13th Biennial NSW Noxious Weeds Conference

19-22 September 2005

Orange Ex-Services Club

Conference Papers

Table of Contents

Taking the wind out of willows: a national focus to willow management in Australia.
Sarah Holland-Clift

The Noxious Weeds Amendment Act 2005; Setting a new Direction for Weed Management in NSW
Sydney Lisle

Why Declare? The role of government in weed management
Philip Blackmore

Role of Councils and Councillors Managing Noxious Weeds in NSW
Lloyd Kingham

The discovery of Mexican Feather Grass (*Nassella tenuissima*) in Tamworth, New South Wales, Australia.
Natasha Soar

Chilean needle grass
Kevin Nelligan

Mesquite & Parkinsonia – a Thorny Threat to New South Wales
Nathan March and Don Mackenzie

Working Together - A Cooperative Approach to Weed Management
Ann Herbert

Rural Land Incentives Program Working with the Community
Jamie Wright and Paul Marynissen

Retired and willing – Harnessing the Community to Control Weeds
Steven Wilson

Developing a Bush Regeneration Plan to protect Biodiversity and Cultural Heritage in Natural areas; Case Study – Glenrock State Conservation Area & Awabakal Nature Reserve
Mellesa Schroder and Tiffany Knott

Conservation Volunteers role in weed control
John Fry

Weed Management and Control – the Whole Picture
Dee Murdoch

Where are we now and where are we going?
Peter Scott

Noxious Weeds Control in the 20th Century - The Changing Role of Weeds Officers
Peter Gray

The Changing Role Of Weed Officers Into The 21st Century
Roger Smith

Evaluating success of the Weeds Training Program - A progress report

Jodie Bartlett-Taylor and Rebecca Spinks

Managing bitou bush in NSW: the value of concerted efforts.
Hillary Cherry and Paul O. Downey

Lantana – Targeting the Hotspots
Andrew Clark and Michael Day

Macquarie Valley Weeds Advisory Committee

A Success Storey

George W. Hammond
Chairman
Macquarie Valley Weeds Advisory Committee
Narromine, NSW

Success! Success! Success!

Why is Macquarie Valley Weeds Advisory Committee such a success story?

INTRODUCTION

Timeline of Events

- 25th October, 1972 – Initial discussions and plans agreed to by Shire of Timbrebongie, Municipality of Narromine and Department of Railways for Johnson Grass control.
- Friday 23rd July, 1976 – Decision made to form a committee to control Johnson Grass.
- Wednesday 18th August, 1976 – Inaugural meeting of Timbrebongie Johnson Grass Eradication Committee held.
- Tuesday 4th April, 1978 – Special meeting with Mr. Alan Mears to promote a regional approach to Johnson Grass control.
- Tuesday 25th July, 1978 – Public meeting held to create a regional committee.
- Tuesday 15th August, 1978 – Inaugural meeting of Macquarie Watershed Johnson Grass Eradication Committee held.
- May, 1987 – Committee changed name to Macquarie Valley Noxious Plants Advisory Committee.
- Monday 31st August, 1989 – commencement of a study of The Ecology and Control of Blue Heliotrope.
- Tuesday 2nd April, 1996 – Formed a Blue Heliotrope "Action" Committee.
- Tuesday 11th August, 1998 – First Constitution adopted and name change to Macquarie Valley Weeds Advisory Committee.
- 1997 – Commencement of Television advertisements for community awareness of noxious weeds.
- !998 – Received first of three successful grant applications to develop an Education and Training programme for Weed Officers.
- Wednesday 21st November, 2001 – First release in Australia of a biological control agent for Blue Heliotrope.
- July, 2003 – Won the right to host, with Orange City Council, the 13th Biennial Noxious Weeds Conference in 2005.
- 19- 22 September, 2005 – 13th Biennial Noxious Weeds Conference, Orange.

It was in the early 1970's that the Shire of Timbrebongie (now known as Narromine Shire Council) became concerned about the increased spread and growth of Johnson Grass *(Sorghum halepense)* within the region. Johnson Grass was well established and was becoming a major problem. It was taking over our prime agricultural land, threatening a

thriving seed Sorghum *(Sorghum bicolor)* production industry and other intensive agricultural cropping as well as creating a dangerous driving hazard to motorist travelling on the roads in the region.

The story really began on Friday 23rd July, 1976, when a Public Meeting was held in the Council's Shire Chambers, where a decision was then made to try and do something about Johnson Grass control.

Following the establishment of river irrigation systems and development of irrigation crops within the Shire, a number of seed Sorghum production companies recognized Narromine's potential for the production of seed Sorghums. The only limiting factor was Johnson Grass. Johnson Grass is recognized as a haven for diseases and insect pests of Sorghum, it readily cross pollinates with Sorghum creating impurities and impacting on the quality of the seed sorghum production.

With the support of Seed Companies interested in this type of productivity, Council decided to convene a meeting of interested Companies, Landholders, Control Experts, Department and Local Government Authorities where infestation was causing concern, in an effort to devise a joint programme of approach to the eventual elimination of the grass.

The meeting, (a half day seminar) was chaired by Councillor Eric Woods and attended by Seed Companies, Chemical Companies, Councillors of the Shire of Timbrebongie, Municipality of Narromine, local Seed and Chemical Agencies, Representatives of Department of Agriculture, Public Transport Commission (Railways), Wellington Shire Council, Representatives of local Irrigation Schemes, Crop Spraying Specialists, Irrigation Advisors and the local media. Large numbers of Landholders and intensive irrigation farmers also attended.

Mr. Greg Downs, Field Officer with the Department of Agriculture, Orange, advised the meeting that Wellington was also another trouble spot in the region and said that from the Department's viewpoint, "there was a need to do something" and further said "I do feel, for the present, we should be looking at containment of the weed by just working these problem areas" (Narromine and Wellington).

Miss Noelene Monoghan, Regional Agronomist Adapted Weeds, Orange Research Station, reported to the meeting that she was in the process of conducting a research programme on Johnson Grass with regard to it's:-

1. Distribution
2. Biology – Seed production and dispersal and the comparative amount of rhizomatous and seed spread.
3. Management control for the prevention of spread.
4. Study of different genetic types and their response to herbicide treatments etc.

Miss Monoghan advised that it would take three years to reach any significant findings.

Public Transport Commission (Railways) Dubbo, offered fullest co-operation and nominate a representative onto a committee that was to be formed.

Railway permanent ways and, in particular, rail crossings where considerable vehicular traffic activity took place were areas of particularly dense infestations.

Mr. Ian Morgan representing Pioneer Hi-Bred Seed Company, a Sorghum seed producing company based in Queensland, advised the meeting that his Company at that time had under seed production approximately 700 acres (283 Hectares) of irrigation land at that time and that increase production would reach some 3,000 acres (1,214 Hectares), the value of these areas was estimated at 3 to 4 million dollars from his Company's activities alone, providing that Johnson Grass could be controlled. He also advised that his Company had virtually been forced out of Queensland due to problems associated with Johnson Grass and that the loss of this type of industry to the Macquarie Valley would be a tremendous economic loss to the region.

Seed Sorghum had been produced in the region by several Companies since, at least, 1970.

At this meeting we learnt that various control methods had been trialed for the past several years. The Shire of Timbrebongie had commenced doing chemical trials in early 1971 (March) using the soil sterilant Hyvar X™. In August 1972 George Hammond of Narromine Crop Centre Pty Ltd, gave a report and slide presentation to Council showing results that had been achieved in trials using Tandone 80™ in the Gundagai area that had shown good promise.

It was decided to conduct some comparative trials with several chemicals so that effectiveness could be observed. This was done on the 25th October, 1972.

The chemicals used were:-

1. Eradone™
2. Weedazol Total™ and Pasma™
3. Tandone 80 and Dalapon
4. Hyvar X

On the 25th October, 1972 a discussion regarding Johnson Grass control was held with representatives of Narromine Municipal Council, Department of Railways and Department of Agriculture. It was highlighted at this meeting that major problems with Johnson Grass were along main roads and railway permanent ways.

The October 1972 meeting recommended that a programme of control commence involving the three Authorities (Narromine Municipality, Timbrebongie Shire and Railways Department), each spraying within their own boundaries.

From the beginning of chemical trials in 1971 until middle 1976 the results were variable. The trials were many and varied and included, together with the chemicals already mentioned, Karmex™, Nuzinol™ (atrazine and amitrole) and Frenock™(tetrapion).

Even though the results were variable, it was still believed that if a combined effort and plan was implemented and a follow-up programme initiated, the results would become evident. This would only come about if the effort was a combined one.

It was suggestered to the July 23, 1976 Public Meeting that a committee of technical, professional men, seed suppliers etc. be formed to advise Council's Noxious Weeds team. The committee would need to able to come to Narromine each month, to hold meetings, inspect operations and results and make recommendations. It was considered if such a committee were formed and operated for a period of 6 months, it could then be determined if the programme was viable.

After much discussion regarding the size and role of the Committee it was resolved ***that a Committee be formed comprising representatives of seed companies, seed sorghum growers, Department of Agriculture, Department of Railways, Irrigation Schemes and both councils for the purpose of correlating information, to meet at determined intervals, to inspect operations being carried out on Johnson Grass control and to give advice and recommendations as required.***

It was resolved that the Committee members be appointed. They were:-
Councillor Alan E. Gainsford – Shire of Timbrebongie
Mr. Gus Shaw – Dept. of Agriculture, District Agronomist, Warren
Mr. Ian Morgan - (Pioneer Hi-Bred Seed Co.) Representing Seed Companies
Mr. George W. Hammond – (Narromine Crop Centre P/L) Representing Chemical Companies
Mr. Len Clark – Representing Growers
Messrs. Leon Percival, Paul Spackman and Barry Roulston – (Channel Attendants) Representing 3 major irrigation schemes
Councillor Peter Kierath- Municipality of Narromine
Mr. Dave Hylan – Divisional Engineer, Department of Railways, Dubbo

It was suggestered that the Department of Main Roads be represented but they declined stating that they did not accept responsibility for weeds on main roads.

And so the first Johnson Grass Advisory Committee was created and was titled the **TIMBREBONGIE JOHNSON GRASS ERADICATION COMMITTEE**.

TIMBREBONGIE JOHNSON GRASS ERADICATION COMMITTEE

The inaugural meeting of the Timbrebongie Johnson Grass Eradication Committee was held on Wednesday 18th August, 1976 at Narromine and chaired by Councillor Alan Gainsford.

At this meeting Mr. Len Clark was elected Chairman.

This meeting was the commencement of the Johnson Grass eradication campaign and was addressed by Mr. Phil Wallens, Dept. of Agriculture District Agronomist, Inverell and gave the Committee a very bleak picture of what our results might be.

Mr. Wallens said that a lot of properties in the Inverell region, the home of the worst infestations in New South Wales, were totally infestered with the grass and that control measures to date had not been good.

Mr. Wallens told the meeting regarding eradication and/or control of Johnson Grass, that individual plants were possible to kill, but to attempt to look at eradicating the grass on a whole farm or district basis; he did not think that it was possible or feasible to set out to eradicate Johnson Grass because it will continue to grow.

Discussions covered approaches to control, to be on two different levels:-
1. District as a whole, which is usually the responsibility of the Councils and
2. Approach of individual landholders.

Many other topics were covered including spraying methods and equipment, types of chemicals, chemical modes of action (total sterilants or translocating), burning or digging out, times to spray and stages of growth, identification and preventative measures. It was also highlighted the problem of spread and reinfestation caused by graders operated by Council and Main Road operators.

It was realized at this meeting that the best possible results would most probably be realized with the use of the herbicide Frenock and Roundup™ after its initial commercial release later in the year, 1976.

The need to map the areas of infestation was also agreed upon. This would identify where the locations of infestations are and how large they are. The information gained would be placed on a map showing infestations on roadsides as solid, unbroken stands, scattered areas, scattered clumps and individual clumps.

A key strategy in the campaign to eradicate Johnson Grass was the importance of getting peoples awareness and acceptance that the plant was a menace, and if this awareness can be created and accepted by people, then control can be achieved. Councils and the Dept. of Agriculture had to be prepared to get a high degree of awareness across to growers and landholders and it was thought that people would then follow with positive action.

It was decided to approach the eradication programme by first controlling isolated plants, small clumps of infestations and scattered plants, this would then contain the infestations to dense clumps and unbroken stands.

This is still the current way of approaching the eradication of weeds to-day that is nothing is new.

The awareness and education campaign included the development of brochures, doing media releases, making available advice on control methods and timing of treatments of chemicals. Also many discussions with farmers and growers were conducted at farmer days and nights. Special public meetings and film nights were organized for all community members.

The message was to be:-

1. Awareness
2. Vigilance
3. Persistence

Vigilance had to be exercised in making sure that all plants in isolated areas were treated thoroughly. It was also accepted that whatever method of treatment that was used, the plants treated would have to be checked and rechecked and any re-growth of seedlings and from rhizomes be retreated.

It has to be said that the programme received excellent support from the Department of Railways from both, Dubbo and Parkes Divisions.

Comparative chemical trials continued through the summer and included the new chemical Roundup, M.S.M.A. *(monosodium acid)*, D.S.M.A. *(disodium methyl arsenate)* and 2, 2-DPA. Frenock was the predominant herbicide used during the first summer followed by Roundup.

The Committee formulated a definite set of recommendations for Johnson Grass under various circumstances and conditions. This plan relied on the experiences and successes of the first summer of control.

Letters were written to all the neighboring Councils requesting support and initiating of their own programmes. The early responses were not very encouraging. The Councils written to were Talbragar Shire Council, Wellington Shire Council, Warren Shire Council and Dubbo City Council. Most Councils cited that a lack of finances was hindering the institution of their own control programmes.

A delegation of Parliamentary members was brought to the region to inspect the problems of Johnson Grass and to begin to get support for having Johnson Grass declared noxious throughout the State of New South Wales so that special grants for funds to assist in the control of the plant could be applied for.

Following the season of control, which included a lot of learning, results were positive and encouraging. Results to date indicated that it may take three years to show real accomplishment, but with costs de-escalating over the next seasons.

Getting some property owners to co-operate was proving difficult in some cases but generally most were very supportive and put in place their own control plans. Council and Main roads were the main areas of initial control so that property owners would be encouraged to co-operate with control on their own land.

In January, 1978 a campaign seeking the co-operation of Local Government Authorities in surrounding areas, commenced with the writing of letters to the Shires of Talbragar, Warren, Gilgandra, Wellington, and Goobang, Dubbo City Council, Mid-Western and Castlereagh Macquarie County Councils. A request was made to these Authorities to allow representatives of our Committee to address their meetings for the purpose of advising on the problems associated with Johnson Grass and the success of the programme for its control and eventual eradication n the Shire.

Wellington and Goobang Shire Councils and Castlereagh Macquarie and Mid-Western County Councils responded favourably to this request.

It was at the Wellington meeting that it was realized that a regional approach with landholders and Government Departments etc. acting in a co-operative manner was needed. It was also realized that large amounts of money would be needed to undertake a regional programme.

Mr. Alan D. Mears, Chairman of Noxious Weeds Advisory Committee, was invited to the region on the 4th April, 1978 where he was given a conducted tour of major infestations on the Bell River flats Dubbo and Narromine. Both untreated and treated sites were inspected. Mr. Mears was advised that an amount of $250.000.00 would be required to undertake a 5 year regional programme so that rural investments and agricultural produce could be protected from contamination of Johnson Grass.

Mr. Mears told this meeting that there very little point cleaning up the problem in Timbrebongie without also attending to the areas upstream from Narromine. The establishment of a regional approach similar to that of a County Council basis be created. For funding it would be essential that a very good case be put forward that would be acceptable to the Government. Politicians had to be convinced of the need for funding and that we should include such facts as to the effect on secondary industry,

increased productivity, taxation, land values and all such relevant issues that would emphasize the need for special funding.

It was also stressed that all Councils within the Macquarie Valley declare Johnson Grass noxious as this would assist with funding an eradication programme. The success of such an application would depend on the strength of the argument put forward with everyone working towards a common end. The Timbrebongie Committee had to be expanded into a larger group of Local Government Councils with an overall input similar to that of Timbrebongie Committee. The possibilities were good if we developed a good scheme for a Valley-long control programme, well documented and supported, of receiving an allocation of an unmatched grant.

Highlighted at this meeting was, that it was a healthy sign that farmers and other associated functionaries were prepared to get behind a particular programme such as Johnson Grass control which was unique in Australia, certainly in New South Wales.

It was at this meeting that a motion was moved that a committee be formed to cover the whole of the Macquarie Watershed and further that such a committee be termed the **MACQUARIE WATERSHED JOHNSON GRASS ERADICATION ADVISORY COMMITTEE** with similar aims and objectives as those of the Timbrebongie Johnson Grass Eradication Committee.

The Timbrebongie Committee's success was brought about largely because the Committee had developed a strong community awareness of Johnson Grass and in turn got the total community involved in its eradication programme. It became community driven rather than driven by Government Departments and people in authority.

The Committee's Chairman, the late Mr. Len Clark, was a very passionate leader who was always in the ear of Politicians, Heads of Government Departments and creating media releases so as to increase public awareness and endeavouring to secure special funding for the cause. Timbrebongie's Weed Officer Mr. Neville Digby carried out a lot of the early comparative chemical trials that became important in identifying the chemicals to use and when. He played a big part in getting landowners to participate in the overall programme of control.

Following the forced amalgamation of Municipality of Narromine and Shire of Timbrebongie, in September, 1981, to form the now Narromine Shire Council, the Committee became know as **Narromine Johnson Grass Eradication Advisory Committee**.

An interesting footnote to this section is the fact that the first ever Australian Weeds Conference sponsored by the Council of Australian Weed Science Societies, was held in Melbourne on the 12th/14th April, 1978. The comprehensive programme included discussions on biological control of weeds and that Mr. Alan Mears was a speaker at the conference – his topic was **"Development Protocols".**

Mr. George Hammond, (me), and Mr. Neville Digby, Timbrebongie Council's Weed Inspector also attended the conference.

MACQUARIE WATERSHED JOHNSON GRASS ERADICATION ADVISORY COMMITTEE

Planning for the creation of a regional committee began in May 1978 following the enthusiasm shown by representatives of the large number of regional Local Government Councils and County Councils and their support for such a body.

It was decided to research the degree of infestation in the head waters of the Macquarie watershed and then to call a Public Meeting of all Local Government bodies in the watershed, excluding those that did not have a Johnson Grass problem, inviting them to send representatives to any meetings that would be held, preferably the Weeds Officer and a Councillor.

The initial meeting would develop guidelines as to how it was to operate, and that the Committee to meet regularly and be purely advisory designed to co-ordinate applications for funding grants.

It was also decided that representatives of Timbrebongie visit those Local Government bodies that had not yet been visited or attended some of conducted public meetings. This was done as matter of urgency.

Meeting dates of all Local Government bodies located in the watershed were researched so that a mutually common meeting date could be selected. Narromine was nominated as the venue for the initial Public Meeting and that future meetings are rotated with other various localities within the watershed so that individual members of the Committee would become familiar with problems facing other areas.

The proposed Committee was to let it be known to all other Councils in the watershed that its members are prepared to do anything and go anywhere to support physically or morally, any other Council within the region.

It was thought necessary that the preparation of a regional map should be undertaken, with each Council having their own map, showing Johnson Grass infestations. The regional map was to incorporate all infestations for the region. Further, it was considered that in such preparation standard terminology be evolved for better understanding. It was considered that this visual submission would be a very powerful argument in the Committee's favour.

The possibility of satellite identification of areas of infestation should be investigated for the future.

A Public Meeting was scheduled for Tuesday, 25th July, 1978.

The meeting was addressed by Mr. Brian Scarsbrick, Special Agronomist, Department of Agriculture and was attended by Mr. Peter Gray, Field Officer, Weeds at Dubbo and Mr. Chris Evans, Field Officer, Weeds at Orange.

Mr. Scarsbrick informed the meeting, and I quote, "that the inauguration of this wonderful, self-help project which is, in fact, history making, with the degree of co-operation from all sectors of the community in this first voluntary, large scale, co-operative venture is truly remarkable". He further said, "it is an excellent way of attacking the problem and the first time we have undertaken a co-ordinated programme on a large scale in Australia".

He went on to say, this combined policy will have:-

1. an effect on the weed population in general

2. effective results in a combined approach and
3. an excellent lever for obtaining funds.

"It is important to get together and put up a combined plan which is both technologically and financially effective".

The meeting was also advised that following a second year of control activities in Timbrebongie, that the costs of control had been less than the previous year which supported the beliefs that Johnson Grass could be successfully eradicated.

It was formally moved that a Macquarie Watershed Johnson Grass Eradication Committee be formed.

The Inaugural Meeting of the regional committee was held in Wellington on Tuesday, 15th August, 1978. The acting Chairman of the Committee, Mr. Len Clark declined to be the Chairman and Councillor George Hammond was appointed and Mrs. Nona Leeds appointed Secretary.

It was said at the time that, "**the life of the Committee, it is assumed, would prevail until such time as heavy growth is minimized to small annual regrowth or seedlings when it is felt the education rendered, the control measures employed, and the acceptance of responsibility by local authorities would ensure the necessity for continued vigilance by the local government instrumentalities".**

From this date up until 1987 the activities followed along the lines as already mentioned with tremendous success being achieved through collectively applying for funds in the form of unmatched grants in addition to member contributions, a well organized plan, strong community development in education and awareness, and the addition to our membership of many State Government Departments and Agencies, the involvement of Pastures Protection Boards plus many other activities. It now seemed that the Committee had effectively worked ourselves out of a job.

Organizing our meetings became difficult to make interesting as infestations were so small that they were hardly worth mentioning, we could not really justify holding meetings as we did not have a great deal to report.

The Committee made a fundamental changes in direction following an approach from the Spiny Burr Grass Eradication Committee for us to consider offering to them an invitation to consider merging their committee with ours, with the view of a wider control measure being put on Spiny Burr Grass. As Nyngan was a member of the Spiny Burr group, it was felt that the combined Committee was more of a regional committee.

Our Committee did make the offer and the two committees merged in 1987.

At this time we then changed our name to the **Macquarie Valley Noxious Plants Advisory Committee**.

MACQUARIE VALLEY NOXIOUS PLANTS ADVISORY COMMITTEE

The change of name allowed the Committee to then address all declared noxious weeds and plants and was responsible in injecting a new lease of life and direction for all members. The challenges became more numerous.

During the later part of 1988 the Committee became aware of the existing and potential problems associated with plant Blue heliotrope *(Heliotropum amplexicaule).* A report had been presented to a meeting highlighting dangers associated with the spread of the weed via the planting of Lucerne crops with seed that had been harvested from production crops contaminated with Blue Heliotrope. Blue Heliotrope at that time was not a declared weed in most of our member regions.

