer, and think about what you can actually adopt when you go home.

CONGRATULATIONS KEVIN NELLIGAN !
1997 Winner of the DuPont - Macspred Travel Award

Geoff Keech
Sales Supervisor
Macspred Pty Ltd

Kevin Nelligan, Noxious Weeds Manager at Cowra Shire Council has won this year's DuPont - Macspred Travel and Education Award. Congratulations from the sponsors and all delegates to the Dubbo conference.

Kevin's entry was selected as the winner because he spent a little time reading and answering the questions raised in the competition guidelines (see below).

> Entrants should submit a written proposal outlining the activity they wish to undertake using the following guidelines.
>
> 1. The nature of the activity (travel, education etc.)
> 2. The relationship of the activity to noxious weed control / management.
> 3. How the activity will benefit the recipient and improve their knowledge and understanding of noxious weed management.
> 4. How the activity will benefit the employer and the community.
> 5. An overview of the three main noxious weed problems in their area.
> 6. An overview of the local community (agricultural production, industrial developments, climate, population and catchment relationships).

These guidelines were sent out to give the entrants a clue as to what the judges would be looking for, and Kevin answered each point in a clear and easy to read manner. It was important to write the submission in your own words, as should the award have been given for travel to Interstate or New Zealand to visit your counterparts there, some indication of the knowledge of your own district and ability to impart that knowledge would have played a major part in the scoring.

Kevin's entry is printed on the following pages and should be looked upon as an indication of the minimum requirement for the next competition.

Once again Kevin, congratulations. We look forward to hearing of your progress and your report to the next conference.

DUPONT/MACSPRED TRAVEL AND EDUCATION AWARD

Kevin Nelligan
Noxious Weeds Manager
Cowra Shire Council

The purpose of this entry is to endeavour to gain further education and training regarding the biological control of St. Johns Wort.

The Keith Turnbull Research Institute in Victoria is currently in charge of the raising, releasing and monitoring of the mite (Acutus hyperici) for control of St. Johns Wort.

I would like further training by spending some time with Mr. Franz Mahr at the Institute.

Training is required in this field to enable officers to identify the agents used in this programme. Collection and distribution can then be carried out over a wide area hastening the establishment process. This will complement the programmes already in place, i.e. chemical control and pasture improvement. This combination of control methods must surely be the essence of integrated pest management.

The skills and knowledge required can be passed on to community and landcare groups thus enhancing the programme. Ag students can also be involved in the establishment of their own nursery sites. This can then be a "hands on" study for years 11 and 12 doing the Higher School Certificate.

This activity will be of great benefit to Council and the community at large by:

Reducing the use of chemicals as Cowra is fast becoming renowned for its production of excellent wines, as we all know how susceptible vines are to herbicides;
Cleaner water and environment as most of the St. Johns Wort is located in the catchment of Wyangala Dam.

Higher productivity in the wool industry and a better fibre quality. If Wort does not kill sheep that are exposed to it, they certainly will develop a break in the staple.
Weeds staff will be able to carry out more time on other weeds rather than half their time on one weed.

5. & 6. The following is an overview of three noxious plants affecting Cowra Shire and demonstrates the problems experienced by Weeds Officers in carrying out their duties and is designed to enlighten the reader and to create an awareness of the problems involved, accordingly I submit this entry to you and wish you pleasant reading.

PAPER FOR THE DUPONT/MACSPRED TRAVEL AWARD FOR THE 9TH BIENNIAL NOXIOUS WEEDS CONFERENCE

CONTENT

The three major noxious plants adversely affecting Cowra Shire.

First and foremost, I believe that a brief description of what is required of an officer to carry out noxious plant control and a description of the Shire and its situation is necessary to allow the reader to fully comprehend the problems and solutions borne out of noxious plants and their control.

Staff

Dare I say that when an officer takes on the job of containing the spread of noxious plants he is either insane, knows not what is in store for him or knows very little about the way noxious plants spread. Don't believe me? – then I'll put it this way, who in their right mind would take on the control of a plant that grows in cover, can only be seen when it flowers, sets 33,000 seeds, runs laterally forming suckers, is easily transported by livestock, cars, boats, trailers and shoes whilst infesting catchment areas and almost every National Park in the State?

If you were to put this scenario to an Army General, he would undoubtedly say "you cannot win" even if he had a thousand troops, however, we know this is not the case and that control of such a situation is left in the hands of one or two people.