We also learnt that a Blue Heliotrope Eradication Committee had been established within the Castlereagh Macquarie County Council and affiliated to the Warrumbungle Landcare Group. This group became a member of our Committee and we took up the cause of campaigning to have the weed declared noxious within the Macquarie Watershed and also trying to find a control for it.

During 1989, the Australian Wool Board made funds available to conduct a study of The Ecology and Control of Blue Heliotrope; this was mostly done, but not completed, at the Agricultural Research Centre, Trangie. Non Completion was due to the cessation of funds by the Wool Board in June 1991.

After much frustration, and a great deal of encouragement Mr. Bill Lambell of Gulargumbone, a driving force behind finding a suitable control for Blue Heliotrope, a Blue Heliotrope "Action" Committee was formed at a public meeting held in Dubbo on Tuesday 2nd April, 1996 organized by our Committee in an effort to find sources of other funding or means of control of this weed.

Finally after continued pressure was put on the Federal Government for funding to continue research, particularly a biological control, funding was made available through the Rural Industry Research and Development Corporation (RIRDC) 1998, with a great deal of assistance from the Deputy Prime Minister the Hon. John Anderson MP. This resulted in the first release in Australia of a leaf eating beetle *(Deuterocampta quadrijuga)* on Wednesday November 21, 2001 at Mr. Bill Lambell's property "Weenya", Gulargumbone.

The results of this programme will be even better if we can have released a complementary agent such as a root-feeding flea-beetle. We are still hoping!

It was in 1998 that the Committee was advised that we should have a formal Constitution. This was developed and adopted at the Committee's 20th Anniversary General Meeting, held at Wellington Caves Complex, August 1998.

The acceptance of a Constitution brought about a further name change of our Committee to that the **Macquarie Valley Weeds Advisory Committee.** It was thought that use of the word "*Weeds"* would allow the Committee to address all plants that could be identified as a potential problem as an incursion, environmentally or declared noxious. This has proved most beneficial.

MACQUARIE VALLEY WEEDS ADVISORY COMMITTEE

Our Committee has always been involved with education and training and making the community aware of the potential problems of noxious weeds and other weed incursions that present a potential hazard to the environment, human and animal health. To this end we had all our weed officers participate in Track Safety Awareness Training That commenced in 1998.

During 1997 The Committee received an invitation from the Noxious Weeds Advisory Committee, to submit an application for funding through their Regional Weed Action Program, for innovative projects that would be a benefit to the community, our Committee decided to develop a submission for funding a program that would deliver a suitable Education and Training package for Weed Officers.

In considering the proposal it was not just for the sake of training but it would also benefit the profile of noxious plants within our communities and also lift the image of all people involved with noxious plants eradication, detection of weed incursions and weed management.

The idea required that a concerted effort should be made to develop a training course which would be acceptable by all Authorities (Councils, County Councils, Rural Lands Protection Boards, National Parks and Wildlife, State Rail, Forestry Commission, etc.) that would result in suitable accreditation for all personnel involved in noxious plant control and weed management. The course needed also to be compatible to the National Competency standards that were being developed at that time. It was also important to note that both the New South Wales and National Weed Strategies were launched in 1997.

The application was successful and a grant of $120,000.00 was received from which a programme was developed based on the recognition of prior learning that people had gained over many years of involvement in the weed industry.

The initial pilot project that was conducted in our region was so successful that the Committee was then invited to further apply for funding to develop the project State wide. This invitation was accepted and an additional grant of $108,000.00 was received. Later, a third application was successful to the value of $26,000.00 which was used to enlarge the training course to cover personnel that wanted to be accredited up to diploma level.

Today our Education and Training programme is seen as being a most successful programme with large numbers of people already trained from Certificate two and up to diploma levels, and is the recognized training and education standard nationally. A great achievement and a major benefit to all from this committee project. Significantly, this was the first true recognition of prior learning process and was the concept of Reg Kidd, the Project Officer.

Also in 1997 our Committee, under the leadership of Mr. Roger Smith, Orange City Council Vegetation Officer, developed a community awareness project of developing a series of Television advertisements, highlighting the adversities of noxious plants, the importance of control and encouraging the wider community to advise their local weed inspectors of any Identified noxious plants, or unusual plants seen in their regions. Mr. Reg Kidd has assisted in making these advertisements, free of charge to the Committee from 1999 until 2005.

This awareness initiative has been most successful and has been repeated annually with each year increased numbers of enquiries being generated.

Several study tours were also organized for the benefit of Weed Officers and Managers. These tours were arranged and planned by Mr. Bryson Rees, Wellington Council Senior Weeds Officer. They were conducted within the State and interstate visiting areas of significant weed infestations, talking to people controlling the problems and being

addressed by researchers, team leaders, those affected by the outbreaks and regional organizers.

The outcomes of these study tours was the awareness the participants got to be continually vigilant in observing any new incursions that may from time to time occur in their own areas of control.

A combined meeting is held annually, with Lachlan Valley Noxious Plants Advisory Committee, at the Australian National Field Days, Orange to assist in understanding each others weed problems and to develop joint projects. The facilities at the Field Day are provided free of charge to both Committees.

CONCLUSION

Our Committee, which was founded in 1978, had worked almost exclusively for 10 years in encouraging the community, Local Government, Government Departments and Agencies to combine their efforts and work together for the purpose of securing adequate funding and identifying the best control methods for eradicating Johnson Grass. In 1987, we began to addressing problems associated with all our proclaimed weeds in the region. This is still an ongoing activity at this present time and will continue to be while ever we have problem weeds.

From 1997 it became very apparent that Weed Officers and Weed Managers needed to be better trained in all aspects of their work and to assist turning an ordinary job, even though it was an important job, into A Vital Career with good industry skills, being well trained and importantly being proud of their work.

We also now believe that the wider community within our region is now better informed regarding the dangers of allowing bad, unwanted plants, to continue to exist unchecked in our environment.

History has now shown that the initial initiative of eradicating Johnson Grass was very successful and that today the only control work that has to done is the controlling of seedling regrowth. The Education and Training programmes, public awareness activities and the development of significant secondary industries active both nationally and internationally, significantly highlight the economic benefits that our Committee's programmes have contributed to the entire region.

Our Committee is an excellent example of how Local Councils, State Government Departments, Rural Land Protection Boards and Landholders can work together to achieve an excellent result when good planning takes place.

How's that for a SUCCESS STORY!!!!!!!!!!

Biography

George Hammond was born in Narromine, educated at Wyong and Young and later at Technical Colleges at East Sydney, Sydney and Granville.

Became a Woolclasser and work with Grazcos and Dalgety NZL until 1964. At this stage left wool and became a Merchandise Manager for Dalgety NZL.

In 1972 created Narromine Crop Centre P/L, specialising in Agricultural Chemicals, Fertilizers, Agronomy Services and Grain Trading until December 1999 when the business was purchased by Wesfarmers Dalgety Ltd (now Landmark).

Through my interest in agriculture became involved in problem weeds that are a concern to agricultural production resulting in assisting with formation of Macquarie Weeds Advisory Committee. Appointed Chairman in 1978, a position still held today. I was made a Life Member in 1998.

Also currently President of Rural Marketing and Supply Association for New South Wales.

While in Narromine assisted with the formation of the Narromine Rescue Squad and the Gorilla Rugby Union Club.

Currently retired and live at Shoal Bay enjoying fishing, restoring old Australian furniture and enjoying life but still involved with weeds.

Author details

- Name: **Mr. George W. Hammond**.....
- Organisation: **Chairman, Macquarie Valley Weeds Advisory Committee**
- Address: **P.O. Box 321, Nelson Bay, NSW 2315**.....
- Phone: **02 4984 2536** ..... Fax: **02 4984 9372** .....
- Mobile: **0418 634 869**.....

Email: **GHammond@bigpond.com**

Our Responsibility in the War Against Weeds

John Thorp
National Weeds Management Facilitator
16 Flowers Court,
Launceston, TAS 7250

ABSTRACT (SUMMARY)

Every person at this conference has some responsibility in fighting the war against weeds, from the land manager to local government to policy analyst to the highest levels of government. Our roles may vary widely from on the ground action to providing funding or possibly regulatory control, but everything we do must focus on conducting the most effective war possible. However, too often we encounter excuses, tardiness and a reluctance to accept our responsibilities. When conflict arises it is often used as an excuse for inaction. What is stakeholder responsibility?

We have the techniques and knowledge to manage the vast majority of weed problems, but are we willing to accept our challenge?

Author details

John R Thorp
National Weeds Management Facilitator
16 Flowers Court, LAUNCESTON TAS 7250
Phone: 03 6344 9657 Fax: 03 6343 1877
Mobile: 0419 323 400
Email: jthorp@jta.com.au

Weeds & Environmental Change – Counting the Real Cost With Special Reference to Tocal

Cameron Archer
Principal, Colleges
NSW Dept Primary Industries
Tocal, Paterson NSW

It is important to recognise that weeds are a consequence of our management and manipulation of the natural environment. Prior to European arrival in Australia, there were no weeds. Aboriginal people lived in harmony with the environment and made use of the natural systems in which they operated. It's difficult to fully reconstruct the environment that we inherited from Aboriginal people, but a few issues bear discussion.

In 1750, travelling from Bathurst to Orange was probably like driving through parkland. The records of various explorers indicate that much of the landscape was either treeless or had scattered Eucalypts with a ground cover of native grasses and other flora. A great opportunity was presented to Europeans when they came over the Great Dividing Range with their sheep flocks and a ready demand for wool. No burrs, no blowflies; some diseases such as catarrh and scab but in general, an ideal environment for grazing sheep.

A study of environmental issues in 19th century newspapers and other literature reveals little mention of weeds. Weeds seem to be something which have developed and become a problem in the 20th century. While there are exceptions, this is a reasonable generalisation.

Weeds have been brought about by environmental changes and the introduction of many plant species into our country. Most of our weeds in our farming systems are introduced. Some are native, but the vast majority are from overseas.

Did these weeds find a ready niche in the Australian environment or have our land use practices encouraged them? Both statements are true.

There were few roadside weeds and there was little need for spraying or controlling these weeds (even if you could) until after World War II.

The end of the war saw the demise of the drover and stock being driven on foot for feed or to market. As a result, the road sides are now a virtual jungle of out-of-control introduced plants, often deemed as weeds. Until then, these stock routes were generally bare, as the long paddock was a source of free grass for the driven livestock.

The question

Counting the real cost of weeds is the question posed for this morning's address.

This is an impossible question to answer but it is one that definitely should be asked. We should also try to answer it and, in the process, unravel some of the issues behind the plants we call weeds.

To do this, I propose to address a number of general issues and then look at some examples before making a conclusion on the matter.

Issues

- **Climatic extremes and episodic events** - We hear the word 'drought' often: a word I suspect we should avoid using if we are to understand the Australian environment and live with it. The Australian environment is episodic. In other words we have prolonged but unpredictable episodes of wet, of dry and so on. These regimes often last for a decade and as a result, they can be the reason why weeds get a hold in an area. These episodes may also give a window of opportunity to control some weeds.

- **Valuing biodiversity** – Weeds are responsible for the destruction of some of the biodiversity of the landscape. In other cases, they can add to the biodiversity, but this is seldom recognised. To put a value on this is virtually impossible but it is necessary to address the matter. With increasing environmental consciousness in the community, many may value biodiversity above food production. Food is now taken for granted but biodiversity is not. The converse was true 50 years ago.

- **Backing winners** - Investing money in weed control is a little like backing racehorses. While I am not involved in all debates about what should be on the noxious weeds list and what shouldn't, it's fair to say that many decisions are quite arbitrary and based on the opinions of forceful personalities and others with an axe to grind. This no doubt is a feature of our democracy but should be seen for what it is.

- **We created the weeds** – it should never be forgotten that our weed problems have been created by us through habitat change and introductions. They are not a quirk of nature, they are an anthropogenic phenomenon and their solution is usually anthropogenic as well. In other words, humans created the problem and we have to take the responsibility for the weeds that are in the landscape. They are a response by nature to our various exploitive activities. The benefits that have accrued from our use of the landscape should go to pay for controlling the weeds.

Stories about weeds

One way of understanding weeds in the landscape is to think of them as a story of ecological and land use change. The timespan of the story extends from the arrival of the first settlers. This will no doubt add to the complexity of addressing matters associated with their cost.

1. **Serrated Tussock *(Nasella trichomota)***

This weed initially was observed in a small patch in the Yass River Valley in the early 20th century. The locals apparently were suspicious of it and tried to get rid of it but failed. It gradually spread from this location and is now a weed of major significance in the NSW tablelands. With hindsight an investment early on would have had a massive benefit cost ratio if it had eradicated serrated tussock. My own experience, having grown up in that district, with a father who was well aware of the danger of serrated tussock, ensured I was always on the lookout for unusual tussocks on the farm. But I didn't know what a serrated tussock plant looked like as I had never seen one. Correct and early identification is the key.

2. **Mimosa (*Mimosa pigra*)**

In the early 1970s I worked for a few years in the Top End of the Northern Territory. Being an agronomist, I had a great interest in anything to do with plants and while not working in the weeds branch, I knew what was generally happening. The branch consisted of an agronomist and a technical officer, a chap called Lofty Pickering and he usually had an offsider. Lofty had the whole of the Northern Territory to manage for weed control. He used to talk to me about spraying Mimosa and fighting a losing battle on the Adelaide River Plain.

He could identify where the patches were but never really had enough resources to get across it all in time to kill it. In addition it was an aggressive plant and seeded profusely. Unfortunately his efforts were in vain and now Mimosa is a weed of national significance in the Northern Territory and invades 800 square kilometres of northern wetlands and flood plains.

3. African Olive *(Olea africana)*

Having now worked and lived in the Paterson Valley for many years, I have observed the various changes in the weed population there. A slow and insidious aggressor in the natural environment is African Olive. This is slowly invading bushland and fence lines and is long-lived, hard to kill and the seeds are readily spread by birds. It doesn't rate highly on noxious weed lists because there are probably others which are more important. In addition it is a useful shade, and in some cases, garden plant. In the next 50 years, African Olive will colonise much of the poorer country and less managed land in the Hunter Valley. The tree can be mistaken as a native and is quite an attractive plant in the landscape. The question is what to do about it? Can its march be stopped, slowed or should it be ignored?

5. Balloon Vine *(Cardiospermum grandiflorum)*

This is an interesting example of how land use change has brought about a weed invasion. In 1989, I fenced off a portion of the Paterson River on the Glendarra property of Tocal. This was to preserve the riparian zone by planting trees and stabilising the riverbank. A recent flood had resulted in further riverbank slips and erosion. The tree planting was successful and now the whole area is a mass of dense trees.

The area has not been grazed since that time, for a number of reasons, including the presence of green cestrum, a toxic plant. Because there has been no grazing, green cestrum *(Cestrum parqui)* and other weeds have invaded, including Balloon Vine. This weed is only on the noxious list for one local government area in Sydney but is rapidly becoming a problem in the Paterson Valley. The problem has been brought about by changed land management and the management I instigated. Therefore we have a conundrum of how bad a weed is.

The neighbours' properties across the river and down the river do not have any Balloon Vine but their banks are nowhere near as stable as the Tocal riverbanks. We have swapped an erosion problem for a weed problem. If not controlled, the Balloon Vine will eventually smother most of the vegetation which was planted to preserve the riverbank, so the story continues.

6. The onward march of the C4 grasses

I have observed in recent years the march of the C4 grasses. These are the tropical or sub-tropical species which grow vigorously during the summer. It would seem that they are spreading in our locality, with recent arrivals including Giant Parramatta Grass *(Sporobolus indicus)* and Coolatai Grass *(Hypparhenia hirta).* These grasses will be further advantaged if the predictions of climate change come to pass. The warmer winters will extend their growing seasons in their current locations and enable them to colonise zones in the cooler country. Again the question is what can we do about these grasses and where do you start?

Paspalum *(Paspalum dilatatum)* has been a long-time invader of the region, initially has a valuable grass for dairy farming but it is now seen in a less favourable light. Its spread has probably been overtaken by Kikuyu (*Pennisetum clandestinum*). Paspalum is probably not seen so much as a weed because others occupy those niches now.

Carpet Grass (*Axonpus affinus*) is more benign but still an invasive species on poorer soils and a problem for the lower carrying capacity grazing land. Some graziers do try to spot spray it to remove it.

Kikuyu Grass is still sown as a productive pasture grass but it is a major environmental weed. To some it's a form of green cancer of the landscape, destroying all natural biodiversity in its path and smothering the landscape with a mono-cultural blanket.

Rhodes Grass *(Chloris gayana)* is still used by some as a pasture grass in poorer areas but has colonised roadsides and has reduced biodiversity in these locations. It is still seen in a favourable light by some but not others.

Whiskey Grass (*Andropogan virginicus*) species has been around for a long time but seems to be slowly spreading particularly into country that is no longer grazed. It is just another import that we could do without, particularly in areas that are set aside from grazing for biodiversity purposes eg tree lots.

Giant Parramatta Grass (*Sporobolus indicus* var. *major*) is a major weed of grazing properties and is of great concern to graziers. This is slowly spreading through the valley, no doubt aided by the warm winters.

Coolatai Grass (*Hyparrhenia hirta*) is a recent arrival and is invading grazing land in much the same way as Giant Parramatta Grass and is also invading roadsides. This reduces biodiversity of natural areas and productivity of those areas.

Climatic change would only exacerbate the impact of these grasses. Both grazing land and non-grazed land are in for major changes from this march of the C4 grasses. Some are still being spread for the purposes of agricultural production and others are finding their own way around.

The proponents of rotational grazing systems for pastures suggest that many weeds will disappear if you get your stocking rates correct. I tend to agree with this, so for many of our farming situations the combination of judicious grazing and other means of control can reduce the impact of some weeds.

Weeds and their impact on Tocal

Some of the above descriptions refer to the weed situation on Tocal and these problems will not exist elsewhere. These are important plants for the future ecology and ecological integrity of the Tocal property.

The Tocal property is 2250 hectares and is located in the Lower Paterson Valley in the Hunter Valley of NSW. It runs a 500-600 breeding herd of beef cattle, milks around 180 cows, has a substantial horse herd, and a small sheep enterprise. It is the site for the CB Alexander Agricultural College, Tocal and the property is used for a wide range of educational and other activities. In addition, it's an important rural heritage site which includes the Tocal Homestead complex and associated curtilage.

The Tocal property in many ways mirrors what is happening in NSW and across the western world. Some land is continuing to be used for serious agricultural production whereas other land is being taken out of production for environmental and other conservation purposes. These changes to land use alter the weed situation and how we view their cost. The following descriptions are associated with the current state of weed management on Tocal and are my own personal reflections made over 30 years in managing the Tocal lands. The following species are mentioned in no particular order as to their importance or otherwise.

Lantana *(Lantana camara)* – probably the most prolific and expensive weed on the property, but is relatively easy to get rid of if one is serious about it. Lantana provides good habitat for small birds and in some cases protects sensitive ecological sites from cattle. A regular spraying program is undertaken for Lantana on Tocal.

Green Cestrum – The most serious poison plant on the property but it has been responsible for few deaths of animals despite its prevalence in many parts from time to time. Any area fenced off on fertile land with trees is a haven for Cestrum. The presence of Green Cestrum on riverbanks is a disincentive for management of fenced off riverbanks. I believe the poisonous qualities of Cestrum are probably overrated but the plant should be respected because of its toxicity. Cestrum is controlled as it is a noxious weed.

Alligator Weed *(Alternanthera philoxeriodes)* – This weed is not yet found on Tocal as far as I know but it's not far away. It's gradually creeping up the tidal reaches of the Paterson River. The Alligator Weed story is similar to that of the Mimosa of the Northern Territory. It looks like being a major problem for us in the future. My problem is that I wouldn't know what it looked like if I saw it which is always a problem for controlling invading weeds.

Water Hyacinth *(Eichhornia crassipes)*– A serious weed of the lagoons and wetlands, and time to time have covered lagoons. At present we have no Water Hyacinth to speak of. The Tocal Homestead lagoon in the past has had serious infestations but we have a committed and dedicated Friend of Tocal volunteer who patrols the lagoon regularly and flicks out any nodules of hyacinth that are growing.

Gomphrema Weed *(Gromphrema celosides)* – An invading weed around roads and public areas. It is fascinating to watch how this plant is spread by car tyres; it can be found anywhere cars are parked on reasonable soil as well as along the roads. It will continue to invade and spread along roadsides as it's very tolerant of traffic.

Balloon Cotton Bush *(Asclepias physocarpa)* – When I first came to Tocal in 1975, this was seen as being a real problem and was going to take us over. At one stage there was a campaign to spray it but it gradually merged into the landscape and there are only scattered plants around in most years. In some years it is more prevalent– an example of episodic weed invasion. I suspect good grazing management works against this weed.

Eucalyptus regrowth – While this conference is about noxious weeds, we should also consider the impact of regrowth of natives in areas where we don't want them as a land management issue. I include regrowth as it's a major issue for people in grazing country.

Silky Oak *(Grevillea robusta)* – This is an introduced native plant from Queensland and it grows readily on much of Tocal. It has the potential to become a weed of bushland if it is allowed to get a hold. It is not as invasive or persistent as African Olive but it needs to be monitored.

Fireweed *(Senecio madagascariensis)* – This annual weed occurs in cultivated pasture land or after a dry summer. It's very obvious and attracts the attention of many because of its yellow flower. Some research has indicated that it has serious poisonous properties but it never seems to cause much of a problem on Tocal. I believe the impact of Fireweed is usually exaggerated because of its obvious nature. In addition sheep and goats will eat it whereas cattle won't. A mixed grazing situation will result in the elimination of Fireweed; as will good groundcover through the summer.

Other – there are many other weeds which can be a problem, particularly in cultivated areas, including Lucerne. Most of these can be dealt with using conventional methods or you live with them. Other weeds which are more of a visual issue to those who like a tidy

landscape are Thistles. For some reason, people don't like thistles and insist on having them slashed and out of the way. We must remember ecology is not always tidy even though a proportion of the population like to see farmland and a grazing property as tidy as a manicured backyard in suburbia. Such sentiments go against good ecological management. The less you cultivate, the fewer weeds you have. I think there is a lesson in that.

Conclusion

Perhaps the costs of weeds will increase chiefly in the non-commercial farm situations where there is not a deliberate management strategy involving a holistic approach to management. The paper by Sinden et al on the economic impact of weeds in Australia suggests the greatest costs of weeds are to agriculture. While this is true, the proportion may change in the future, particularly for noxious weeds. It's important that we continue to tease out the real cost of weeds. We need to undertake economic studies to identify cost benefit ratios for control programs and to continue to assess weed threats to our farming operations but also to our environment.