The Shire

The Cowra Shire is situated partly in the catchment area of Wyangala Dam and along the floodplains of the Lachlan River. The Lachlan forms a division throughout the middle of the Shire, whilst the Belubula River, a tributary of the Lachlan, forms a boundary with Cabonne Shire to the North.

The Lachlan River produces a major flood at intervals of 20 years and moderate and minor floods every 3 to 4 years. The Belubula River because of steep catchment is considered one of the fastest flowing rivers in the State and suffers from major flooding many times each year. Also the layout of the land along the Belubula causes most of the flooding and silt deposits to occur on the Cowra side hence a very fertile flood plain and of course a resultant weed problem.

We are responsible for control on both sides of the floodplain of the Lachlan below Wyangala until the river exits the Shire below Gooloogong where it enters the Forbes Shire.

The Shire is known as a safe district with wide stock routes, luscious feed and ample water on river reserves. Heavy concentrations of travelling stock occurs along these routes in droughts when dealers from many part of the State come to take advantage of the feed and water and to leave a noxious plants nightmare in their wake. This has now occurred twice in the last decade, once in 1983 and again in 1991. Both times Council has been left with a problem of gigantic proportions and a massive bill for the clean up programme. Sometimes and in some situations this clean-up takes many years and is usually achieved just in time for the next

drought and resultant invasion. Therefore, it should not be hard to understand how this demoralises the staff involved.

St. Johns Wort

This plant is an ongoing problem in the Shire. It was spread along roads in the Shire by travelling stock in 1982 and was particularly bad in 1984/5. Since then each year a programme of control has been instigated followed by a debriefing among staff on how to deal with the pest the following year. The outcome of these debriefings usually results in a keenly motivated staff with all the answers on how we will lick the situation next year. However, armed with all modern chemicals, the best equipment (a left hand drive power steered automatic truck with all the latest in pumping and reeling equipment), the best advice and recommendations from the Department of Agriculture and chemical companies, only to find half way through the programme that factors unpredicted and beyond the control of staff come into play resulting in the weed managing to produce enough seed to undo the work already carried out.

These unknown and uncontrollable factors strongly emerged in 1992. Factors like heavy rainfall commencing with 10 inches in February and concluding with 3.5 inches. Christmas Eve brought the annual rainfall for 1992 to 40 inches. This brought about infestations beyond imagination. Other factors like seed dormancy, heavy use of travelling stock routes by drovers during 1991 and the particular route taken by them were factors hard to plan for, least of all control, and if that was not problem enough, how about this, the 1990 wet caused a break up of many roads in the Shire, the unsuitable gravel under them was scraped up and dumped on the roadside verge many 1,000 metres along and 6 inches deep, well do you want to know, you guessed it, St. Johns Wort seedlings emerged in the millions.

These areas are boom sprayed as hand spraying was impossible. Our theory is that these seeds must have lain dormant under the asphalt for 30 to 40 years and where they came from is anyone's guess. Not convinced yet, well what about adding insult to injury with this situation.

The Engineer's staff in their ignorance and wisdom had opened a quarry in the northern area whilst we were in the southern areas and carted A grade gravel in a 15 mile radius. Yes, this quarry is situated in one of the most heavily infested areas and has been closed for 30 years. Now root segments and seed have been deposited on roads that have been kept and were considered free.

Now, a new strategy is on the drawing board. The aim is to treat all St. Johns Wort by second week of flowering. The Shire has been cut into four quarters with an operator/inspector in each quarter, we are optimistic that each operator will do his area by the second week of flowering, leaving time to enter private property as contract or under Section 20 entry if necessary. We are firmly of the belief that the only way to handle St. Johns Wort is to aim for 100% control.

The Wyangala State Recreation Area is a matter of real concern to us and to other adjoining Shires. We feel that the Trust is not doing enough to control St. Johns Wort and therefore does not display enough initiative to attract a grant from the Noxious Plants Advisory Committee. Therefore, we intend to take much firmer action with regard to this area.

Johnson Grass

This was a weed of significant importance in 1980 when it was declared noxious in Cowra Shire. It had already overrun many productive properties on the Belubula River and was imposing a similar threat to the Lachlan downstream of Cowra.

A special Committee was formed in 1980 to formulate a uniform policy for control and to ensure this policy was carried out by all constituent members of the Committee.

Cowra and Cabonne Councils who were the worst affect by this weed, took the matter further by introducing a joint inspection programme. This meant that both sides of the river were inspected by both inspectors with individual property reports made out. This type of approach has been very successful in reducing, in area and density, a weed problem common to both Shires.