People generally take for granted the food they receive on their table each day and there is no concern or thought about food shortages or even the cost of providing basic food necessities. The economic case for weed control paid for by the tax payer for agricultural weeds will probably never be as strong as rural industry would like.

On the other hand, the environment remains a major issue for many in the community and any environmental issue— particularly of a photogenic nature— receives media attention. Therefore the case for public investment in the control of environmental weeds will continue to strengthen. It is necessary to undertake economic-based research to assess the impact of environmental weeds in the long-term. This is particularly important for weeds which are obvious to the general public or impact in some way or other on modern lifestyles.

The real cost of weeds should be costed out over decades and not examined on the basis of annual cost alone.

The efforts to eradicate the world of diseases such as Small Pox, and our livestock industries of Brucellosis and Tuberculosis are well known and regarded as success stories. Total eradication of some weeds may be a little different but the issues can be the same. The current success of the fire ant eradication in Queensland bears witness to the ability of these crises to be dealt with. Perhaps the fire ant is more threatening because it can upset the family backyard BBQ.

The real cost of noxious weeds will never be known but the costs of developing ways to leverage for funds for well targeted control strategies is miniscule compared to the benefits of such control.

Acknowledgements

I wish to acknowledge the assistance of my colleagues, Darren Bayley and David Brouwer for their assistance in reviewing the manuscript and to Maggie Moffat for preparing it.

Reference

Sinden J, Jones R, Hester S, Odom D, Kalisch C, James R and Cacho O (2004). *The Economic Impact of Weeds in Australia.* Report to the CRC for Australian Weed Management. Glen Osmond, SA.

Brief biography
Cameron Archer is Director of the Tocal Agricultural Centre and Principal of NSW DPI's two agricultural colleges, Murrumbidgee College of Agriculture and the CB Alexander Agricultural College, Tocal Paterson. He has had a long-time interest in weeds, studying them in his first degree at the University of Sydney and working in agronomy of his career. He is presently undertaking a doctoral study into the environmental history of the Paterson Valley.

Author details
Mr Cameron Archer
NSW Department of Primary Industries, Tocal
Tocal Road
PATERSON NSW 2421
Ph (02) 4939 8888, Fax (02) 4939 8919
Mob 0427 202 948
Email cameron.archer@dpi.nsw.gov.au

The Economic Impact of Weeds in Australia

Jack Sinden[1] and Rachel McFadyen[2]
[1] Associate Professor, School of Economics, University of New England, Armidale, NSW 2351
[2] Chief Executive Officer, CRC for Australian Weed Management, Waite Campus, University of Adelaide, PMB1, Glen Osmond, SA 5064

SUMMARY
New economic research undertaken by the Weeds CRC through the University of New England has established that weeds cost Australia $3.9 billion per year in lower farm incomes and higher food costs. In addition, Commonwealth, State and local government spend at least $116.4 million each year on costs of monitoring, control, management, and research on weeds. These costs do not include the loss of services from the natural environment, the impacts of pollen on human health, or the value of the 'volunteer army' widely active in weed control around Australia. So they are conservative estimates of the annual costs of weeds.

INTRODUCTION
Weeds have a wide variety of impacts on society, the environment and the economy. Some of the economic impacts are benefits but most are costs. The costs of particular weeds in given areas have been estimated by many writers in a rich literature on the assessment of the impacts in agriculture. But only Combellack (1987) has attempted to estimate the nationwide impact of weeds in general. In this innovative study, he valued the costs of weeds in cropping, pasture, horticulture, forests, aquatic areas, industrial areas, railways, and national parks, to be $2,096m in 1981-82.

The nationwide impact of weeds needed to be re-estimated to provide a more recent benchmark that reflects current costs, prices and technologies, and the current distribution of impacts within the community. A current estimate would provide useful information on the magnitude of the weed problem relative to other problems, and for decisions on the allocation of resources and cost sharing.

With support from the CRC for Australian Weed Management, a team from the School of Economics University of New England attempted to estimate the economic costs of weeds across Australia. The full method and results are reported in Sinden at al (2004, 2005), and the procedure and main results are now reviewed.

COSTS TO AGRICULTURE
The costs to agriculture were estimated as direct financial costs of control (such as the cost of herbicides and fuel), yield losses, lost net income to farmers and higher food costs to consumers. The lost net income to farmers includes, of course, the financial costs of control and yield losses. These costs were all estimated for each agricultural industry, such as wheat, barley cotton and beef, and aggregated to give totals for agriculture as a whole.

Control costs are highest for the cropping industries, but yield losses are greater for livestock (Table 1). Indeed, yield losses due to weeds in the livestock industries are a substantial $1,870m each year.

Table 1. Direct financial costs of control and yield losses, in agriculture.

Group of agricultural industries	Costs of control $m	Yield losses $m
Crops	1,033	346
Livestock	315	1,870
Horticulture	17	2
Total	1,365	2,218

* The direct costs are the low estimates and yield loses are best estimates.

The sum of these lost farm incomes and the higher food costs is the total cost of weeds in agriculture and was estimated directly by economic modelling. The results, as five-year averages over the period 1997-98 to 2001-02, may be summarised as follows.

• The mean loss was $3,927m per annum.

• The range was $3,442m to $4,420m per annum.

• The mean loss comprised $883m in the beef industry, $717m in the wheat industry and $588m in the wool industry.

• Primary producers bear 81.4% of the mean loss while consumers bear 18.6%.

The annual cost of weeds to Australian agriculture therefore exceeds $3.4 billion, and may be as high as $4.4 billion per year. The figure varies with seasonal conditions, input prices and commodity prices, but on average the annual net loss is $3.9 billion. The relatively-large cost to consumers indicates that the losses caused by weeds in agriculture impact widely across the whole community.

The loss of $3.9 billion is about 14 % of the current value added by agriculture to the economy, so Australia loses about $1 in every $7 of its agricultural income due to weeds. The loss is about one half of 1% of Gross Domestic Product so Australia loses about $1 in every $200 of its total economic activity due to weeds. But the value of $3.9 billion excludes some significant costs, such as the value of owner-operator labour for spraying weeds, so the real figure will be higher.

COSTS TO THE NATURAL ENVIRONMENT

Natural environments were taken to be National Parks and other areas so described in Natural Heritage Trust agreements. Natural areas provide environmental services, such as benefits from protecting native species of plants and animals. Due to lack of data, the study could not place a dollar figure on the national value of the services that are lost due to weed

invasions. However, we did estimate that at least $19.6m is spent on weed control in these areas each year.

The impacts on agriculture include both control expenditures and yield losses, whereas the cost for natural environments ($19.6m) comprises just control costs. A specific value was estimated for the gain in benefits from the natural environment when weeds are controlled. Based on expenditures to manage 35 weeds of pastures, production forests, and environmental areas (Thorp and Lynch, 2000), the study estimated that $68,712 per year is currently spent by weeds managers to protect each native species threatened by a weed. This is a measure of the benefit expected from preserving these species and natural areas.

This benefit value reflects the budgets available, and so may be the minimum annual value currently assigned to the benefits from protecting the natural environment from a weed invasion. Despite these limitations, this figure does help in benefit-cost analyses to assess the economic desirability of weed programmes. For example, data from the WONS report (Thorp and Lynch, 2000) suggests that $2.032m is spent annually to control each of the 35 primary industry weeds. Using the benefit value from above, the gain in benefits to the natural environment from this control is equal to 67 per cent of the expenditure. So gains to the natural environment cover two-thirds of the expenditures needed to control weeds of agriculture and forests.

COSTS TO COMMONWEALTH AND STATE AUTHORITIES

The total expenditure on weeds by Commonwealth and state agencies (excluding the national park and wildlife services), other government authorities, local government and other public land managers in 2001-02 was at least $80.8m. Commonwealth authorities spent a further $13.0m at least on weed management, policy and research in 2001-02. There is an increasing reliance on community groups to undertake weed management. The case studies in the report indicate that governments avoid a considerable cost as a result of this volunteer effort.

COSTS ON INDIGENOUS LAND

The financial cost of weed control on indigenous land in the Northern Territory over the period 1998-99 to 2001-02 was at least $3.045m per year.

CONCLUSION

The study establishes that the loss to agriculture is $3.9 billion per year, while a further $116.4 m is spent each year by governments in control and management. At an annual cost of $3.9 billion per year to agriculture, weeds constitute a major natural resource management issue. Indeed, this estimate of the cost of weeds exceeds the combined estimates of the cost of salinity, soil acidity and soil sodicity, all major problems in the farm sector. The figures show why weeds continue to dominate the problems listed by farmers in all three major agricultural zones (pastoral, wheat-sheep and high rainfall). This information complements other reports that highlight the urgency of the current situation and which call for a program of new national action on weed

awareness, education, research and control at the national, state and regional level.

REFERENCES

Combellack, Harry (1987) "Weed control pursuits in Australia", *Chemistry and Industry*, 20th April, 273-280.

Sinden, Jack, Randall Jones, Susie Hester, Doreen Odom, Cheryl Kalisch, Rosemary James and Oscar Cacho (2004). *The Economic Impact of Weeds in Australia*, CRC for Australian Weed Management, Technical Series No 8, Adelaide. pp 55. (This report is available at the CRC website *www.weeds.crc.org.au*)

Sinden, Jack, Randall Jones, Susie Hester, Doreen Odom, Cheryl Kalisch, Rosemary James, Oscar Cacho, and Garry Griffith, 2005, "The economic impact of weeds in Australia", *Plant Protection Quarterly*, 20(1) 25-32.

Thorp, J R and R Lynch, (2000), *The Determination of Weeds of National Significance*, Commonwealth of Australia and National Weeds Strategy Executive Committee, Launceston.

ACKNOWLEDGEMENTS

This research was supported by the CRC for Australian Weed Management. We are grateful to Randall Jones, Susie Hester, Doreen Odom, Cheryl Kalisch, Rosemary James, and Oscar Cacho who prepared the chapters in the main report. Garry Griffith was the peer reviewer for the report. We also particularly acknowledge the help of the many individuals and government departments who provided data.

A Unique Approach to Weed Management

Jane Tracy
Noxious Weeds Extension Officer
Cooma Monaro Shire Council

INTRODUCTION

Invasive species and landclearing are the primary causes of biodiversity loss in Australia. Noxious weeds particularly, present negative impacts seen economically with reductions in production, environmentally through biodiversity losses and socially in a reduction in the recreational value of public land. It is a problem unlikely to lessen in many areas of Australia.

Legislation relating to noxious weed control has been in place for over 100 years in one form or another (Carter 2000). The regulatory application of legislation is event of more recent times, and even more recently it has been realised that there is rarely sufficient funds for Local Control Authorities to enforce control (Selsky 2002). Ever persistent drought cycles continue to limit effective weed control options and the increasing adoption of Ecologically Sustainable Development practices and policies further limit budgetary demands. Noxious weed control can be daunting time for Local Control Authorities.

In their last review of noxious weed policies and operations, the Cooma Monaro Shire Council decided to embrace all the challenges faced in noxious weed control enforcement and look beyond the immediate weed issues to the future where sustainable land practices by all land managers at the grass-root level will result in economical, environmental and social gains.

This paper is an overview of the challenges and successes faced by the Cooma Monaro Shire Council in the adoption of a unique way to manage noxious weeds.

PRINCIPLES OF WEED MANAGEMENT

Weed management demands time, attention and resources, yet despite significant amounts of money being spent on chemicals annually, weeds remain a major problem. Controlling a weed in the early establishment stage is far more cost effective than managing a widespread problem. In fact, effective weed management is only possible with the correct identification of both desirable and undesirable species; as well an understanding of the biology and ecology of weeds and ecosystems in which they occur as well as an appropriate assessment of the current and future impacts of both the weeds and any control options (Sindel 2000 and Dowling 2000 *et al*). This underlying principle to weed management is nothing revolutionary. The adoption of this for some can be challenging.

Historically, methods utilised to control weeds have varied from doing nothing to pasture production. The most common method of weed control includes herbicide applications but in many cases without appropriate planning or follow-up measures. This approach is clearly unsustainable and has resulted in escalations of weed spread and as Reeve *et al* (2000) found, also in less vigorous pastures with subsequent losses of perennial and legume species.

In areas where agricultural production has been a long-standing feature, pasture management has prevented isolated weed issues developing into substantial infestations. However, as vast areas of land have progressively been subdivided, new land managers with differing values or practices have impeded, often unknowingly, the ability of pastures to

effectively compete with noxious weeds (Campbell 1998). A shift towards the adoption of integrated weed management systems has then been required to spread the risk of failure and increase the probability of success for controlling weed species (Sindel 2000).

Integrated weed management is a long term process that aims to maintain or return an ecosystem to stability. Techniques that reduce seed production, survival and establishment must be worked into an ecosystem context. Grazing (including the density, frequency and length) impacts directly on the prevalence or management of weed populations. Both native and improved pastures must be able to regenerate and cope with disturbances caused by undesirable species (Eddy 2002, Friend & Kemp 2000, Burton & Dowling 2004 and Dellow *et al* 2002). However, grazing a noxious weed species such as African Lovegrass (*Eragrostis curvula*) a C4 species, for example, presents difficulties in some areas of the Coma Monaro Shire where managers are to maintain grazing pressure throughout the weeds growing cycle to effectively manage infestations whilst at the same time encouraging or allowing desirable species to set seed.

Integrated weed management requires the use of a number of different management tools and for some species of weeds there are natural predators which, with the establishment of a natural enemy complex, can assist weed and pasture management (Myres & Bazely 2003). When used with other practices such as grazing and fertility management, biological control can be even more effective and as an added bonus native species are largely unaffected by biological control agents and being more adapted to local environments and climate, can provide effective competition to weed species. Biological control however, is as Mugt (2001) found, unlikely to be the panacea to weed problems unless used in an integrated weed management context.

All noxious and environmental weeds have the potential to impact on biological diversity and native vegetation including three threatened ecological communities found within the Cooma Monaro Shire and protected under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* and the New South Wales *Threatened Species Conservation Act 1995.* Managers of natural ecosystems therefore must consider all recreational, community, cultural, ecological and financial imperatives when designing and implementing weed control programs (Mason & Hocking 2003 & McLaren *et al* 2004).

In a natural environment, such as the grasslands and woodlands found throughout the Cooma Monaro Shire, integrated weed management must also aim to contain the spread of undesirable species, manage the existing desirable populations to prevent further weed incursions and manage the rehabilitation of disturbed areas as changes in structure and composition of vegetation impacts directly on flora, fauna, soil biota, bacteria and fungi (Benson 1994, Kirkpatrick *et al* 1995 & Vranjic *et al* 2000).

CHALLENGES TO WEED MANAGEMENT

The Cooma Monaro Shire covers an area of more than 5,400 square kilometres across diverse landscapes supporting over 9,700 occupants. The Shire is flanked on the east, west and north by national parks and state forests accounting for 15% of the Shire area. The Monaro Grasslands are shared with the Bombala Council and Snowy River Shire. Approximately 90% of the Shire lies in the South-Eastern Highlands bioregion comprising predominately wet and dry sclerophyll forests, woodland, minor cool temperate rainforest and minor grassland and herbaceous communities (Thackway & Cresswell 1995). The north-west area covering about 11% is defined as the Australian Alps region and includes alpine herbfields and other treeless communities; Snow Gum woodlands and Montane forest dominated by Alpine Ash and is protected within National Park or National Reserve systems (Thackway & Cresswell 1995).

The Monaro grasslands, as a result of weed incursions and a lack of control actions in some areas historically, have been subjected to long-term floristic changes with some species

impacted upon and others able to persist. Those species remaining are in some instances the only remaining indigenous ground flora (Sharp *et al* 2004). Ceasing grazing now for example, may prove detrimental to achieving a complete ecosystem recovery even with the very best of intentions (Mugt 2001). As a result, effective weed control was and in some cases is still viewed as not completely achievable, especially economically as Vranjic *et al* (2000) found and then, as is often the case, the weed burden continued.

As indicated above, the correct identification of both desirable and undesirable species can present further challenges to effective weed management. In some of the areas where control actions were attempted, it is clear now that the misidentification of noxious weeds is as detrimental as Roberg (2003) forewarns. And whilst chemical applications in native environments, when undertaken with care, can result in positive effects, the preservation of every self-sown native plant when treating large weed infestations is not assured (Mugt 2001 & Roberg 2003).

Further, as pastures deteriorate due to combinations of climate and markets and the management responses to these influences (Dowling *et al* 2000) weed control was often overlooked. Fertiliser use, as Campbell (1998) found, was reduced on the Monaro due to declining margins as weeds began to dominate the landscape.

Challenges Faced By the Cooma Monaro Shire Council

In terms of meeting their statutory obligation to weed control enforcement, the Cooma Monaro Shire Council has travelled down the path all too familiar to Local Control Authorities. Through the provision of a service approach, which included education of land managers, the Cooma Monaro Shire Council initially either undertook control works (chemical spraying) on behalf of the land manager and charged a subsidised rate, or organised aerial work over normally inaccessible land. This approach proved unsustainable as the recovery of fees became increasingly difficult and it did little to alleviate the spread of noxious weeds or achieve changes in land management particularly with little or no follow-up until Council was in the area again some years later.

The service and education approach was rarely able to make sufficient impact on significant infestations which continued to shed seed over other areas of the Shire. The resources required to undertake this approach left little time for staff to perform routine property inspections resulting in no or very few detections of new incursions of weeds before they developed into significant problems for land managers. It also became evident that this approach did not support private enterprise. Since ceasing this approach, numerous businesses have developed to become successful service providers of land management.

Further drought years and the removal from the market of the only chemical available to selectively control Serrated Tussock necessitated a change in policy and operations during the mid 1990's. Increased community participation drove the development of a policy that aimed to protect the agricultural industry and natural environments. The Cooma Monaro Shire Council Serrated Tussock Strategy was written during this policy development process and at this time included a formal request to have this species' control category changed from W2 to W4 with a requirement for property plans. At this time the Cooma Monaro Shire Council had no framework, policy or procedures in place to support the use of property plans and therefore opted to endorse the new noxious weeds policy with the Serrated Tussock Strategy as a means of achieving suitable land management changes over significant problem areas where Section 18 Weed Control Notice's were served.

A LONG-TERM FOCUS FOR ALL

The financial return from agricultural production in the Cooma Monaro Shire is worth more than twenty five million dollars per annum (ABS 2005) and as weeds have the potential to reduce both on-farm and flow-on income as well as threaten biodiversity in pristine landscapes, the impact of weeds on the shire is taken seriously but is, as evident above,

complicated and must focus on more than just killing the weed. This is particularly evident as the eradication of a weed is difficult when a species has been in a region for several years or when the area of infestation is significant and the socio-economic, socio-political and lend tenure variables appear limiting (Panetta & Timmins 2004).

In 2003 the Cooma Monaro Shire Council fully endorsed a reviewed noxious weed policy with a renewed focus for using the combination of education and enforcement to achieve suitable weed control and land management through the use of property weed management plans. This combination of the education and enforcement is found to provide appropriate mechanisms for land managers to fulfil their obligations to control noxious weeds whilst at the same time providing an educational service to the community and ensuring the ecological integrity of natural environments is protected.

In promoting this goal, the Cooma Monaro Shire Council developed the Noxious Weeds Extension Officer position to work collaboratively with existing weeds officers. The position is separate from the inspection process and as such is removed from the sometimes, unpleasant actions and reactions of enforcing legislation. Council is now able to develop lasting beneficial partnerships with individual landholders through the development of weed management plans for individual properties as well as through education and advice.

Land managers identified through the systematic inspectorial process as requiring assistance are predominately those with significant weed infestations. They are contacted by the Noxious Weeds Extension Officer and are able to carefully develop weed management plans for these properties. Management plans ensure land managers meet the requirements of all noxious weed and environmental legislation and are only adopted after lengthy consultation processes with input from specialised knowledge from outside Council.

As the Cooma Monaro Shire Council has found, prior to the adoption of integrated weed management systems, the general public, farmers and managers of agricultural and non-agricultural land must be convinced that noxious weeds present significant problems for them, their neighbours, the Australian economy and the environment (Adkins & Walker 2000). This is often the biggest hurdle to be crossed initially however with the right approach and persistence, it is proving beneficial with the resultant weed management plans developed with an integrated management outlook over a number of years.

To further ensure the success of this process, the Cooma Monaro Shire Council found that increased surveillance, achieved through annual inspections of those properties that have entered into formal weed management plans was required. The increased surveillance provides the added benefit of risk management given, as Panetta and Timmins (2004) found, there is an inverse relationship between the probability of success and the required effort required for eradication, since effort increases with the size of the problem, while the probability of achieving success can be expected to decrease.

Since the instigation of this unique approach to weed management there has been a noticeable decrease in the number of formal complaints to Council by landholders and an increase in the awareness and demand for the weed management services the Cooma Monaro Shire Council provides. Significantly, more than eighty percent of the plans already developed have been successfully demonstrated that finding a balance between legislation and education is important to achieving sustainable outcomes for both parties.

CONCLUSION

The introduction and spread of undesirable species such as noxious weeds is a feature of today's world we will never escape. Weed legislation is in place to restrict the spread of weeds and define the responsibilities of all land managers in controlling noxious weeds. Environmental legislation exists to protect the ecological biodiversity as it exists now for

future generations. How to work within the legislative frameworks to achieve economical, environmental and socially acceptable outcomes are the challenges Local Control Authorities must face.

The Cooma Monaro Shire Council has found that land manager education and engagement is paramount to taming any noxious weed burden and that regulatory enforcement, although necessary in some instances, is prescriptive, costly and rarely effective on its own. Changes in landscape management from single reactive approaches to systematic integrated management will ensure a future that is more adaptable to change.

The approach outlined in this paper may be easily adopted by other Local Control Authorities where, given the increasing regulatory and enforcement roles they must perform, are often looking for an alternative approach.

References

AUSTRALIAN BUREAU OF STATISTICS National Regional Profile, ABS cat. no. 1379.0.55.001. Cooma-Monaro (A) Commonwealth of Australia 2005 http://www.ausstats.abs.gov.au/Ausstats/free.nsf/Lookup/B0BDBA8D74C6C185CA256E6E00015BF5/$File/NRP_LGA12050.xls

Adkins, Stephen W & Walker, Steven R (2000) Challenges and Future Approaches to Weed Management. Cpt. 24 pp 481-496 **in** *Australian Weed Management Systems*, Sindel Brian M (Ed), RG and FJ Richardson, Victoria, Australia

Benson, J. S. (1994) *The Native Grasslands of the Monaro Region: Southern Tablelands of NSW*. Cunninghamia 3(3)

Burton Jeff & Dowling Peter (2004) *Pasture Management for Weed Control*. Cpt 2. Cooperateive Research Centre for Australian Weed Management, NSW Agriculture, Meat & Livestock Australia and CSIRO

Campbell, M H (1998) Methods of Controlling Serrated Tussock (*Nassella trichotoma)* on The Monaro **in** Recovering the Monaro – Alternative approaches to managing the weed problem on the Monaro 12 & 13 August 1998 in Cooma and the Snowy River Corridor. Workshop

Carter, Richard. J. (2000) Cpt 5 pp 83-104 **in** *Australian Weed Management Systems*, Sindel Brian M (Ed), RG and FJ Richardson, Victoria, Australia

Dellow, J.J.; Wilson, G.C.; King, W. McG; Auld, B.A. (2002) Occurrences of Weeds in the Perennial Pasture Zone of NSW. *Plant Protection Quarterly* v17. RG and FJ Richardson, Victoria, Australia

Dowling, Peter M; Michalk, David L and Sindel, Brian M. (2000) Weed Management in Pasture Systems Cpt 16, pp 307-328 **in** *Australian Weed Management Systems*, Sindel Brian M (Ed), RG and FJ Richardson, Victoria, Australia

Eddy, DA (2002) *Managing Native Grassland: a guide to management for conservation, production& landscape protection.* WWF - Sydney

Friend Douglas A & Kemp David A. (2000) Grazing Management Methods Cpt 8 pp 139-160 RG and FJ Richardson, Victoria, Australia

Kirkpatrick, J.; McDougal, K. & Hyde, M. (1995) *Australia's Most Threatened Ecosystems: the South Eastern lowland native grasslands*. Surrey Beatty & Sons in association with World Wide Fund for Nature, Australia - Sydney

Mason, Brian & Hocking, Colin *Herbicide Control of Exotic Grasses in South East Australian Native Grasslands: case study with Serrated Tussock (Nassella trichotoma)* **in** Pasture Protection Quarterly V18 (2) 2003. RG and FJ Richardson, Victoria, Australia

McLaren, David, A.; Stajsic, Val. & Isaconis, Linda. (2004) The Distribution, Impact and Identification of Exotic Stipoid Grasses in Australia. **In** *Plant Protection Quarterly V10 (2)*. RG & FJ Richardson, Victoria, Australia

Mugt, Adam (2001) *Bush Invaders of South-East Australia: a guide to the identification and control of environmental weeds found in South-Eastern Australia.* R G & F G Richardson, Victoria, Australia

Myres, Judith& Bazely, David (2003) *Ecology and Control of Introduced Plants*. University Press Cambridge – United Kingdom

Panetta, F.D. & Timmins, Susan. M. (2004) Evaluating the Feasibility of Eradication for Terrestrial Weed Incursions. **in** *Plant Protection Quarterly* V19 (1) RG & FJ Richardson, Victoria, Australia

Reeve I.J.; Kaine G.; Lees J.W. Barllay E. Producer Perceptions of Pasture Decline & Grazing Management **in** *Australian Journal of Experimental Agriculture* 40 (2000)

Roberg, Katrina (2000) Herbicide Use in Natural Vegetation – the problems faced by local government, implementation and the importance of record keeping **in** *Plant Protection Quarterly* V. 18(12) RG & FJ Richardson, Victoria, Australia

Sharp, S.; Dorrough, J.; Rehwinkle, R.; Eddy, D. & Breckwoldt, A. (2004) *The Grassy Ecosystems Management Kit: A Guide to Developing Conservation Management Plans.* Environment ACT Canberra.

Selsky, Robyn (2002) *the Infestation of Weeds in the Eden-Monaro District and the Availability of Funds for Weed Management*. Prepared for Mr Gary Nairn MP, Federal Member for Eden-Monaro, Parliament of the Commonwealth of Australia

Sindel Brian M. (2000) The History of Integrated Weed Management Cpt 13 pp 253-265 **in** *Australian Weed Management Systems*, Sindel Brian M (Ed), RG and FJ Richardson, Victoria Australia

Sindel Brian M. (2000) Weeds and Their Impact Cpt1 3-16 **in** *Australian Weed Management Systems*, Sindel Brian M (Ed), RG and FJ Richardson, Victoria, Australia

Thackway, R. & Cresswell, E.D. (1995) *An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program.* Version 4.0 Australian Nature Conservation Agency, Canberra.

Vranjic, John A.; Groves, Richard. H. & Willis, Anthony, J. (2000) Environmental Management Systems. Cpt 17 pp329-354 **in** *Australian Weed Management Systems*, Sindel Brian M (Ed), RG and FJ Richardson, Victoria, Australia

Developing Weed Recording in Dubbo

Lynton Auld
Manager Landcare Services
Dubbo City Council

Summary
Dubbo City Council, like many Local Control Authorities (LCA's) has long recognised the need for an objective and archivable record of weed infestations across the City.

Dubbo City Council's Parks and Landcare Division, responsible for weed management in the City recognised the need for a weed management software system to automate some processes and, just as importantly, to record past infestation for future interrogation.

The Division examined its goals from the project and identified the need for connectivity with other (existing and future) data within Council's systems as critical to the long term success of the project.

Parks and Landcare examined its role and its capacities in relation to information and data management and identified early that another Division of Council, Administration and Finance, is responsible for managing and maintaining Corporate Data. A system was therefore needed which would piggyback on the Corporate system so that those responsible within the Administration and Finance Division could maintain it and any changes to the Land Information System, Geographic Information System or Financial Management System would be recognised and be instantly useable by the weed management system.

Put simply we needed our system to be part of the Corporate system.

Given existing decisions regarding the management of corporate data and Geographic Information this effectively tied the development to one of three approaches;

1. either using the data management system's supplier to develop a "new" product to add on to the data management system, or
2. develop a system separate to the supplier
    a. in house or
    b. from a separate software supplier.

All of these approaches were attempted. An external, independent, supplier was initially approached, the data management systems supplier was approached, and finally the development was brought back in house where we are finally seeing success.

Dubbo City Council's Needs

Dubbo City Councils' needs from a weed recording product are seemingly straightforward, we need a product with which;

- Staff can collect data easily
- Staff can transfer that data to the Corporate database
- The database can communicate with and be interrogated by the GIS
- Staff can produce maps of infestations easily
- Weed notices cannot be automatically generated

There are other features which would be nice but we can work on them in the future. Right now, if we can get those points to work we'll be satisfied.

Another, very important, reason to keep it simple is that if an additional feature proves too difficult to add later, the program will still work in its "core" state. If the additional feature becomes "core" and can't be made to work, the system itself can't be made to work. Better 80% of the pie than 100% of an empty pie tin.

The Process

1. Council's Parks and Landcare Division staff responsible for Weed Management met with Council's IT staff in 1997 to request development of a product which would meet Councils needs. IT sought an external consultant who made a range of attempts over several months but failed to deliver the required product.

The project was shelved as "too hard" at the time and dot point mapping and manual recording/reporting continued.

2. Council's Parks and Landcare Division Director reinvigorated the project in mid 2003 through frustration at the lack of progress on an on-going budget item. A meeting was called with IT and GIS to examine options for developing/producing or procuring a system capable of delivering the Divisions expressed needs.

Information Technologies initial feedback was, "that's OK we'll get our database supplier to develop an "add-on" to their system which will meet your needs".

Subsequently the supplier arrived, spent a day with staff, went away and developed three quarters of a system. The supplier has been unable to complete the project at this stage.

3. A meeting was called in early 2004 to reinvigorate the stalled process. A detailed assessment was carried out and both IT and GIS committed to deadlines for achieving the various components of the product.

4. Council's Parks and Landcare Division staff responsible for Weed Management met with Council's IT and GIS staff throughout 2004 and 2005 to follow up progress and reschedule missed deadlines, trial the initial products, discuss difficulties with prototypes, and generally to maintain the projects focus and progress.

Specific issues with the database not communicating with the GIS were a continuing problem until IT staff developed a new sub-program. In one instance the way the two

systems write dates was incompatible and initially unresolvable. IT staff resolved this issue, and many others.

The Result

Right now we are at a point where we have two thirds of our needs met.

We can now map an infestation in the field and transfer that to the GIS system allowing maps to be produced which now accompany our notices. This mapping information is now saved in the Corporate database and the GIS and database systems can now communicate freely, an advantage for the systems which will follow, such as our street tree database.

However, we still can't get forms or notices printed by the system, we're still doing that manually. We are much closer however, I've seen a draft of form number 1 and we have been promised the first four forms linked to the mapping by September 23, the day after this Conference ends.

So while we still don't have a completely working product, we will be there very soon.

The Product

Council's weed inspection staff use a Trimble hand held computer/GPS unit to map infestations. Staff identify the weed, record information on the weed and its density via drop down boxes on the screen.

The Trimbles internal GPS locates the infestation, mapping its outline by tracking staff movements. This produces accurate polygons (irregular shapes) of the shape of an infestation at a given time

This record(s) is then downloaded to Council's database system, which refers the information to the GIS from which maps can be printed. So far so good.

- √ Staff can collect data easily
- √ Staff can transfer that data to the Corporate database
- √ The database can communicate with and be interrogated by the GIS
- √ Maps can be produced
- x Weed notices cannot be automatically generated

The Lessons

The lessons to be learnt from our experiences are simple;

1. Identify your needs clearly at the commencement of your project
2. Identify system limitations clearly (ie data management and GIS constraints)
3. Confirm data maintenance responsibilities; preferably elsewhere
4. Ensure all players, weed management, IT, GIS (if separate) and particularly management in all Divisions understand the projects needs and limitations
5. Examine "off the shelf" (commercial) or "copyable" (such as ours) options, if one of these existing systems meets your needs PRECISELY, consider it, but do so with care, a slight flaw, omission or (far worse) incompatibility will deliver a stand alone system with its inherent high on going maintenance costs
    a. ensure that it does not require duplication of datasets, mapsets, rates information, land tenure etc.

6. If no viable alternative exists develop the product you need yourself, you will be sure of getting what you want;
    a. Get to know your IT people, buy them Christmas presents (don't mention the "Code of Conduct")
    b. Prepare for a long process
    c. Be focused on your needs, keep them simple and achievable and don't let yourself get carried away with offers of little "extras" – they might be nice but they can be added after the core is in place.
    d. Maintain pressure for the achievement of targets
    e. Celebrate the development of a working product or,
7. Copy what Dubbo City Council has developed (assuming you're operating with the same software as us). I'm sure our system will be working brilliantly by then!

Good Luck!

~~Geospatial~~GPS Technology in the Fight Against Weeds

~~USING NEW AND OLD INITIATIVE INNOVATIONS~~

The Parkes Shire Council Experience

Ian Stephenson
Noxious Weeds officer
Parkes Shire Council

C~~Laptop c~~omputers combined with global positioning systems (GPS) and Geographical Information Systems (GIS) have become an integral part of the ~~play an integral role within the~~ weed management system employed at Parkes Shire Council.

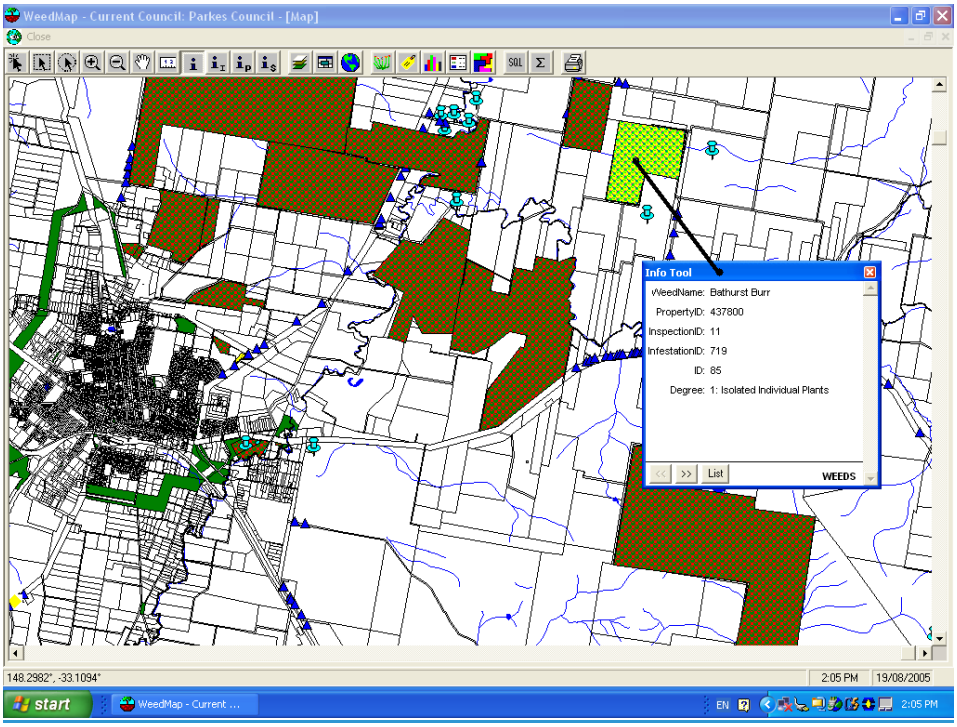
Back in 1996, Parkes Shire Council identified the need ~~needed to~~ to quantify the locations and the extent of infestation within our shire~~. (WHY ????)~~. At the time there was a requirement for regional weed plans to be developed and there was also a disturbing decline in grant funding. This motivated Council to investigate how it could improve its weed control operations. Parkes Shire Council was also developing its Roadside Management Plan which had direct implications for weed management.

At th~~e~~at time, Council~~we~~ only had hard copies of ~~paper~~ maps indicating the known infestations of each declared weed, often represented ~~as~~by a dot. The dot ~~was~~ merely ~~a representation~~ showed the approximate location only. No other information could be conveyed by the hardcopy maps such as precise location, property name, owner, size of infestation~~s~~, number of plants etc. ~~of had dots that may measure about 1 kilometres of road reserve, not of true accurate enough for council road side management plan.~~

This meant that there was undue reliance upon the weeds officers memory and experience, plus any other information held on file. Problems also arose when officers were on holidays, transferred or left the organisation, taking important undocumented knowledge and information with them.

To address these deficiencies, Council initially went towards utilising a global positioning system (GPS) linked to a laptop computer containing Weedmap© which at the time had basic cadastral information for the Shire only. ~~The only really accurate and accountable measures we had where a handheld GPS and a old laptop with weedmap program using a GPS system.~~

The~~is~~ program was satisfactory ~~part OK~~ for some inspections and data logging~~-~~ infestations on private property, but lacked many characteristics needed for roads or other land parcels~~s~~.

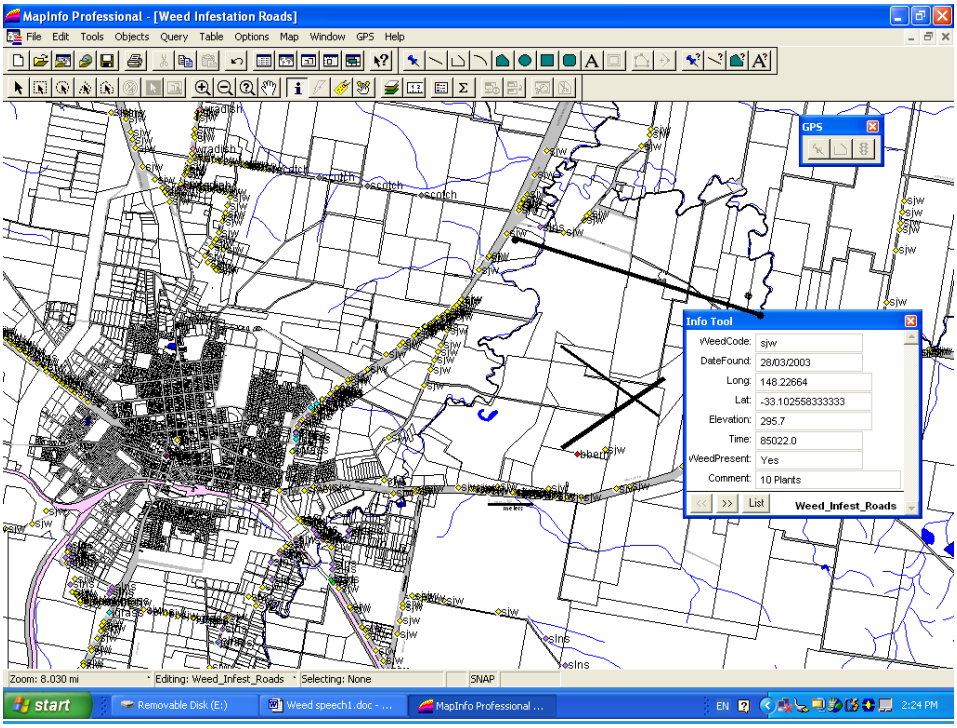


We required a ~~a~~ more complete and accurate mapping system that also included~~for~~ all our road~~s~~, rail and Crown R~~r~~eserves ~~and other lands~~ to ~~actually~~ measure and record ~~measure~~ the full extent of infestations throughout the Shire.

LiaisingNetworking with our advancing IT Ddepartment ensured that they guided in the direction of a compatible program compatiblewas selected that linked easily –with the existing GPS technology and the improved Weedmap© program. The program selected was know as MapInfo©, a geographical information system (GIS) which catered for all the mapping and data collection requirements needed for effective weed management. It also catered for a number of other Council requirements including asset managementaccess.. This program has already been proving to council a valuable tool in its other duties.

Having linked thecombined GPS unit to the MapInfo program on computerthe laptop we were able where able to precisely put marks –on an electronic map instantly the location of any infestations. All data recorded taken in the field is live and accurate normally within to down to two to five metres or so.

The combination Having combined of thesе two programs enabled cCouncil to develop can now show a true and accurate electronic map of infestation as found each year on all lands inspected . This allowed us to track the spread of weed populations and prioritise future weed control measures.



Going back a bit, some of you may remember the ~~Going back to the~~ Ballina W~~w~~eeds C~~c~~onf~~e~~rence in 1999. M~~ m~~any weeds officers sitting ~~at~~ around a table late one night, discuss~~ed~~~~ing~~ weeds and mapping for the future. ~~i~~It was ask~~ed~~ what was out there in electronic mapping that really would work. Given that we had purchased MapInfo and Weedmap there was still some doubt as to whether this was the best way to go.

However, ~~i~~In April 2000 ~~we received~~ a report from the former D~~d~~epartment Agriculture, ~~and~~ based on a survey of ~~participating~~ S~~s~~hires throughout the S~~s~~tate concluded that W~~that w~~eedmap and MapInfo w~~h~~ere the leading programs being used. Council new then, that it ha~~s~~d been proceeding in the right direction ~~on the correct pathway~~ with regard to~~in~~ its mapping and data collection.

The information recorded over space and time allows Council staff to see the big picture and develop priorities and action plans. This approach is proactive rather than reactive and allows for

more efficient weed management.

Major benefits for Council arising out of the use of GPS and GIS systems since 1996 include ~~are to council from 1996 to now is that we have~~ the development of a comprehensive ~~a~~ data base of all the ~~it~~ declared weeds digitised and visually represented on Council's Shire ~~electronic~~ maps ~~in MapInfo©. This enables all staff to accurately locate existing infestations and also monitor trends in distribution~~ ~~able to be located as required~~.

Other ~~All infestations are of a true accurate location giving the ability to see the big picture in weeds prioritisation and management.~~
benefits of utilising GIS and GPS include:

- Proving ~~A~~accurately ~~proving~~ what are core and/or rare and isolated infestations. **Formatted:** Bullets and Numbering
- Increasing Council's efficiency ~~Reducing overall costs for council~~ in inspection and control~~s~~ programs. **Formatted:** Bullets and Numbering
- Controlling weeds at a precise location~~s in~~ early in the season and reducing early seed set~~.~~. **Formatted:** Bullets and Numbering
- Giv~~ing~~ing C~~e~~ouncil's engineering section a true visual indication of the weed infestation along a particular section of road side. ~~Council using weeds data base as part of there roads construction and maintenance programs.~~ **Formatted:** Bullets and Numbering
- The visual presentation of the distribution of weeds throughout a region, which provides an invaluable tool in educating the community. **Formatted:** Bullets and Numbering
- The readily available weed maps which all Council staff can access. **Formatted:** Bullets and Numbering
- Improving the likelihood of a successful grant application. Often grant applications require evidence of ongoing management of a certain weed. The information provided by these mapping systems enable a strong argument to be conveyed in grant applications. **Formatted:** Bullets and Numbering

Council has now updated its Roadside Management Plan to reflect the increase in accuracy the

new technology has provided. This has meant a reduction in the incidental spread of weeds through road maintenance grading and construction work.

~~Rewriting there roadside management plan and giving weeds a higher prioritisation in there applications in new management plan.~~

Prior to most work being undertaken by Council there has to be an Environmental Impact Assessment completed. The information now available for inclusion in these reports highlight important management issues in reducing the spread of weeds. Appropriate action can be taken prior to the project commencing that will address the issue so as the potential impact can be avoided or minimised.

Take Home Message

The technology is out there, a ~~,Ask around~~ other C~~c~~ouncils that are, or have been using these programs ~~in the past.Trying~~ The technology has the advantage in conveying a true and accurate measure of the concentration and spread of weeds and greatly assists in their management. It will also most likely ~~these~~ have the added benefit ~~programs it may suites y~~to your ~~c~~Council or ~~b~~Boards in assisting in many other duties, for example asset management. ~~as well.~~ Collectively ~~together we are~~ can, and are, raising the standard of ~~becoming to set standards in~~ weed mapping in local and regional area's through the use of this technology.

~~Totally having the advantage in true and accrete measures for the fight in weed management.~~

USE OF GEOGRAPHIC INFORMATION SYSTEMS
for Noxious Weed management

Reece Luxton, Chief Weeds Officer
Chris Clausen, Senior Weeds Inspector
Clarence Valley Council - Noxious Weeds Office
Locked Bag 23 Grafton NSW 2460

ABSTRACT

Geographic Information Systems and other like systems are thought to be under-utilised by those involved in on-ground weed management. The authors propose that novel approaches need to be taken to get information into more useable formats from those in the 'know' - the Weed Inspectors and Spray Operators in the field. Mapping technology through Geographic Information Systems and PocketPC's were used to obtain up to **55%** increase in efficiencies in property inspections over 12 months in addition to tripling the area of properties inspected.

Keywords: Property inspections, GIS, mapping, PocketPC, adaptive management.

INTRODUCTION

Mapping is a term used in most weeds strategies, from National to Local level, pointing out that it provides objective information. This can be used for decision making in identifying new and priority weed species, and monitor the success of weed programs. Hence mapping is a critical component of effective weed management. Mapping provides a means of monitoring and evaluating programs. It is also becoming more affordable for Noxious Weed Officers to have access to this technology.