The Cowra Shire was also successful in gaining a revolving fund grant in 1984, to assist landholders with their control programmes. This was of great benefit to landholders, particularly the smaller ones who had diversified into row cropping of vegetables.

It is a readily known fact that row cropping is the quickest and easiest way to proliferate Johnson Grass. The gaining of a revolving fund grant meant that landholders could treat their entire property in one year rather than a piece meal approach over 5 years or longer.

Johnson Grass levels are now on a decrease on the Lachlan and Belubula River flats and now pose no threat to the Shire.

Boxthorn

This weed was particularly bad on crown land reserves, shire roads and other vacant and abandoned blocks in and around the town and local villages.

I was fortunate when I commenced work with Cowra Shire in that my predecessor had manufactured two special tools for the extraction and dismembering of this particular plant.

The directions went something like this:-

First approach the bush and size it up for the particular type of instrument chosen.

Then you were to either crawl in under the boxthorn and saw it off with the bow saw whilst endeavouring to avoid having the bush fall on you or if this method appeared dangerous, you were instructed to stay clear of the bush and by taking the long saw (a short saw with a 10 foot handle) saw off the bush at ground level.

If this treatment for any reason was not effective then you were to take the guillotine and crawl in placing the jaws around the trunk and jacking the jaws closed and in doing so, cut the bush off at the stump. Then treatment of the stump with equal parts of 245-T, distillate and sump oil was to be carried out.

Then if you survived the summer without being bitten by a snake or blood poisoning from the thorns you could visit each bush in the winter and burn them with fire.

This campaign, however heavy on manpower, was low on chemical consumption and was very effective. When I joined the team we only had suckers and seedlings to contend with and which we treat annually with glyphosate.

This is a true and authentic description of a weedo's memoirs in Cowra and I have kept these tools as a source of discipline for any new members that are prone to misbehave, as a few weeks on the long saw or guillotine usually achieves a compliant and grateful employee.

Now we come to 1997 and where does that leave us, a new Weeds Act, categories, Award Restructuring, Performance Agreement, Weed Strategies, Regional Weed Programmes, mission statements, visions and goals – all the high tech terminology that you can possibly dream of, however, the weeds remain defiant irrespective of the ploy designed to bring about their demise, perhaps it can be said that when all is said and done, most likely they are laughing at us.

VALOUR AWARDS

Valor Awards were presented to a number of Weeds Officers and associated personnel who were considered most worthy of the award.

1) Road Runner's Award- Peter Proctor
Kept fit running stachels upstairs and downstairs.
Hugh Milvain was a strong stayer, but Peter ran in better on weight and age.

2) Happy Napper Award - Pat Walmsley
Nothing aroused him.
Many contenders from Day One!

3) Investor's Award - David Karlson
Shirley Horsfield had more success with her investments.
Thanks from the "Club" for your support!

4) Rolf Harris Award - Mike Boulton
Rolf had Mike in mind when he composed "Jake-the-Peg"
Note: Mike was on crtuches following surgery.

5) Opticum Award - Ken Hayes
For Communication! and Communication and ***MORE Communication***

6) Best Actor Award - Roger Smith
Promoting Weeds Awareness Week as "Woody"
Cut quite a figure in tights! Not sure whether he does parties?

7) Lateral Thinker Award - Graham Matthews
No other contenders! No explanation required!

8) State of Origin Award- Scott Dearden
NSW has won the Parthenium Battle
Scott has worked effectively on his game-plan but still needs a winner!

9) Linguist Award - Dick Honeyman
Serves up a good Verse and Speaks his mind on occasions!
A poem prepared and presented at the Biennial Dinner to capture the activities of the Conference and its participants.
Always good value - Congratulations again DICK!

10) Plant identification
The standard was high with most winners achieving 100% correct.
Ken Hayes (Coffs Harbour), Terry Schmitzer (Hastings)
Geoff Keech (Macspred Tamworth)
David Pomery, Tony Martin (Illawarra)
John Conlan (Lockhart), James Smith (Coolamon)

11) Most outstanding written paper from an officer - Lee Amidy, Jim Morrison
These papers, on aerial inspections and Consul lovegrass, are worth another look.

PHOTO GALLERY

The evil arms of Woody the Weed reach out with unprecedented impact.

Woody the Weed engulfs conference convenor, Peter Gray.

Graham Matthews, Bellingen Shire, receives the lateral thinkers award.

Kevin Nelligan, Cowra Shire, receives the DuPont Macspred Travel Award from Bernie Horsefield (Macspred) and Matt Jones (DuPont).

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