Background

In NSW noxious weed control is administered by NSW Department of Primary Industries (DPI) and delivered by Local Control Authorities (LCA's). There is a requirement of LCA's to carry out routine inspections of private properties and Council's lands under the *Noxious Weed Act 1993*. NSW DPI provides matching funding for these inspections and enforcement activities on the proviso that annual reports are submitted. This requirement, and the availability of new technology in weed mapping, has prompted many LCA's to acquire desktop mapping software and GIS as a management tool for weed control (Maguire 1999). Weed mapping standards from NSW DPI were produced in 1999 following a workshop of stakeholders.

The power of a GIS comes from viewing your data spatially, which means that different pieces of information on a computer can be directly related to their real location on the land. GIS is an extremely valuable tool for the management of weeds. The application of data overlays of land use, road and waterway locations, along with topographical data enables weed management strategies to be designed (Bishop 1995).

MapInfo Professional ® was the desktop GIS purchased through the Regional Mapping funding through NSW Agriculture in 1998.

However for Clarence Valley Council - Noxious Weeds staff, the GIS was under utilised, as there was little understanding of the concepts and no set procedures. Mapping was always seen as a desirable outcome for property inspections, but was always dropped off the list of priorities when Weed Inspectors went back to the office - hence mapping didn't get done.

Past procedures and problems

Inspections areas in the past were decided by looking at topographic maps, drawing a rough circle around an area of concern, issuing Section 45 Notification of Entry and inspecting all properties within that region.

Garmin GPS units were originally used for recording data for property inspections but it was found to be too cumbersome and still required information to be entered manually in the office. Information collected in the field was recorded on paper. Once in the office, it was transposed onto inspection reports, of which a copy was kept by council. The same information was then inserted into a Section 18 or similar notice. Although it captured the position of weed infestations, it was difficult to match the data with property ownership details.

A similar process of manual entering and later mail-merging, being a slight improvement, had to be undertaken when issuing Section 45 Notices to enter properties. Property information including the recipients name, postal address, Lot and DP, and property addresses had to be queried out of a larger database and entered into the fields of the correspondence. This became an arduous task for weed inspectors who then had to moonlight as typists and filing clerks.

At this time, a tally of inspections and reports issued were the only statistics kept by the three Weed Inspectors of Clarence Valley Council. It did not reflect trends or changes in weed infestations. Spray Operators only had Pesticide Distribution books to show what weeds were controlled.

What was proposed?

It was proposed that the Noxious Weeds Office make better use of our Geographic Information System (GIS) to help understand where weed infestations were located through mapping technology, and assessing the effectiveness of our inspection and control programs through appropriate monitoring systems.

A standard mapping procedure was needed to allow for consistent, reliable information that can be compared from year to year through use of GIS and other technologies. Information systems are only as good as the design and data entered.

A workshop with staff determined that we should look to how other Councils and organisations addressed their weed mapping tasks, to get the data into a format that will produce appropriate letter. Along with fulfilling NSW DPI requirements, it had to be affordable, staff needed to be trained, and understand concepts and terminology of GIS. There needed to be a functional program that will enable effective manipulation and reporting of the data following property inspections.

Following the investigation of a number of programs throughout the year, particularly Civic View, WeedMap and PestInfo, it was found that none suited the Council's requirements. All were found to be lacking in some area or another in relation to what was needed by the Council for the end goal of property inspection data for use in reporting and issuing of letters Principally they did not fit our existing procedures.

SELECTION OF WEED MAPPING PROGRAMS

After evaluating potential options the Council opted for the PocketPC hardware and MOST software systems, which are described below. With the software and hardware provided, GIS mapping and Inspection Notes could be collected electronically. Altogether the cost was in the vicinity of $3750 for the software and $4000 for the four handheld computers.

PocketPC's

These handheld computers have provided a quantum leap for viewing property information in a geographical sense. The use of PocketPC's allows for mapping of inspections against a property cadastre as a background.

The advantages were quite simple. They are small in size; conveniently fits in your pocket and can run all day on a rechargeable battery. They have other added benefits of onboard programs such as Microsoft Excel spreadsheets, which is used to calculate quotes in the field for operational works and calibrating spray equipment.

Data can be synchronized automatically or manually with a desktop computer where the data is then uploaded for producing letters and reports. It was encouraging to see the Weed Inspectors jump at the opportunity to use them, when the technology of mobile mapping through PocketPC's became available. It was the attractant to get the Weed Inspectors to collect the mapping data.

Mobile Open Spatial Technology (MOST)

MOST can enable seamless transition between desktop and mobile GIS applications. Field staff can use it to draw basic map objects (points, lines and polygons) and to capture new data or update existing data with a map background.

Data entry in the field is via pull down lists to minimise capture time and operator errors. The customised entry forms are developed from a desktop computer via a dialog box which allows users to specify required columns. The application automatically populates the entry forms pull down lists from existing entry types for each column (OST 2003).

It is designed specifically for field officers with limited computer skills. Training was minimal and staff were underway in 10 minutes

DISCUSSION

With all the systems in place we set forward in trying to utilise this equipment. Adaptive management or 'learning by doing' is the best way to describe what was achieved, as we were unsure what to expect with the technology. We had particular perceptions of what the technology could do, but it was a matter of trying to fit with the capabilities of the technology

It is thought that the Weed Inspectors had more commitment because they helped develop the mapping procedure right from the start. They have assisted with continuous improvement of the system over time.

Mapping of Property Inspection - improves productivity

Now with the use of PocketPC's and MOST, it has proven effective particularly for the collection of data from property inspections. Staff were mapping more, although it was limited to learning by doing. A lot of trial and error occurred before we got the process right.

It is a handy tool on properties where no fenced boundaries exist. This alone has saved a lot of angst for the Weed Inspectors in the field - sending information to the wrong person and delaying the process of effective weed management.

The PocketPC's also have the capability of running GPS, where the Weeds Inspector can confidently navigate the property to all land types that may exist on the parcel of land. This is beneficial to enable staff to revisit the exact same spot, to determine if the infestation has decreased in size, or possible radiated out from the initial source giving real time location of the weed infestations on a property.

This is where the benefits of the PocketPC came to the fore - you could visually see where you have been over a property and could better determine the size of weed infestations by using your GPS to mark around infestations - it takes the guess work out of it.

Use of Database with Property Inspection data

To further enhance the process, the data is manipulated in MapInfo and uploaded to a Microsoft Access database through a series of *workspaces*, or set commands. From here further data can be added in the office and the database is used to facilitate the production of reports and letters. Weed Inspectors have now cut down office time manually producing letters with these systems, allowing the database to automate the process. It saves a lot of time using the PocketPC instead of re-entering handwritten records into a Microsoft Access database. It effectively eliminates paper forms needed in the field.

Statistical data can also be retrieved, including *total hectare area* of an inspection region, *total area* inspected within a financial year, specific *dates* of property inspection, and *frequency of weeds* in an inspection region.

This new technology of mobile mapping has improved efficiency in property inspections for Council by 55% in one year of operation through staff having more time in the field and less time in the office. There is also the tangible benefit of digital data, which can be used for improved decision-making.

Table 1. Total property inspections for noxious weeds undertaken by Clarence Valley Council.

Year	No. of inspections	Notes
2001/2002	1485	Prior to useage of GIS
2002/2003	1930	Use of GIS & Garmin GPS
2003/2004	2149	Initial useage of PocketPC in field
2004/2005	3323	Advanced useage PocketPC linked to Database

Mapping of Roadsides and Reserves - assists operational programs

Further to the use of PocketPC's, we enhanced the use of GIS in Operational programs. In this instance the staff plot any treated sites with Garmin GPS and manually record other important data, including weed species and chemical/s used to control. Data is uploaded to a GIS and stored for future reference. Council can now provide information to landholders as to dates of application and what chemicals were used, in circumstances where long withholding periods may interfere with roadsides grazing.

Maps are produced and staff can easily see where they have been, what species and the frequency of weeds were found along roadsides. Furthermore, it can identify which chemicals have been used to treat the weeds on these roads in any period of time. Using GIS, we can simply identify gaps in areas not treated prior to flowering and ensure they become priority for works.

The collected data is spatially described as point data in the GIS, however, is easily translated into poly-lines or regions. It was difficult to get the Spray Operators to do it at first, but once they saw the results of the GIS they were hooked!

GPS are also useful during helicopter surveys, where raw data can be loaded onto a GIS for further manipulation to ensure follow up control works and prioritize ground inspections in the required areas.

Mapping outputs

The level of outputs in regards to mapping weeds has increased as a result of having the data in digital form. Data is easily transferred to other organisations such as the NSW North Coast Weeds Advisory Committee when they were mapping the region. The data was transferred electronically with ease. Maps with meaningful data could also be produced for

landholders following property inspections. Weed mapping in general using GIS has assisted in identifying areas of concern and prioritising work programs on respective weed species.

Problems

With any computer programs there are always traps. The matter of ongoing maintenance of the data is of concern, and it is best to keep the layers simple and make sure they are updated regularly. Also, to an extent the data layers are not survey accurate - if property inspections are close to boundaries then GPS may be too accurate in rural residential areas. There was also the difficulty of trying to fit in with other requirements of Council - namely filing/records management, out of date cadastre information. Constant monitoring is required to ensure staff don't take short cuts or miss steps in procedures.

CONCLUSION

For years Weed Officers have relied on keeping information on weed locations, infestation levels and treatments in their heads and not putting it down on paper for prosperity. The Clarence Valley Council has now demonstrated the importance of getting the information down using mapping technology, and utilising it for more improved property inspections.

The GIS tools used can demonstrate the increase in efficiencies in property inspections, and hence help to see the 'big picture". While the benefits of these systems are undeniable, the information derived from them is only as good as the data entered. (Maguire 1999). It should be noted that it would be advantageous of NSW DPI to follow up their Weed Recording Standards document and identify a suitable standardised computer program that Local Control Authorities can use.

Noxious weeds officers need to develop and enhance skills, keeping up to date with new technologies like GIS and PocketPC's. The case study attempted to demonstrate how it could be possible for those with little experience in the field of GIS can understand the concepts and benefits of using such a system.

Therefore I challenge other Weed Officers and managers to seek out these Information Systems and utilise them more.

ACKNOWLEDGMENTS

I would like to acknowledge the assistance of the staff who were so keen to pick up the technology and adapt it - Chris Clausen, Darrin Heron and Bill Jordan. Also thanks must go to Peter Bell, Tim Howarth and Brad Crispin of the former Maclean Shire staff with database development, IT and financial support. Also thanks to the staff at Open Spatial.

REFERENCES

Bishop, A. (1995). Weed Mapping - a standard approach for Tasmania. In Lemerle, D. *Survey Workshop - proceedings of a workshop*. Cooperative Research Centre for Weed Management Systems/NSW Agriculture, Wagga Wagga. pp. 11-14.

Maguire, A. (1999). 'Weed Recording Standards in New South Wales'. (NSW Agriculture, Orange)

Biography

Reece Luxton initially dipped his toes into the field of weed management working on Bitou Bush on North Stradbroke Island, Qld in 1992. His first real foray into weeds started in 1995 with Rubber Vine control in the Burnett River catchment under the Qld DNRM SWEEP program. He held the position of Land Protection Officer in Innisfail, Qld for three years working on the Siam Weed Program and other SWEEP programs. Following this he worked as a Co-ordinator for the Tamar Valley Weed Strategy, a Landcare-based community weed management group based in Launceston, Tas.

He has now settled in the position of Chief Weeds Officer with the Clarence Valley Council – Noxious Weeds Office, formerly the Clarence Valley Weeds Authority for the last three years. He is happily married with two boys.

Contact details

Name: Reece Luxton
Organisation: Clarence Valley Council – Noxious Weeds Office
Address: PO Box 171 Maclean NSW 2463
Phone: 02 6643 3820
Fax: 02 6642 4496
Mobile: 0427 279717
Email: reece.luxton@clarence.nsw.gov.au

Public Education
Adding communication to weed plans: Can we afford not to?

Annette McCaffery
Project Officer (Weeds)
NSW Department of Primary Industries, Orange

INTRODUCTION

The devastating effects of weeds are well documented. But has that made a difference to public knowledge of the problem or the magnitude of the problem itself?

Evidence would suggest that it hasn't.

Despite our best intentions and efforts at communicating the problem to the community at large, many of the weed issues we have had for a century or more have not improved. In fact many of them are becoming worse.

It is ironic that many of the messages we promote today were also being promoted in the early days of this "war on weeds".

For instance, in the Agricultural Gazette of NSW in 1916 it was stated that "All good citizens should be able to recognise the proclaimed weeds". After nearly 90 years we are still trying to achieve this.

Likewise, R.H. Anderson the Assistant Botanist for NSW reported in the Agricultural Gazette in 1934 that "the main methods of introduction of weeds are through seed impurities, stock fodders, as garden and hedge plants and in the packing around goods". Again a message we are still trying to deliver with limited success.

The lack of awareness is even evident with our most important decision makers. In a recent survey of federal parliamentarians on the nations top 20 science issues, invasive plants were rated the least important (Killing us softly-Australia's green stalkers, 2003).

So, if after 100 years of promoting the identification and control of weeds we have little to report as progress, can we afford to not review and modify our communication strategies.

Let's look at the facts and ask the question: Have we successfully delivered the weed awareness and management message?

THE FACTS: Is the weed situation improving?

- When Matthew Flinders visited Sydney in 1802 there were 20 recorded weeds (Killing us softly-Australia's green stalkers, 2003). Today, despite 100 years of communication and action, there are over 120 weeds declared noxious in NSW (NSW DPI website).

- The number of alien plants becoming established in Australia is rising by ten species per year and the rate is increasing (Groves et.al., 2005).

- Garden plants are the dominant source of new naturalised plants in Australia (66%) (Groves et.al., 2005).

- 13 of the 24 emerging weeds identified as having potential to become highly significant for grazing industries are invasive garden plants (Groves et.al., 2005).

- People are involved in spreading invasive plants in 90% of cases (Killing us softly-Australia's green stalkers, 2003).

- Despite large amounts of money being spent on the control of weeds that affect human health, none of these species are in retreat (Killing us softly-Australia's green stalkers, 2003).

- There are currently 57 native plant species threatened or becoming so through weed competition (Groves et.al., 2005).

- 11% of councils indicated they have limited knowledge of natural resource management (NRM) issues in a local and regional context (LGSA Survey, 2004).

- 46% of councils indicated they had limited capacity and 2% of councils indicated they had no capacity to undertake natural resource management activities (LGSA Survey, 2004).

- 32% of councils indicated they had limited capacity and 19% of councils indicated they had no capacity to link regional NRM goals to council's corporate plans (LGSA Survey, 2004).

All of these facts indicate that communication of weeds issues to key groups has not been effective. Our efforts need to be more strategic and targeted.

IS COMMUNICATION CONSIDERED IN WEED PLANNING?

There are many communication objectives built into the "official" or administrative side of weed planning.

For instance, some of the objectives of the National Weed Strategy are to:

- Initiate community education programs to increase awareness
- Educate landowners, land users, industry and the general public in how to restrict the spread of weeds
- Promote the Landcare approach for hands on weed management, and
- Promote the benefits of developing complementary weed management plans at all levels.

At the State level, the NSW Weed Strategy also has many communication objectives. These are to:

- Improve community understanding of weeds and the relevant legislation
- Improve community education
- Promote awareness to Local Control Authorities and the community of emerging weeds
- Promote an understanding of weed invasion and the need to retain healthy, competitive ecosystems
- Publicise environmental problems caused by garden escapes
- Publicise health risks from specific weeds
- Inform councils and the community of the benefits of controlling weeds, and
- Provide information on best practice weed management.

But, having these objectives in official documents without putting it into practice at the local level does little to address the problems. We all need to take responsibility for adding communication to our weed management projects, no matter how small, and make sure it is effective.

To do this we need to understand our target audiences.

Our communication or extension should be aimed at not only informing a particular group of people but also to modify or change either their attitude or behaviour. Therefore, any communication should consider what will motivate the target audience to accept the messages we are giving them and act on the information.

WHO ARE OUR KEY TARGET AUDIENCES?

In a recent study by the NSW Department of Primary Industries, local government weed officers indicated the key client groups they service are primary producers, community groups such as Landcare groups, urban residents with a particular focus on peri-urban residents or "hobby" farmers and other local government members and staff (McCaffery & Naughton, 2005).

Splitting or segmenting our communities into groups like those identified is an effective tool in helping us to conduct our communication efforts in the most effective way. Each separate group has a similar set of wants and needs so the communication efforts or messages should reflect this.

The information age has complicated effective communication for many of us. Individuals now have so many messages being delivered through so many channels that it is easy for an important message to be lost. Only a sustained commitment in well planned communication will engage the community in effective weed management.

To target these groups effectively we first need to understand how we process information when making decisions.

The decision making process

Individuals go through a series of logical stages to arrive at a decision. All the steps in this process are impacted on by both internal factors such as personality and motivation and external factors such as culture, peer groups and family.

Figure 1 provides a simple model of the decision making process and the potential factors that can influence individuals or groups when processing information to make a decision.

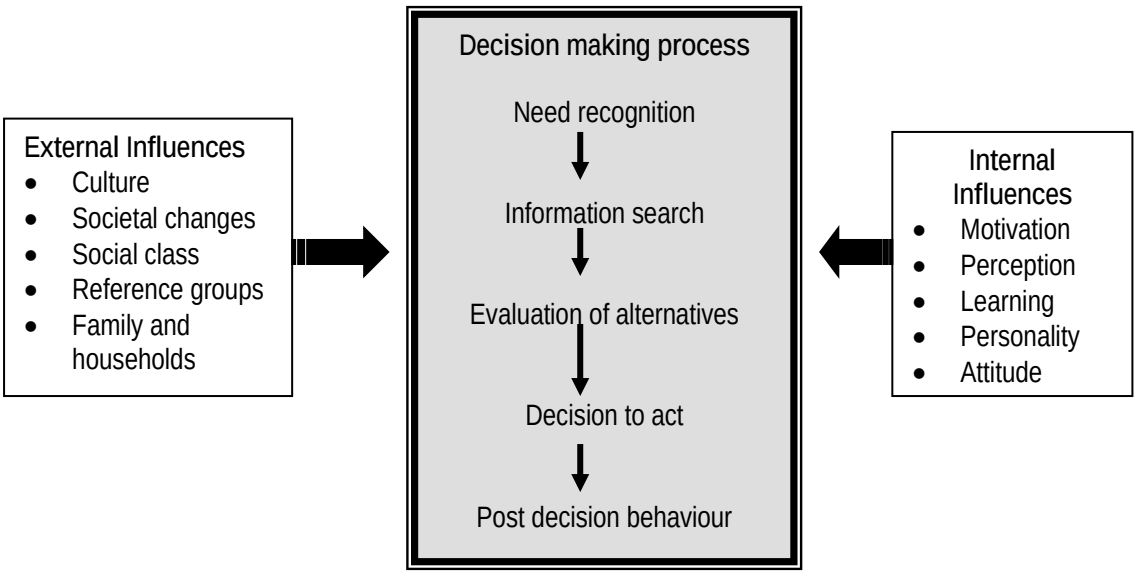


Figure 1: The decision making process and the factors that influence it. Adapted from Millar and Layton, 2000. pp.143

A particular group will be affected by similar internal and external factors when working through the decision making process and therefore will require a specific communication message which takes that into account.

Let's look at the groups local government weeds officers have identified and some of the factors highlighted in Figure 1 that could impact on their decision making process regarding weed management issues

Primary producers

Concern about land degradation problems (eg weeds) amongst the Australian public including primary producers is now well established.

Research in Australia has found that most practice changes of primary producers are influenced by the information gained through a combination of: interaction with peers and experts; and training events eg workshops and field days. In fact, for many individuals or farming families, exposure to issues during events with social and emotional connections may be necessary before change can occur (Kilpatrick, 2000).

Farm families exposed to the social and cultural norms of peer groups are more likely to be willing to change to alternative practices. A "norm" guides how we should behave and is a tool used to change behaviour if incorporated into communication programs (McKenzie-Mohr, 2005). The reinforcement of norms through communication efforts can strengthen social movements such as Landcare and impact on farmer behaviour (Carey et.al., 2002).

New practices that are believed to be profitable are often more readily adopted but there is also strong evidence suggesting many farmers are motivated by a balance between this, their standard of living and minimising risk. This is likely to be more powerful in motivating change than symbolic beliefs regarding the environment and communication efforts should reflect this.

Communication can occur in many forms. Innovations in farm management that can be trialled or observed are more likely to be adopted because non-adoption is usually based on

concerns about ease of use, speed and reliability (Kilpatrick, 2000). This is an important consideration when developing appropriate communication strategies.

Several studies indicate that female partners exert the primary influence on joint decision making within a family structure (Burns, 1992; Kilpatrick, 2000). In Australia women occupy many roles within the farm business and are more involved in decisions regarding sustainable farm management. This growing importance of women as farm decision makers is an important consideration in targeting communication. It may be more effective to target this group with appropriate weed awareness information rather than the more traditional male farming partner.

Peri-urban residents or "hobby" farmers

Peri-urban residents are a specific group that needs to be targeted because of the potential bio-security risks they pose by their behaviour (Aslin et.al., 2004).

This group will have different motivations to a "traditional" primary producer.

They are more likely to be focused on the lands lifestyle or amenity values rather than production. They are likely to concentrate on off-farm occupations, be pre-occupied with personal lives, have stronger conservation and environmental values and therefore be more likely to engage in conservation or environmental activities.

Communication needs to understand the interest and diversity of this group and appeal to their motivation of leisure and lifestyle, not economics or financial interests.

Again, the role of family members should be considered in the household decision making process and communication targeted appropriately.

Community groups

The work of volunteers and community groups in undertaking weed management projects is being relied on more and more. There is some form of 'landcare' now being undertaken on more than a third of farms (Carey et.al., 2002). Likewise, the Natural Heritage Trust (NHT) recognise the potential of urban community groups in vegetation management and dedicated 15% of the Buschcare funding program to supporting their activities (NHT website).

Both the CRC for Weed Management and the National Weed Strategy have a focus on using Landcare, Bushcare and Coastcare groups to undertake much of the hands-on work in weed management.

However, maintaining and motivating these groups is the key. Many of them are focused on other aspects of natural resource management. Effective communication at the local level is critical to ensure weeds are a priority issue when they are planning their activities. It is critical that they continue to be engaged in weed management. They need to be supported with information and resources to be effective at managing weed infestations which can be achieved through well planned communication.

Local government members and staff

Noxious weed management has been the responsibility of local government for almost 100 years. However, evidence would suggest there is still little understanding (by non-weed staff and elected members) of the magnitude of the weed problem and the benefits to be gained through effective weed management.

Often we concentrate so much on trying to communicate with our external clients that we forget the importance of internal communication in influencing decision making.

Responding to changing community needs, maintaining integrity and accountability to the general public are key factors influencing the decision making processes within councils (Warburton & Baker, 2005).

Changes taking place in society can force an organisation to change its behaviour and modify its strategies and this is certainly the case for local government. It is intimately linked to the community by addressing local economic, social and environmental issues through regulatory regimes and the provision of infrastructure and services (Warburton & Baker, 2005). Therefore there is an expectation by the community that their council will respond to their changing needs.

The capacity to do this is driven largely by the company's external and internal communication (Grof, 2001) and weeds officers have an important role to play. Weeds officers deal with other council employees, partner organisations and the public on a day to day basis allowing them to identify issues and understand what other stakeholders expect from council. If quality internal communication is in place council will satisfy their clients, empower their employees and as a consequence lower their costs (Spinks & Wells, 1995).

Maintaining the profile of noxious weed management as a core council activity delivering benefits is critical in ensuring council fulfil their legal, financial and social obligations (Warburton & Baker, 2005).

Communities in Australia now demand that organisations are accountable for the expenditure of public funds. They need to know there are public benefits coming from such expenditure and councils are driven by this in decision making.

In 1962/63 local government in NSW received $40,000 in noxious weeds grants (2002 value of $385,200) which has steadily increased to the current situation of $7.4 M in 2004/05. Councils need to be accountable for this money to Treasury and to their ratepayers. It is important for weeds officers to base internal communication efforts on positive information that will satisfy the need to be accountable.

Effective internal communication also increases the importance of the role weeds officers play in maintaining the integrity of council with ratepayers. This is likely to lead to weed management having a higher priority in council business and greater support for the provision of funds, resources, staff and training opportunities.

If nothing else, internal communication within councils is important for promoting weed management issues because after every local government election approximately 40% of all councillors in NSW are newly elected (Department of Local Government, 2005). These new players in council operations, in all likelihood, have never been exposed to weed issues or even know it is the responsibility of local government. This is an opportunity to impact on their decision making processes by informing them of the councils weed management activities and how they can fulfil their role as an elected representative.

BRINGING IT ALL TOGETHER

The following is a checklist of considerations when developing communication plans.

1. Decide who are the target audience. It is better to communicate well with one group than poorly with everyone.
2. Understand the attitudes, beliefs and behaviour of this group and what will motivate them to modify their attitudes or behaviour.

3. Develop a clear and specific message for this group. Always be consistent.
4. Decide where (eg. home, tractor, school) and how (eg. hear, see, read) your target is more likely to accept your message and time your efforts appropriately. Repetition is also critical for effective communication.
5. Decide on the most appropriate communication channels (eg. newspaper, radio, billboards etc.). This is only limited by your imagination.
6. Use established communication networks (eg Rotary, garden clubs, agribusiness etc.). This adds credibility to the message and gives an opportunity for interaction and the promotion of community norms.
7. Always provide a course of action for the target audience in any communication effort eg. provide a contact person or activity to try.
8. Concentrate on the positives or benefits of committing to weed management initiatives.
9. Always provide feedback to reinforce the message and justify any resultant actions.

CONCLUSION

There is no doubt that despite our communication efforts we are not winning the war on weeds and there are a great number of challenges to be faced in the future. Even if we achieve all the communication objectives of our current weed strategies, phenomena like climate change will ensure we may never achieve a status quo.

For that reason, incorporating communication into our weed management plans is a necessity. We can't afford not to!

REFERENCES

Anderson, R.H. 1934. Our Noxious Weeds. Countries of origin and methods of introduction. *Agricultural Gazette of NSW*. pp 241.

Aslin, H., Kelson, S., Smith, J, & Lesslie, R. 2004. *Peri-urban landholders and bio-security issues – a scoping study*. Canberra: Bureau of Rural Sciences.

Burns, D.J. 1992, Husband-wife innovative consumer decision making: Exploring the effect of family power. *Journal of Psychology and Marketing*, 9(3), May/June, 175-189.

Cary, J.W., Webb, T.J. & Barr, N.F. 2002. *Understanding landholder's capacity to change to sustainable practices. Insights about practice adoption and social capacity for change.* Canberra: Bureau of Rural Sciences.

Grof, A. 2001. Communication in the creation of corporate values. *Corporate Communications: An International Journal*. 6(4), pp 193-198.

Groves, R.H., Boden, R. & Lonsdale, W.M., 2005. *Jumping the Garden Fence. Invasive garden plants in Australia and their environmental and agricultural impacts.* CSIRO report prepared for WWF-Australia. WWF-Australia, Sydney.

Killing us softly- Australia's green stalkers. 2003. CRC for Australian Weed Management.

Kilpatrick, S. 2000. Education and Training: Impacts on Farm Management Practice. *Journal of Education & Extension*. 7(2), pp 105-116.

Maiden, J.H. 1916. Some observations on weeds. *Agricultural Gazette of NSW*. pp 235.

McCaffery, A. & Naughton, M. 2005. *Client Needs Analysis for NSW DPI Weeds Information*. NSW Department of Primary Industries, Orange.

McKenzie-Mohr, D. 2005. *Community-based social marketing*. www.cbsm.com.

Millar & Layton. 2000. *Fundamentals of Marketing*. 4th ed. Irwin/McGraw-Hill. Australia.

National Heritage Trust website. 2005. www.nht.gov.au.

Natural Resource Management Survey of the Needs of Councils. 2004. Local Government Association of NSW & Shires Association of NSW, Sydney.

NSW Department of Primary Industries website. 2005. www.dpi.nsw.gov.au.

Spinks, N. & Wells, B. 1995. Quality communication: a key to quality leadership. *Training for Quality*, 3(2), pp 14-19.

The National Weeds Strategy. 2005. Weeds Australia. www.weeds.org.au.

The NSW Weed Strategy, 2005. NSW Department of Primary Industries. www.dpi.nsw.gov.au.

Warburton, J. & Baker, G. 2005. Integrity Systems and Local Government. *Australian Journal of Public Administration*. 64(2), pp 62-68.

PRIVET. A SUCCESS STORY

Author details
Name: Roger Smith
Organisation: Orange City Council
Address: PO Box 35, Orange NSW 2800

Key Description
Privet has been causing health problems for Orange residents for years. In 1999 Orange City Council decided to meet the problem head on. The runs are now on the board.

Abstract
Privet, both broadleaf and small leaf was declared a noxious weed within Orange City Council in 1999 after many calls from the general community to have it declared noxious. The basis for the declaration was purely health reasons. Some of the effects that privet has on people who are allergic to it include hay fever, asthma, respiratory problems and skin irritation.
Orange City Councils application for declaration followed the successful application from the Upper Macquarie County Council the previous year and unanimous support from all stakeholders. Privet was declared a W4b noxious weed within Orange City Council. This categorisation means it is not allowed to flower or fruit and cannot be sold or propagated.
The declaration of privet was widely accepted as a positive move by Orange City Council and had the support of all stakeholders, the general community and the local media.
Advertising and promotion through the media was used to inform the community of their obligations regarding privet control. Word of mouth also proved very successful.
The introduction of a free pickup service for residents by Council proved very popular and alleviated the task for residents of disposing of privet once they had cut it down.
Privet on high profile Council owned land was targeted early after the declaration to illustrate that Council was serious about removing privet.
Six years after the declaration privet has been reduced to only isolated infestations.

Biography
Roger is employed as Orange City Council's Vegetation Coordinator having recently achieved a Diploma in Conservation and Land Management. One of his roles includes implementing Council's Noxious Weeds Program.

PRIVET: A SUCCESS STORY

PRIVET
(Large leaf/narrowleaf)
↓
↓
HEALTH CONCERNS
(Hayfever, asthma, breathing difficulties)
↓
↓
COUNCIL'S ROLE
(Application for declaration, awareness campaign)
↓
↓
CONSULTATION
(Neighbouring LCAs, landowners & stakeholders)
↓
↓
APPLICATION FOR DECLARATION
(Made to NSW Agriculture November 1998)
↓
↓
DECLARATION SUCCESSFUL
(W4b, August 1999)
↓
↓
ENFORCEMENT
(Not enforced for 12 months, act on complaints only)
↓
↓
ACTION PLAN
(Promotion in local paper, word of mouth)
↓
↓
RESULTS

Privet

The flowers of privet are pungent, heavily scented and extremely overpowering. They may cause hay fever, asthma and breathing difficulties with up to 15% of the community.

Health Concerns

People who are affected do suffer terribly from wheezes and sneezes which can have an adverse effect on their sleeping habits, social life and general well being. The allergy season for privet starts in September, (small leaf privet) and goes through until January, (large leaf privet).

Council's Reaction

After numerous complaints from the community regarding the effects of privet on people's health Orange City Council decided to make application to NSW Agriculture to have privet declared a noxious weed. Privet was a common garden plant in Orange used as a quick growing hedge in many of the more established residential areas. Privet was also planted in the grounds of schools, nursing homes, hospitals and golf courses. The declaration application sought a W4b category that states the plant is not allowed to flower or fruit and cannot be sold or propagated. The categorisation allows residents to keep established privet hedges if they are kept trimmed.

Upper Macquarie County Council, a neighbouring LCA, had recently made a successful declaration application to NSW Agriculture to have privet declared a W4b noxious weed. It was felt Orange City's application would be looked upon more favourably following the successful application of the Upper Macquarie County Council.

Consultation

Prior to a declaration application being submitted to NSW Agriculture the majority of stakeholders were consulted. The major stakeholders included:

- 3 local Golf Clubs
- 2 hospitals
- 2 nursing homes
- All schools

The Department of Housing was overlooked during the consultation process. This was an oversight on Council's behalf but the Department was very obliging and acted on all privet infestations on their properties.

All the stakeholders had privet, mainly broadleaf, growing on their land. All agreed privet was a health problem that needed to be addressed and they gave their full support to the declaration application. They also gave a verbal commitment they would remove any privet growing on their land within two years of a declaration being made.

Application for Declaration

Orange City Council made application in November 1998 to NSW Agriculture to have Broad Leaf Privet, (Ligustium lucidium) and Small Leaf Privet, (Ligustium sinense) declared W4b noxious weeds. A similar declaration already existed in Bathurst and 8 other LCA's.

The ***aim*** of the declaration was:

"To alleviate the health problems of asthma, hay fever and respiratory difficulties caused by flowering privet."

The ***objectives*** were:

a) To remove all established privet plants on Council lands within 2 years
b) To reduce the amount of privet flowering by 20% in the second year of declaration
c) To increase people's knowledge regarding the health affects of privet.

Peter Gray, Noxious Plants Advisory Officer, supported the declaration application wholeheartedly. Mr Gray also commented that Orange City Council "implements an excellent noxious weeds program".

Declaration Successful

The application was successful and both broadleaf and narrowleaf privet were declared noxious with a W4b rating in April 1999.

Action Plan

Council's action plan was instigated following the successful declaration of privet. The plan consisted of the following actions:

- an advertising campaign to inform residents of the declaration
- information and control options to be included in rate notices
- word of mouth was a great mode of informing people.
- for the first 12 months Orange City Council will act on complaints only allowing residents a phasing in period for the declaration
- during the second year the inspection process will begin concentrating on the older, more established areas of Orange. Notices will be issued if necessary.
- All privet on Council land will be removed by the end of the third year of declaration
- A free privet pickup service will be implemented collecting cut down privet from residences nature strips.

The Central Western Daily, (local paper), played an integral role throughout the initial phase pf the campaign. The paper supported the declaration and was very obliging by running stories regarding the declaration and the free pickup service. Plenty of photos were shown and lots of phone calls received from the articles.

It was explained to people control of privet was reasonably easy. Once the tree/shrub was cut down at ground level the stump had to be painted with a straight glyphosate based chemical within 30 seconds of the cut being made. This was a “tried and true” method used on Council land with a 100% success rate. Some residential privet was not painted with chemical quickly enough which resulted in regrowth. All privet was disposed of at Orange City Council’s waste depot. There is no charge on green waste at the depot. Privet, which was heavy in fruit, was buried deep under the general waste at the depot whilst non fruiting privet was chipped.

Enforcement

For the first 12 months of the declaration Council decided to act on complaints rather then carrying out blanket inspections. i.e. if a neighbour reported privet on an adjoining property inspectors would inspect the property. The owner would be contacted and verbally asked to remove the flowers on the privet or alternatively take the privet out. In the first year of declaration there were 341 privet reports to Council with 204 of those being made in January/February.

When Section 18 notices started being issued feedback from the community, particularly elderly residents, was negative. They felt intimidated by the notices commenting that they were “***too hard and fast***” and contained a lot of legal jargon. These residents had been living in the community for decades then all of a sudden they receive a Section 18 Notice in the mail demanding the removal of a tree, which perhaps had been growing in their back yard for 40 years. This was a fair comment.

Council reacted immediately by introducing a Preliminary Privet Notice and softening the Section 18 Notices. The Preliminary Privet Notice is not a legal document but rather an information letter explaining to residents the negative health affects caused by privet flowers and what their responsibilities are in regard to controlling privet. The Preliminary Privet Notice still had a date by which Council would like to see the privet controlled and states if it is not controlled by that date a Section 18 Notice would be issued. The response from residents to the Preliminary Privet Notice was very positive.

Several residents who had privet infestations never had the physical or financial resources to remove privet. The majority of people usually had no local family support, were pensioners or were too elderly to take any action themselves. Council was empathetic towards these residents and did the utmost to assist them. Several home care/residential assistance organisations were approached for support. Financial assistance was provided to remove the privet at no cost to the residents. Occasionally, if the privet infestation was relatively minor, Council inspectors would enter the property, with the owner’s permission, and remove the privet at no cost. This saved a lot of paper work!

Numerous complaints regarding privet were found to be look-a-likes. The plant often mistaken for privet is photinia. Photinia does mildly resemble privet in its leaf but the main factor is the strong smell of its flowers. To alleviate this problem a privet brochure was developed. The brochure was sent out with notices and also made available at the Orange Civic Centre. To assist in identification a specimen plant was placed in the Customer

Service area of the Civic Centre. It was not a good idea to display a flowering specimen as staff were affected by the smell of the flowers.

Results

1999 – 2000

- $26,238 expended on privet inspections, control of privet on Council land and free pick-up service for residents
- The free pick-up service resulted in over 800 truck and ute loads transported to Council's waste depot.
- 155 notices sent to owners of properties infested with privet.

2000 – 2001

- $10,820 expended on privet removal on Council land and free pick-up service
- 168 notices sent out
- 297 Preliminary Privet Notices dropped in mail-boxes after inspections
- 1049 inspections carried out in regard to Section 603 property exchange enquiries.

2001 – 2002

- 69 notices sent out
- 809 inspections carried out in regard to Section 603 property exchange enquiries

2002 – 2003

- 103 notices sent out
- $6,843 expended on privet collection

2003 – 2004

- 53 Notices sent out
- $6,500 expended on privet collection

Conclusion

The campaign to rid the City of Orange of privet has been a true success story. The support of the local media, larger stakeholders and the community overall was paramount in achieving the results of the campaign. The free pickup service provided by Orange City Council took a lot of the hassle out of removing privet for residents. It's one thing to cut the privet down but the real work is in its disposal. Privet is now at very manageable levels in Orange. Minor infestations still exist but in general the community of Orange can breath a lot easier.

MANAGING SALVINIA ON THE HAWKESBURY RIVER, 2004

A $1.6m cooperative effort

Rebecca Coventry
Hawkesbury Catchment Weeds Strategy Officer
DPI Richmond

~~**EXECUTIVE SUMMARY**~~

~~Emergency funding applications were made through the Hawkesbury Lower Nepean Catchment Management Authority and a joint project with the NSW Department of Primary Industries developed to deal with possibly the largest temperate infestation of the tropical floating fern salvinia on the Hawkesbury River and tributaries in the summer of 2004.~~
~~The project employed a team of aquatic weed harvesting machines which operated non-stop on the river for 8 months, supported by ancillary activities including boom deployment, herbicide spraying, predatory insect releases, and the off-water management of large stockpiles of weed. The project involved a huge community communication component and sparked State and local media interest. It is estimated 347 hectares of weed were cleared from a stretch of river and tributaries over 88 kilometres long. Over 100 000 tonnes of weed were collected. These are currently in a composting process which will see the disposal sites rehabilitated and ensure other weeds such as Alligator Weed are not a new threat.~~

~~This project is effectively the second or continuing phase of initial activities that commenced in April 2004. The first phase was implemented through a joint State and Federal funded program and was delivered through a Hawkesbury Lower Nepean Catchment Management Authority Interim Regional Funding process.~~
~~Both projects should be seen as two phases of action to manage a single issue: the unprecedented and extensive outbreak of the floating aquatic weed *Salvinia molesta* on the Hawkesbury River.~~

Background

Towards the end of the 2003 summer season, a number of environmental factors contributed to an alarming increase in salvinia levels on the Hawkesbury ~~r~~River. The ongoing drought and ~~very high~~ hot weather~~temperatures~~ led to low river flows, high water temperatures, and high nutrient levels from undiluted STP inflows. This effectively transformed the shallow stretches of the river into hydroponic growing media for aquatic weeds. Salvinia, *(Salvinia molesta)* a South American hybrid fern capable of multiplying very rapidly under such conditions, covered large sections of the river almost to the exclusion of any clear water surface and for a length of many kilometres. These infestations were concentrated at Windsor, Richmond, Yarramundi and much of the river between these points, (see map) and were both highly visible and posed considerable hazard and interference to water-based activities. An aerial survey conducted in May 2004 indicated the weed covered a~~a~~pproximately 347 hectares ~~of weed on the river and in major tributaries~~ over a length of river and creeks of approximately 88 kilometres.
The impact of this infestation on the environmental conditions in the river, and on businesses, industries and farms reliant on the river or its water was serious. Emergency funding applications were made to the Federal Government through the Hawkesbury Nepean Catchment Management Authority and a joint project with the NSW Department of Primary Industries was developed to deal with what is now recognised as possibly the largest temperate infestation of salvinia ever in Australia.

The project employed a team of aquatic weed harvesting machines which operated non-stop on the river for 8 months, supported by ancillary activities including boom deployment, herbicide spraying, predatory insect releases, and the off-water management of large stockpiles of weed. The project involved a huge community communication component and sparked State and local media interest. Over 100 000 tonnes of weed were collected. These are currently in a composting process which will see the disposal sites rehabilitated and ensure other weeds such as Alligator Weed are not a new threat.

Initial funding of $600 000 was received; $300 000 from an interim priority NHT grant, $100 000 from DPI and $200 000 from DIPNR, with the aim of achieving a triple-bottom-line result for the main navigable stretch of the river from Windsor Bridge to the salt-water confluence at the junction with the Colo River. Efforts were at first concentrated on physical removal using aquatic weed harvesters operating at three different locations to remove over 150 000 cubic metres of weed[1]. That may be described as the first part of the project.
After three months of very successful efforts, it became clear further funding would be required to complete the weeding effort to the degree that would prevent a recurrence in the coming season. A further input of $700 000 was received, again through NHT ($350 000) and from NSW Treasury ($350 000) and then another $104 000 from DPI and $200 000 again from Treasury. This brought the project total, not including in-kind DPI, DIPNR and Waterways salary inputs, to $1604 000.

Aims of the project

The overall aim of the project was to reduce the impacts of the *Salvinia molesta* infestation on the river system, including environmental, social and economic impacts, through use of integrated control activities. This was achieved by removal of the weed mats from those areas most affected, and actions to prevent a recurrence of the problem. This removal took three main forms: physical removal using mechanical weed harvesters, chemical removal through judicious herbicide application, and biological removal through release of the *Cyrtobagus* salvinia weevil. Further preventative actions include monitoring and surveillance, and trials to optimise biocontrol success. Other activities include disposal and recycling of weed material, and care of areas where stockpiling occurred.

Project Management

The project was managed by a project officer from NSW Department of Primary Industries (Rebecca Coventry) through an executive committee which consisted of the Chair of the HNCMA John Klem, CMA staff, DPI Program Leader Pastures and Rangelands Ken Archer, Waterways Authority's Steve Black, a local government and community representative Les Sheather, and chair of the Local Government Advisory Group Robert Bell. An operations committee included Waterways Authority, Hawkesbury River County Council, the River Manager (appointed to govern on-river operations) and with input from other involved parties as required (including local professional fishermen, harvesting operators, other DPI and council weeds staff, EPA and Sydney Water officers, Fisheries officers etc).
An expert panel of recognised salvinia specialists was convened to advise the project on options. This consisted of Tony Church (River Forum consultant) Geoff Sainty, (author and consultant), David Mitchell, (Adjunct Prof, Albury, and the name beside the species of the weed), and Nimal Chandrasena, (Sydney Water Environmental Manager).

The employment of an on-river operations manager proved crucial in developing the most efficient systems for harvesting the weed. Oil retention booms were accessed from a variety of sources and used to gather weed in strategic locations where the harvesting machines could gain access. Collecting the weed also meant time was not wasted chasing it around the river. River flow, tides and wind were all harnessed in weed collection, with booms being opened and closed 24 hours a day for optimum collection.

Mechanical harvesting

[1] This is a rough estimate based on daily removal rates for the different harvesters. These differed depending on size of machine and degree of compaction if unloaded into a compacting truck. Estimating weight accurately of the amount of weed removed is almost impossible – wet weight includes approximately 90% water, and different compacters remove different amounts of water. Cubic metres are the most accurate measure, as the basis is wet weight as collected.

Harvesting not only removed the weed mass from interfering with river function, it also removed the nutrients the weed contained, thus preventing further water quality degradation which would have occurred if the whole infestation had been sprayed and died in the water. The weed material removed was compacted into garbage trucks and taken to specific disposal sites, or unloaded onto prepared riverside locations. As this amounted to thousands of cubic metres of material weighing an estimated 100 000 tonnes, this part of the project was quite significant. Most of the stockpiles are now undergoing recycling for commercial compost production.

Mechanical harvesting continued without a pause from April 27th when the first machine commenced work, until the 10th of December 2004. Initially two harvesters with a load capacity of approximately 13 cubic metres each were used. These were supplemented for 12 weeks in June and July by a 26 cubic metres capacity machine loaned by Wyong Council. One of the small machines ceased operation at the end of October when there was less need for two machines to continue.

In addition to the main harvesters, two smaller support vehicles have been used. These are an amphibious "Truxor" which can mow, cut, push or collect weed with different attachments, and has proven efficient in moving weed material from hard to access areas and through rapids etc where the harvesters cannot go.

The second vehicle is a carrying barge adapted to also collect weed, which can move faster than the harvesters and is able to collect small amounts of weed over long distances in a more efficient manner.

At various times and in different locations, shore conveyor ramps were also used to move weed off the harvesters to shore, unloading either into dump or garbage trucks or directly onto piles to be moved by backhoe or bobcat.

The total amount of weed collected by the harvesters totals nearly 100 000 tonnes.

The occasional harvesting of weed mats has continued with booms still in place at Devlins Road, at Yarramundi, at Cordners Corner and in South Creek until the end of May 2005. Release of weed material from Shaws Lake using the Truxor allowed sufficient weed to be collected at Devlin road for several days harvesting in mid-May2005, with a total of 60 compacted tonnes (approx. 600 cubic metres) of weed harvested from Devlin Rd (250 m^3) Shaws Lake (300 m^3) and Yarramundi (50 m^3) in the ten weeks from March to May.

Herbicide treatment

Follow-up treatment with herbicides was deemed necessary where weed fragments were lodged in areas inaccessible to the harvesting machines and inappropriate for biocontrol. Whilst the main herbicide registered for salvinia is Diquat, community concerns led to a modification of the recommendation to a glyphosate formulation, and a permit was issued by the Australian Pesticide and Veterinary Medicines Association. Hawkesbury River County Council were given the initial herbicide contract and spent on average 2 days per month on treatment, with up to 3 teams in operation. The main sites for herbicide application were Russell Street near Penrith, Shaws Lake and Devlin Rd at Castlereagh and occasional small patches along the river from Yarramundi down to Windsor. Between December 10th 2004 and March 9th 2005 a total of 203 litres of glyphosate based herbicide were used on the river.

After that period a second contract was let to Australian Environmental Services which comprised monitoring, reporting, spot spraying and other activities as necessary to maintain the river clear of weed. Small amounts of salvinia were continually appearing, particularly after rain, and these have been kept in check by spraying. Less than 30 litres of Weedmaster Duo®™ have been applied between the Warragamba River and Windsor, and in Cattai, Mackenzies, Jerry's, Duncan's and South creeks.

Biocontrol program

Paul Sullivan from NSW Department of Primary Industries managed the biological control part of the project. Paul has run departmental weed bio-control programs for many years and worked extensively with the salvinia weevil. A project officer, Lesley Postle, was employed to carry out the monitoring and recording work on a weekly basis.

Twelve sites were chosen for intensive monitoring, reflecting both the types of salvinia infestations and their geographic range. Therefore there are four sites on the main stem of the river, four on creeks and billabongs, and four on farm dams. Further mass weevil release sites act as nursery sites. The research sites are delineated in 2 m by 2 m quadrats made from 90 mm white plastic pipe. These are anchored in situ and protected where required by booms. Data loggers are attached to the quadrats to collect water and air temperature data.

Five separate collections of wild weevils were made from the North Coast areas and from rearing facilities in Grafton and Brisbane. Weevils were released on a monthly basis from August to December. Total number of weevils released is approximately 124 000.

Sites have been selected to provide a cross section of growing conditions found in the region. Salvinia from various sites has been analysed for nutrient content and the results used to assist in monitoring site selection. The twelve sites are as follows:

No. of sites	Site description	Nutrient status	Water level	Temperature
4	River	high	Flow and varies	Buffered by amount of water
4	Creeks and lagoons	high	Flow and shallow	Poor temp. buffering
4	Farm dams	lower	varies	Poor temp buffering

Initial findings are that the weevils are surviving, with more than 90% of plants in the quadrats showing some degree of damage. The weevils have now been recorded up to 1/2 km from the nearest study quadrats at Devlin Rd.

The salvinia weevils do not breed below 21 degrees Celsius. In winter the temperature rarely get above this temperature in the Hawkesbury Nepean River System so during this period the weevil populations will be greatly reduced. It is not known how low the weevil populations will go during winter or how long it will take them to increase during the warmer months to levels where they are exerting control over the salvinia. With this in mind their future as biological control agents in the Hawkesbury Nepean River System will not be known until weevil populations have passed through at least three and possibly five winters.

Florida and south eastern USA has similar climatic conditions to the Hawkesbury Nepean River System and in these areas of the USA the salvinia weevil is used to control salvinia by breeding and releasing large numbers of the weevils in early spring. It may be that the weevils can not increase quickly enough in the Hawkesbury Nepean River System from their low winter populations to exert control over salvinia with out breeding and releasing large numbers of weevils each year in early spring.

Monitoring and Evaluation

The river is now largely clear of salvinia except for small patches caught up under overhanging branches, amongst rocks, in other aquatic weeds (Egeria for example) or in backwaters. Nursery sites for the weed still exist in isolated coves, particularly Shaws Lake and Black Falls (upstream of Yarramundi) and these are being carefully monitored. Weevil activity is now occurring in some of these areas which is very encouraging. Inputs from off-river source infestations have now been located and are under inspection and treatment regimes in cooperation with the relevant council authorities. The AES contract for surveillance and treatment has meant a weekly report on the state of the river and the problem tributaries has been received from March until May, with recommendations for future action where required. This has given clear indication of the behaviour and growth of the last remnants of the weed over the 88 kilometre stretch (river and creeks) into the winter

months. The biocontrol site surveys will continue to note river, creek and dam locations, weed growth and status, and weevil populations.

Recommendations for the future

Provision should be made for ongoing surveillance of the river system including off-river sources (such as creeks and property dams) on a regular basis to report on issues before they become a major problem, at least until a permanent process is enacted.
There is a need for clear delineation of responsibilities for river management issues.
The HNCMA and other stakeholders should continue to pursue implementation of the recommendations of the River Forum re environmental flows and off-river use of treated effluent.
Aquatic weed management for the river should be closely allied to off-river weed issues through a comprehensive weed strategy for the catchment, and rigorous enforcement and coordinated effort from all LCAs could be negotiated through this strategy.
There should be mechanisms that trigger an early response to river health issues.
Contingency funds available for emergency intervention in aquatic weed issues outside the normal responsibility of the LCAs should be held in reserve to enable rapid response to issues until permanent and workable solutions are found.

BIOGRAPHY

Rebecca Coventry has been working with NSW DPI since 2001 in various positions including WONS officer and Aquatic weed coordinator. Her previous experience was with the Hawkesbury Nepean Catchment Management Trust as Natural Resources officer. She is currently employed as Hawkesbury Nepean Catchment Weeds Strategy Officer.

AUTHOR

Author: Rebecca Coventry
Organisation: NSW Department of Primary Industries
Address: Locked Bag 4 RICHMOND NSW 2753
Phone: 0245 882 117 Fax: 0245 882 159
Email: rebecca.coventry@agric.nsw.gov.au

WEED CONTROL USING GOATS

THE SITUATION

↓

OPTIONS

↓

COSTS

↓

BENEFITS

↓

DISADVANTAGES

↓

RESULTS

THE SITUATION

CASE STUDY ONE: LAKE CANOBOLAS DEER PADDOCK

The paddock is probably similar to many paddocks under the control of most LCAs across the state. It's really a nothing paddock, tucked out of the sight of the general community, there are no funds available to control the weeds this year so it can probably wait to next year to treat. Sound familiar.

Orange City Council had one such paddock. The paddock, up until 1995, was used to run deer that were on display to the general public. It was about 12 hectares in size with rich basalt soils and a northern aspect. Once the deer were sold the paddock was semi cleared, erosion control measures were installed, some tree planting was undertaken and than it was left. Within a few years the paddock was overrun with blackberries, St John's Wort, lucerne trees, hawthorne and a variety of other woody weeds. The majority of the blackberries were the size of houses whilst the lucerne trees were fast becoming out of control. To make matters worse the land, which was owned by Orange City Council, was located in a neighbouring LCA.

THE OPTIONS

The options for control were fairly limited. The usual approach would be to chemically control all the weeds and implement a follow up control program, if we had the funds and the time. We would then need to burn the blackberries down to a manageable size to allow follow up work the following year. The estimated cost of controlling the weeds in the paddock over a three-year period, which includes follow up work, was approximately $5000. And the benefits would be minor even if the funds were available to do the work. Another factor, which compounded the issue, was an orchard adjoining the southeastern boundary of the paddock. Orchards and spray drift don't mix.

Another option open to Council was biological control of weeds in the paddock, but with such a species diversity the agent would need to be very adaptable. Research was carried out and it was decided to put goats to work in the paddock. Goats are constant browsers making them useful for weed control activities.

COSTS

Before the goats were released into the paddock, the perimeter fencing had to be addressed. The original fence was erected to contain deer. Being 2 metres tall it was conducive to keeping goats in. The fence was about 20 years old and did need some running repairs. The cost of these repairs were minimal.

The cost per goat was $40 delivered. Thirty goats were purchased for a total outlay of $1200. This equates to two 20-litre drums of Grazon DS. The goats proved to be relatively maintenance free. They were drenched after 12 months and left. Two goats have died since being placed in the paddock whilst a fox took a kid, who was born after delivery.

If the goats were to be sold now the money invested in them initially would be fully recovered. In fact the goats would most likely be sold for a higher amount then

what they were purchased. If this were the case the control of weeds in the paddock would be nil.

BENEFITS

The main benefits of using goats to control weeds in the paddock include:

- Cost effectiveness. Once the goats were purchased they paid for themselves in the first 6 months. They have provided ongoing follow up work through their characteristic grazing habits.
- Environmentally friendly. Using the goats avoided the use of chemicals in the paddock ie not putting out 40 litres of Grazon has got to be good for the environment.
- Eliminating not target spray drift ie not putting the neighbouring properties in the situation of possible not target spray drift with the use of chemicals.

DISADVANTAGES

There were some disadvantages/problems of using the goats in this situation. The buggers managed to escape to neighbouring properties on several occasions. The boundary fence had been repaired several times but the goats are very persistent and often found a way out. They would rather go under the fence or over it rather than through it. Constant monitoring of the fence is essential.

Another disadvantage with the goats was the fact that they enjoyed stripping the bark off young Eucalyptus trees. This seems to have little effect on the trees with only a few fatalities since the goats were placed in the paddock.

RESULTS

Vegetation control was obvious almost immediately. The goats attacked the blackberries and lucerne trees with great gusto. Some blackberries were 3 metres tall so the goats would start at the bottom and work their way up. They would eventually get to the top of the blackberry and eat and trample it down to ground level. The lucerne trees proved very palatable. The goats would eat the bottom branches of the trees then jump up on the trees eventually pushing them over and destroying them. Hawthorne was also eaten back significantly though not wiped out. Vegetation controlled is listed in the table below.

Table 1

Common Name	Botanical Name	Palatability	Results
Blackberry	Rubus fruticosus	High	Eaten back to crown
Tree Lucerne	Chamaecytisus proliferus	High	Destroyed
Hawthorne	Crataegus spp	Medium	Eaten back
Radiata Pine	Pinus radiata	Medium	Ring barked
Serrated Tussock	Nassella trichotoma	Low	Eaten back
Thistles	Various species	High	Eaten back to crown
Biddy Bush	Cassinia arcuata	Low	Lightly Grazed

CASE STUDY TWO: GOSLING CREEK RESERVE

THE SITUATION

Gosling Creek Reserve was a former pine plantation that was mostly cleared in 2000 to establish a recreational/environmental area for the Orange community. The reserve surrounds Gosling Creek reservoir, Orange's former main water supply. Whilst the northern side of the reserve was revegetated with endemic plant species after it was cleared, the southern side was left untouched. This side was approximately 30 hectares in size and overrun with blackberry, broom, thistles, hawthorn and radiata pines. It was a real dog's breakfast. To give you some idea, a bulldozer had to be used to create a track for access vehicles. The Gosling Creek Master Plan did include the clearing and revegetating of the site but something needed to be done in the short term to control the vegetation. After the success of the goats at Lake Canobolas it was again decided to deploy their services after examining all the options.

OPTIONS

The planned development of the southern side would involve clearing of the site to allow for revegetation to occur. The amount of overgrowth in this section left Council with 3 options, chemical control, mulching of the site with new technology machinery or goats. It was estimated to control the weeds chemically would cost in the vicinity of ***$20,000***. To have the site mulched would cost ***$40,000*** and to purchase goats would cost around ***$1600***, (40 goats at $40 per head). The goats would be ideal for cleaning up all the undergrowth, mainly blackberries and broom. Once this was achieved access to fell the larger pine trees would be made easier.

COSTS

Perimeter fencing around the site was in poor condition and would need to have been replaced in any case. Some internal fencing was installed to keep the goats in specific areas. Initially 40 goats were purchased in March 2004 for $1760 delivered and drenched. The vegetation was so dense, especially the broom, it was decided to purchase another 50 goats in October 2004 to speed up the process. The second lot were purchased for a $50 a head drenched and delivered. The total cost of both lots being ***$4260*** and once again if the goats were sold now they would actually make us money with their control work effectively costing nothing.

BENEFITS

The main benefits of using goats in this situation were:

- Cost effectiveness and longevity of control
- Environmentally friendly. No chemicals used
- Avoid the use of chemicals near reservoirs

DISADVANTAGES

The main disadvantage of the goats on this particular site is the medium level of soil disturbance as a result of high stocking rates, (90 goats to 13.7 hectares).

Because the area is to be revegetated with endemic trees, shrubs and grasses the soil disturbance should not be a problem.

RESULTS

The goats have done a fantastic job in the reserve. Blackberries were eaten back to the crown, as were the thistles, English broom was stripped and trampled down to ground level, hawthorn was eaten back and feral pine seedlings were ringbarked. Vegetation that was controlled is listed in the table below.

Table 2

Common Name	Botanical Name	Palatability	Results
Blackberry	Rubus fruticosus	High	Eaten back to crown
English Broom	Cytisus scoparius	High	Stripped and trampled
Thistles	Various species	High	Eaten back to crown
Hawthorn	Crataegus spp	Medium	Eaten back
Radiata Pine	Pinus radiata	Medium	Ring barked
Montpellier broom	Genista monspessulana		

CONCLUSION

Weed control using goats has been extremely successful for Orange City Council but obviously this type of control won't suit every LCA. The area of the land to be controlled is relevant to the equation. The two areas owned by Orange City Council allowed for the goats to be monitored closely. Whilst the weed infestations could be classed as core the grazing techniques implemented were conducive to the situation and the weeds were controlled in a relatively short time. On a larger scale this may not be the case. The longevity of the control must also be considered. Short term applications may need chemical assistance if the goats are pulled out early whilst long term control is as good as the initial work and prolonged follow up work.

Would we deploy goats again? Yes!

Author details:
Mr Neil Boyd
Orange City Council
P.O. Box 35
ORANGE NSW 2800
Ph (02) 63938500, Fax (02) 63938199
Mob 0408 692 369
Email nboyd@orange.nsw.gov.au

Mysore Thorn control at Lake Innes Nature Reserve,NSW

Susan Phillips (Education Officer) & Michael Dodkin (Pest Management Officer)
Mid North Coast Region, Parks & Wildlife Division
NSW Department of Environment & Conservation

Introduction

This paper describes action taken by the Parks & Wildlife Division of the Dept. of Environment & Conservation (DEC), to control a serious infestation of mysore thorn at the Innes Ruins Historic Site within Lake Innes Nature Reserve, 11km south west of Port Macquarie in NSW.

Mysore thorn (*Caesalpinia decapetala*) (Roth) Alston, also known as thorny poinciana, wait-a-while and mother-in-law vine, is an exotic thorny climber that infests forests, woodlands and disturbed areas of rainforest along the NSW and Queensland coasts and adjacent uplands. It has the capacity to spread and dominate native vegetation where it occurs. It is currently not declared as a noxious plant under the Noxious Weeds Act, 1993.

Origin & Distribution of mysore thorn

Harden (1991, p.315) describes mysore thorn as a native of South East Asia. Mysore thorn was first officially recorded in NSW in 1911 near Ryde. National Herbarium of NSW records state that present day infestations of mysore thorn occur adjacent to river banks and flood channels in northern NSW near Murwillumbah, Lismore, Grafton, Dalmorton, Coffs Harbour and Macksville. In Queensland, mysore thorn has been recorded at Brisbane, Toowoomba, Mt Marrow and Yeppoon and was one of the major environmental weeds of New Zealand's Raoul Island in 1977 (Swarbrick & Timmins, 1997).

Two infestations occurred within the Great Lakes LGA. One infestation covered 3 ha, between Tahlee and Karuah, near the upper reaches of Port Stephens. It is of interest to note that this site was in the vicinity of a colonial land holding by relatives of the family who established the Innes Estate near Port Macquarie and planted mysore thorn there. Other smaller infestations have been recorded on the Bucketts Way, near Stroud, near Johns River within Taree LGA and at Ross Glen on the Camden Haven River, Hastings LGA.

Historical background & early treatment efforts

Anecdotal evidence indicates that mysore thorn was first planted in 1838 by assigned convict labour as an ornamental garden feature around Lake Innes House. Around 1905 the derelict estate buildings were destroyed by fire, leaving only a skeleton of brickwork. During the next 50 years the Ruins became overgrown with an almost impenetrable tangle of both mysore thorn & lantana *(Lantana camara).* Attempts by the Port Macquarie Historical Society in the 1950's to clear the thickets were abandoned when cleared areas were vandalised. Mysore thorn recolonised the site and by 1985 engulfed the remaining brick structures, to a height of approximately 8m. In 1992 when DEC (then National Parks & Wildlife Service of NSW) formally acquired the ruins the mysore thorn was assessed as a serious threat to the archaeological and aesthetic integrity of the remaining fabric.

In late 1992, a comprehensive weed control program was commenced. Initially all areas of mysore thorn growing adjacent to the Ruins and nearby access trails were sprayed with Roundup ® herbicide, concentration 1:400. It was considered that this concentration would not damage any surviving rainforest vegetation. However this treatment did not kill the mysore thorn entirely because spray droplets did not fully penetrate the canopy and the result was an impenetrable, brittle structure that had to be manually removed.

In mid 1993, a Land and Environmental Action Program (LEAP) commenced re-clearing the site immediately around the Ruins. An average of 10 people worked three days a week for six months to clear the site (approx 6,200 person hours). In the area close to the Ruins, mysore thorn stems were cut manually and with brushcutters. Mechanised equipment was not used to avoid damage to the remaining brick fabric.

The debris was heaped whilst still green and pliable. Stalks were initially cut about 50 cm above ground level, to permit removal of the thorny canes, then cut again 5 cm above ground level and daubed immediately with undiluted Roundup ® herbicide. In areas not immediately adjacent to the Ruins, the mysore thorn was sprayed with Roundup ® herbicide concentration 1:100, whilst a rubber-tyred vehicle was used to heap debris for burning.

In 1994 a second LEAP scheme completed the clearing of mysore thorn around the Ruins and extended the program to adjacent waterlines, gullies between the Ruins and Lake Innes. An average of 12 people worked three days a week for six months on this project (over 7,000 person hours). Follow-up spraying with Roundup ® herbicide, concentration 1:100, about five times in the following two years (1995-1996) treated re-growth adjacent to the Ruins. From 1996 onwards, the area immediately adjacent to the Ruins has been sprayed on average twice a year.

Control compartments

In 1996 an area of 25 ha around the Ruins was professionally surveyed and divided into 27 control compartments that varied in size from 0.08 ha to 3.65ha. Compartment boundary lines were slashed and a series of colour coded steel posts identified the corners of the compartments. This enabled a more effective weed control program to be undertaken as precise locations could be specified for treatment, monitoring and re-treatment purposes.

Pesticide Permit Applications

In 1996 changes to legislation concerning the use of herbicides in NSW necessitated the preparation of a Pesticide Permit Application for Off-Label Herbicide Use on mysore thorn (Popovic,1996). Permission was sought from the National Registration Authority for Agricultural and Veterinary Chemicals, to use both the herbicide Roundup ® and the brush controller Brushoff ®, at dosages based on trials conducted by NSW Agriculture at Wollongong. Permit PER 556 was issued to cover 1997 and application rates of 1L per 100 L water for Roundup ® Bioactive (360g/LGlyphosate) and 10g per 100 L water for Brushoff ® (600g/kg Metasulfuron methyl) were specified. Extensions to the Permits were also subsequently granted.

Site Survey 2000

By 1999, despite a five-year weed control program within Lake Innes Nature Reserve, mysore thorn was very much in evidence and was regenerating from both seed and suckers. It was decided to survey all 25 ha of weed control compartments for mysore thorn. Methodology involved undertaking a north-south transect across all plots at 5 metre intervals, then recording and tagging all plants and/or thickets observed. 5 metre intervals were selected to enable close observation through the dense undergrowth. At the time of the survey, the site had not been sprayed or slashed for 6 months and the understorey was very dense. A length of pink plastic survey tape was tied to each plant/thicket observed. The size and location of each plant and thicket was recorded on a compartment survey map scale (approx 1:500) This enabled precise location of all known infestations for follow-up control.

Approximately 2,800 mysore thorn plants were recorded over the 25 ha surveyed. Plants varied in height from several centimetres to over 2 metres. Examination of root systems of plants <2m indicated that most had regenerated from seed rather than suckering, particularly on downslope locations. Plants that had reached a height of over 2 metres were mostly suckers from existing plants. Plants regenerating from seed were common in compartments with less than 30% estimated canopy cover. Smaller plants (<1m in height) were also common in compartments with a dense understorey of tall pasture grasses.

From the survey a pattern of regeneration was evident along natural gully lines that drained away from the Ruins. A series of small infestations was found parallel to the line of a former convict road. Regenerating plants appeared to favour more open locations with less than 30% canopy cover. Mysore thorn seedlings also occurred within the Ruins themselves - archaeological investigations in August 2000 revealed over 300 seeds in approximately one sq. metre of soil to a depth of to 30cm.

Recommendations from 2001 Mysore Thorn Pest Strategy

Five (5) recommendations for the control of Mysore thorn within Lake Innes Nature Reserve were stated in the Mysore Thorn Strategy (Phillips 2001).

1. Eradication of mysore thorn

The eventual eradication of mysore thorn was considered feasible, given that:

- the infestation was confined within 26 ha of surveyed compartments,
- a survey and monitoring methodology had been developed and implemented,
- effective control techniques had been established.

2. Surveying for mysore thorn

Regular systematic surveying of the control compartments for mysore thorn should occur every two- three years until 2010, when the need for regular surveying should be reviewed. It is expected that occasional surveying would continue on an irregular basis given the long-term viability of mysore thorn seed in the soil (>20years).

3. Regular slashing & 'follow-up' spraying as an effective control technique

Regular slashing at a height of 15 cm to assist control other exotic weeds and to stimulate the germination of mysore thorn seed to reduce the soil seed bank. Slashing was recommended at least once a year with care exercised to avoid areas of known or probable archaeological significance.

After several months, areas where mysore thorn was visibly regenerating to be spot spray with Roundup ® and Brushoff ® herbicides and applied by mechanised spraying equipment mounted on a 4WD vehicle driven along the compartment boundaries.

4. Continued use of metsulfuron methyl (Brushoff ®) and glyphosate (Roundup ®)

Both these herbicides are effective in controlling mysore thorn. It was also recommended that a stable understorey should be established using species that would permit views from the Ruins over Lake Innes, in keeping with historical precedents. 'Cut and daubing' freshly cut stumps with concentrated Roundup ® herbicide was found to be an effective in killing mysore thorn and preventing suckering.

5. Declaration as noxious weed

It was recommended that mysore thorn should be declared a noxious W2 weed within any local government areas where it is now evident. Whilst not currently declared as a noxious weed in NSW, it is regarded by most LGA's and community groups as an environmental weed and infestations are treated accordingly when discovered.

2003 Mysore Thorn Survey

Surveying for mysore thorn again took place in spring 2002. The 2002 survey recorded 298 stems, 90% were under <2m and most were located in 'hot spots' recorded in the 2000 survey. One notable concentration was approximately 50m downslope of the Coachyard and on the site of a former colonial orchard. Overall this result was a tenfold reduction in the number of mysore plants present in the 25 ha control area since 2000.

Conclusion

The treatment of mysore thorn at the Innes Ruins Historic Site and subsequent development of a Pest Strategy enabled the development of a systematic approach to consistently monitor and implement a successful control program that supports:

(1) the eradication of mysore thorn from Lake Innes Nature Reserve, and
(2) the facilitation of ongoing restoration works at the Innes Ruins Historic Site.

The program has, and continues to, achieve both important biodiversity conservation and cultural heritage outcomes in a significant reserve area of the NSW's national park and reserve estate.

****

References:

Harden G (ed), 1991, Flora of NSW Vol 2, Uni of NSW Press, Kensington, NSW.
Popovic P, 1996, Pesticide Permit Application for Off-Label Use on Mysore Thorn, NPWS, Port Macquarie District, NSW.
Swarbrick J & Timmins S, 1997, Annotated Bibliography of Environmental Weeds in Australia and New Zealand, Environment Australia, Canberra, ACT.

WEEDS OF NATIONAL SIGNIFICANCE

Weeds of National Significance and other National Issues

John Thorp
National Weeds Management Facilitator
16 Flowers Court,
Launceston, TAS 7250

ABSTRACT (SUMMARY)
National programmes are having a significant and ongoing impact on the management of weed species across Australia with three specific programmes having a major role, the revision of the National Weeds Strategy (NWS), Weeds of National Significance (WONS), coordinators and working groups and funding from the "Defeating the Weed Menace" programme conducted by the Australian Government.

All these activities are designed to enhance the effectiveness of managing weeds by example and on the ground action. Every person working in weed management at programme manager level or higher is encouraged to adopt the underlying principles contained in these and apply them to their day today work as they encourage the use of integrated weed management programmes.

The following papers in this session provide four case studies of WONS weeds which demonstrate what can be achieved when an integrated national approach is adopted.

INTRODUCTION
The NWS was launched in 1997 and the list of 20 WONS weeds was agreed in 2000. This has been followed by the development of national strategies for all weeds and the appointment of coordinators. The period of National coordinated activity varies for each species depending on when finding and the formation of the national working group occurred.

The first of the WONS species attacked was prickly acacia (*Acacia nilotica* subsp. *Indica)* in 1998 with willows (*Salix* spp. With exceptions) commencing in early 2005.

The NWS has been in effect for 8 years and much of the strategy has been completed. It is now in the process of being revised.

Defeating the Weed Menace programme was a Liberal Party funding initiative initiated as a part of the 2004 election policy, which is currently being implemented by the Australian Government.

NATIONAL PROGRAMS
National Weeds Strategy

The NWS is currently under revision and is expected to be finalised by the end of 2005. The revision will result in a new strategy which builds on the achievements of the earlier version.
The revision is to be undertaken in full consultation with all key stakeholders to ensure that it contains a vision for weed management in 2010 and beyond. It will address many issues, some of which will be new and others will have been carried forward from the first edition.

The revised strategy will be endorsed by the National Resource Management Ministerial Council which ensures that all states and territories and the Australian Government are satisfied with its content and committed to its implementation.

Weeds of National Significance

In order to implement the WONS strategies, a coordinator has been appointed to each species (some coordinators cover more than one species) and a working group appointed, comprised of community, industry and government key stakeholder representatives. These groups focus on a national approach, addressing the major areas of preventing spread, containing existing infestations and managing core infestations. The groups draw on the most competent expertise in Australia and develop innovative actions, coordinate funding applications and establish priorities for research and on the ground action.

Every group has developed new insights and identified coordinated methods for managing their species. This probably would not have occurred if there had not been a national approach with a shared common vision.

WONS groups generally have the following characteristics and roles:

- Comprised of wide ranging expertise and approaches;
- A drive and desire to make the strategies succeed by killing weeds and assisting land managers;
- An ability to prioritise action and identify innovative solutions;
- A significant level of political/networking influence;
- An ability to prioritise actions for all types f work;
- An ability to identify opportunities for coordination of effort;
- An ability to advise on funding priorities and proposals;
- An ability to take independent action such as initiating publicity etc.

At times people criticise the WONS, because they are only comprised of 20 species, but it is more useful to see them as models for attacking weedy species and already an entirely independent national strategy has been established for Weedy Sporobolus Grasses, lead by the Department of Natural Resources and Mines (Qld). It is to be hoped that more species will be treated in this manner.

A second major issue arises where a WONS weed may be replaced by other weeds, providing no gain for the management effort. In this case a site led approach needs to be taken and this usually results in higher level adaptive management being undertaken.

It is necessary to recognise that WONS priorities will be established that direct funding to define areas, leaving others as low priority and this will understandably annoy some land managers as they feel abandoned or left out, an understandable reaction. However this is the result of limited funding and a desire to gain best value for expenditure. In all instances the coordinator will be able to explain the decision in a clear, transparent and justified manner based on a clear priority setting process.

Defeating the Weed Menace

This is an Australian Government funding programme for weed management at the national level which amounts to $40 million over four years. The funding is available for research, extension, management and other activities which have national application. On the ground weed management funding is still to be provided via natural resource management regions, Envirofund, Landcare and other sources.

The programme requires matching contributions, preferably in the form of “new money”. It is not designed to replace existing state and territory effort and any sign that cost shifting is taking place would jeopardise the application.

DISCUSSION

The programmes described above are designed to improve and enhance our national weed management effort and increase existing state and territory performance. They identify areas where national action is desirable, such as research on biological control, weed awareness, national strategies and weed spread programmes, just to highlight a few examples.

The four WONS weed presentations that follow in this session serve a case studies and examples of where national action has vale added to state and territory programmes. They should be seen as offering approaches that can be adopted for other species beyond WONS.

There is still an emphasis on spray, slash and burn as the main solution to weed problems, but these are only be a short term solutions which must be followed with integrated weed management and natural resource management solutions, of the type presented in the remainder of this session.

The programmes described are designed to encourage continuous improvement in weed management and encourage innovative approaches with lasting consequences. It is also important that the community be involved and encouraged to champion on ground action as they will endure beyond government short term programmes and provide a continuity of activity.

You are urged to use the national programmes and principles in your day to day work in order to enhance and improve the effectiveness of weed management across Australia.

Biography

John is a trained agricultural scientist and extension officer having worked at all levels from the field to highest levels of government.

He currently holds the contract to act as National Weeds Management Facilitator under the Natural Heritage Trust responsible to the Department of the Environment and Heritage and Department of Agriculture, Fisheries and Forestry.

He held contracts to act as Project Manager for the implementation of the National Weeds Strategy and Executive Officer to Australian Weeds Committee. He facilitated the development of the Weeds of National Significance and their subsequent management.

Other work includes program and legislation reviews, including industry assistance and support programs, development of legislative principles and reviews of national and state strategies.

Author details

John R Thorp
National Weeds Management Facilitator
16 Flowers Court, LAUNCESTON TAS 7250
Phone: 03 6344 9657 Fax: 03 6343 1877
Mobile: 0419 323 400
Email: jthorp@jta.com.au

WoNS National Gorse Program

- What's in it for New South Wales?

Ms Sandy Leighton
National Gorse Coordinator
Weeds of National Significance Program
Department of Primary Industries, Water & Environment
13 St Johns Avenue New Town Tasmania 7008

KEYWORDS

Gorse, *Ulex europaeus*, Weeds of National Significance, eradication, national coordination, mapping, partnerships, education and awareness, garden escapes

ABSTRACT

Progress is underway to form partnerships, create linkages, raise awareness and seek strategic national funding assistance for gorse management (a Weed of National Significance). This work is helping weed managers in NSW meet the objectives of the National Gorse Strategy. The major challenge for the national gorse coordinator is to value-add to existing programs and expertise to facilitate a more strategic approach to gorse management throughout Australia. Other challenges are creating active networks to enable information exchange and cooperation and encouraging stakeholders to document the distribution and density of gorse in the State, targeting areas where eradication is or has potential to be the primary management objective. Partnerships are being forged between many stakeholders including regional weed control coordinators, council weeds officers, landcare facilitators, landcare groups, landholders, Catchment Management Authorities and State and Australian government natural resource management officers. Such cooperative action is crucial if gorse is to be successfully eradicated and contained in the long term. In addition awareness is being raised amongst the community and government organisations regarding the importance and value of treating small and/ or isolated infestations of this weed. Justification was developed by gathering historical information regarding the initial source of infestations and impacts over time, as well as information on the impact of gorse on agricultural areas, priority vegetation types, high conservation value areas and threatened species. National funding for eradication (including education and awareness) has been sought from the Australian Government Defeating the Weed Menace program for the New England area as well as the Eastern Riverina/ Monaro Regional and Southern Tablelands and South Coast area. Gorse management in NSW has progressed to a more strategic mode as a result of this work.

INTRODUCTION

Gorse (*Ulex europaeus* Linnaeus), native to Europe and the United Kingdom, is a Weed of National Significance in Australia. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread and economic (agriculture and forestry) and environmental (threatened species, priority vegetation and conservation areas) impacts. Economic impacts are estimated at around $7 million per year in Australia in lost production alone (Thorp and Lynch, 2000). Costs to the environment in terms of biodiversity loss are inestimable at this stage.

In agricultural areas gorse provides shelter for pests such as rabbits, foxes and feral cats, increases the risk of bushfires due to its flammability, reduces access by forming dense thickets and dramatically reduces stocking rates. Control of gorse is expensive, with initial costs of up to $1200 per hectare plus costs of follow up that may be required for many years. In environmental areas gorse impacts on biodiversity values including threatened species, priority vegetation and high value conservation areas. Gorse has the potential to smother

native vegetation and inhibit native seedling germination and growth. It can also form a monoculture along watercourses and in forest understoreys.

The National Gorse Strategy (ARMCANZ, ANZECC & FM, 2003) was approved by the Standing Committee of Agriculture & Resource Management and Natural Resource Management Steering Committee in June 2002. The strategy was developed by the Tasmanian Department of Primary Industries, Water and Environment with full cooperation from all the States, Territories and Commonwealth of Australia. The main aims of the national strategy are to encourage eradication of isolated and scattered infestations, to ensure the spread of gorse is prevented and that best management practice is implemented across Australia.

The National Gorse Taskforce was formed in December 2004 and has representatives from State and Territory government agencies where gorse is or has been present (New South Wales, Tasmania, Victoria, South Australia, Australian Capital Territory and Queensland) plus agricultural production, conservation and community representatives. The taskforce guides the delivery of the strategy and has developed a National Gorse Action Plan (http://www.weeds.org.au/WoNS/gorse/) that synthesises and guides the implementation of the national strategy objectives and actions. The key priorities of the action plan are:

1. Produce a national gorse map and determine containment lines, eradication areas and priority sites.
2. National education and awareness.
3. Support nationally strategic on-ground control aimed at eradication in identified priority areas.
4. Research integrated gorse management options.
5. Establish field demonstration sites in priority containment areas, communicate and monitor on-going results.
6. Support a national biological control program.

Identification

Gorse is a prickly, perennial, evergreen legume which, if left undisturbed, will grow to a height of more than four meters. It produces deep and extensive roots and all its leaves and stems are prickly, ending in a sharp spine. The bush is covered with bright yellow, pea-like flowers in spring (from August to October), and in many areas flowering also occurs in autumn (March to May). The plant produces many grey, hairy pods, each holding two to four brown or black seeds. A mature infestation can produce up to six million seeds per hectare each year. Germination occurs best between 15 to 19^0C, with most germination occurring autumn and spring to mid summer. Germination is accelerated by fire and mechanical disturbance. Seedlings are grazed by stock and wildlife before they develop spines, and young plants are reported to be frost sensitive. Early seedling growth is rapid, with flowers first appearing after 18 months. Plants are long-lived and new growth develops each spring (Auld & Medd, 1987).

The seeds have a water-resistant coating that allows them to remain dormant in the soil for more than 30 years. This coating also enables the seed to be readily dispersed by water. The small, dark green leaves are stiff and covered with a waxy coat that helps reduce water loss and, together with its deep root system, enables gorse to flourish in areas with very low rainfall (ARMCANZ, ANZECC & FM, 2003).

Spread

Most seeds fall around the plant but the pods can split open and shoot seeds up to five meters from the parent plant (Auld & Medd, 1987). In this way gorse infestations spread rapidly, particularly when growing along watercourses. Roadside infestations are also easily dispersed by road maintenance machinery.

Gorse can spread into new areas from seed movement in water, soil, machinery, infected produce (eg. hay) and footwear. Birds, ants, stock and wildlife are also known to spread the

seeds. Whilst it is mainly spread by seed, cultivation and the spread of the root system can permit some plant fragments to regenerate in new areas (ARMCANZ, ANZECC & FM, 2003).

DISTRIBUTION IN NEW SOUTH WALES

New South Wales (NSW) has the third largest distribution of gorse in Australia, after Tasmania and Victoria, covering over 1,000 hectares. Many of the areas in NSW where gorse is now present have become infested from original plantings in homestead gardens and as hedges in the early to mid 1800s. These plantings have since spread primarily via watercourses, movement of contaminated soil and by machinery. Infestations are now found along creek lines, in townships, agricultural areas and National Parks, along roadsides, rail lines and electricity easements, and in quarries and mine sites. Gorse occurs on the North and Central coasts, Central tablelands and Central and South Western slopes (Auld and Medd 1987).

Of national importance is that the Australian Capital Territory has an active eradication program for its 21 known gorse sites, a program that is currently at risk from adjacent NSW infestations in the Queanbeyan/ Yass River and Tumut areas.

Current distribution

No state wide gorse map is available for NSW. The following details are based on information available to the author and may not necessarily include all areas infested with gorse.

Isolated gorse infestations are known to be present in the following areas -
The northern-most distribution in Australia is in the New England area, NSW at Boorolong Creek, Kelly's Plains, Ebor, near Dorrigo National Park (NP) and Glenn Innes. Of these only Boorolong Creek has a large-scale infestation (nearly 30 kilometers along the creek line), Ebor and Kelly's Plains occurrences are small hedges, a small paddock infestation and hedge near Dorrigo NP and, at one location along the roadside near Glenn Innes (James Browning, personal communication 2005).

In the Eastern Riverina area small roadside infestations are found at Willans Hill near Wagga Wagga (roadside table-drain), Burrumbuttock and Bungowannah. Two creek line infestations occur near Tumut at Wyangle and Brungle Creek and one roadside area (Peter Ellison, personal communication 2005).

In the Monaro regional area small localised infestations occur over two hectares in the Bombala area (Ken Roberts, personal communication 2005), in the Snowy River area (including some old homestead plantings) (Jo Clarke, personal communication 2005) and in the Cooma Monaro area (Marianna Anderson, personal communication 2005).

In the Southern Tablelands and South Coast area localised infestations exist in the Bega Valley at Murruna Point (crown land) (Ann Herbert, personal communication 2005), Greater Queanbeyan City (garden escapes now along the Queanbeyan River) (Phil Hansen, personal communication 2005), in the Shoalhaven area near Milton (small) and Berry Mountain (more widespread in steep country) (Ian Borrowdale, personal communication 2005). A small infestation exists in the Cecil Hopkins Nature Reserve (Melinda Norton, personal communication 2005). In the Illawarra area infestations occur near Kiama and Shellharbour (mainly on rural lands) and in the Wollongong area (mainly on degraded industrial lands in the south and invading sensitive escarpment bushland in the north including around Helensburgh) (David Pomery, personal communication 2005). The Helensburgh infestation has the potential to spread into The Royal National Park, via the Hacking River.

In the Blue Mountains area, dense infestations have mostly been confined to the upper mountains (Auld *et. al*, 1998). Original infestations resulted from garden plantings and

hedges in horse paddocks in the Blackheath area. Infestations established where infested soil from the Blackheath area had been imported throughout the Blue Mountain Council area (Auld *et. al* 1998) (Ian Lett, personal communication 2005). These infestations have spread along upper tributaries of the Grose River and been carried over the escarpment into the Blue Mountains National Park.

In the Upper Macquarie County Council area a small infestation occurs near Oberon and at Sunny Corner (between Lithgow and Bathurst) and along the railway between Emu Plains and Lithgow (Ian Lett, personal communication 2005).

In the South West Sydney area small infestations occur in the Camden Vale area (Luke McLachlan, personal communication 2005) and in the Wollondilly council area (no details available). In the Hawksberry area a small infestation (0.1 hectares) exists in the Navua Reserve.

Widespread infestations are known to exist in the following areas –
The Wingecaribee council area has gorse east of Goulburn on the edge of the escarpment adjoining the Morton National Park.

In the Yass Valley area gorse is widespread along the Yass River and Brooks Creek where the Southern Slopes County Council estimates 250 hectares and Palerang Shire Council 100 hectares (Deane, 2005) with gorse severely impacting on riparian vegetation. Other areas include Bendoura (along Shoalhaven River), Boro and Nerriga (along Endrick River) (Peter Deane, personal communication 2005).

In the Blue Mountains National Park it is estimated that gorse covers over 100 hectares (Chris Banffy, personal communication 2005).

Potential distribution

Of considerable concern is the huge potential for gorse to spread well beyond its current distribution in NSW (ARMCANZ, ANZECC & FM, 2003). Based on climate suitability gorse could spread to large areas within the Riverina, Lachlan Valley, Lower Macquarie Valley (especially Lithgow/ Bathurst), Blue Mountains area, Southern Tablelands, South Coast and in the New England area/ North coast areas.

LEGISLATION AND STRATEGIES

In NSW, gorse is declared noxious, control category W2, in 34+ out of 138 local control authority areas. Under the NSW *Noxious Weeds* Act 1993 a W2 noxious weed must be fully and continuously suppressed and destroyed.

NSW Department of Primary Industries (DPI) has developed an internal organisational plan for gorse based on the national gorse strategy actions and NSW Department of Conservation and Environment has an active gorse weed management program, especially in the Blue Mountains area. Regional Gorse Management Plans exist for the South Coast and Southern Tablelands, New England and North West and the Blue Mountains areas. In addition NSW is a key stakeholder in the delivery of the National Gorse Strategy.

VALUE-ADDING TO EXISTING PROGRAMS

As no state wide gorse map exists for NSW, cooperation has been sought between stakeholders in areas where gorse is known to have a limited distribution and density. Mapping of current infestations is essential to guide strategic investment within council and CMA areas and to determine national eradication areas, containment lines and priority sites (priority vegetation types, high conservation value areas and threatened species).

In NSW opportunities exist for sourcing national funding for works that are a high priority in the National Gorse Action Plan, namely eradication areas, priority sites and demonstration sites in containment areas. The Defeating the Weed Menace initiative, National Landcare

Program and the Envirofund provide key national funding opportunities whilst in the longer-term, Catchment Management Authority (CMA) regional investment proposals and State government funding will also be vital.

Eradication areas

Partnerships have been created in areas with isolated gorse infestations with the aim of developing long-term, locally owned eradication programs. Project applications have been submitted for funding under the Australian Government's Defeating the Weed Menace program to value-add to existing control programs for both the New England area and E Riverina/ Cooma Monaro/ Southern Tablelands and South Coast area.

In the New England area partnerships now exist between the New England Weeds Authority, Southern New England Landcare, Boorolong Landcare Group, Glenn Innes Severn Council, Bellingen Shire Council, NSW DPI and Border Rivers/ Gwydir CMA.

In the E Riverina/ Cooma Monaro/ Southern Tablelands and South Coast area partnerships have been created between all three regional Weed Advisory Committees and steps have been taken to engage the Southern Rivers and Murrumbidgee CMAs.

FUTURE DIRECTIONS

Mapping

Mapping of gorse throughout NSW is an essential tool for determining national containment lines, eradication areas and priority sites. It is hoped that a partnership can be created between the NSW DPI and NSW Department of Conservation and Environment to set up and maintain a state wide database of gorse distribution in order to document progress being made on the ground. Mapping will need to adopt the WoNS core attributes as a minimum standard (Thackway *et. al*, 2005). In the meantime, Regional Weed Control Authorities are urged to compile and document existing municipal mapping information). This will greatly assist in the delivery of national objectives and is the top priority of the National Gorse Action Plan.

Eradication

In areas where eradication in the primary management objective and Defeating the Weed Menace funding has been sought for a three year period, stakeholders are looking to the CMA regions to provide a commitment for additional funding to maintain these programs for the long term. NSW noxious weed grants will also be of assistance. Where this is the case it is hoped that the CMA regions, NSW DPI and the NSW Department of Environment and Conservation will support these programs. Additional eradication areas are yet to be identified.

Containment

In areas where containment is the primary management objective strategic demonstration sites will provide a catalyst for local action by informing land managers of best integrated gorse management options for their area. Demonstration sites, including revegetation techniques, will need to be maintained and monitored into the future in order to document and determine best practice options for gorse and field days held to impart this information to land managers. Funding options include the Defeating the Weed Menace program, the National Landcare Program and State government funding. In areas where gorse is widespread, the designation and protection of containment lines will assist with the delivery of national priorities. Future investment in these areas by CMAs will be of significant value and assistance eg along watercourses as part of integrated natural resource management programs.

The national gorse biological control program, a joint initiative between the Tasmanian Institute of Agricultural Research and the Victorian Department of Primary Industries and funded by the Australian Government, has recently been expanded to include NSW and South Australia. Future releases of biological control agents, including the gorse spider mite

(*Tetranychus lintearius*) and gorse thrip (*Sericothrips staphylinus*), will assist with containment. The gorse spider mite can reduce plant biomass by up to 35% whilst the gorse thrip feeds on soft new growth (John Ireson, personal communication 2004). In addition surveys will be conducted to determine whether the gorse seed weevil (*Exapion ulicis*) has become widespread throughout NSW and whether colonies of the gorse spider mite contain predators. Additional studies are currently being conducted by CSIRO in Europe to search for additional biocontrol agents for gorse.

Priority sites

At priority sites where protection of threatened species, priority vegetation and high value conservation areas is the primary management objective, the Envirofund may provide a funding avenue to protect these important natural resource assets, together with CMAs and State government funding.

Education and Awareness

Ongoing gorse education and awareness programs are essential to protect NSW's valuable natural resources from the threat of gorse. Programs will need to be supported into the long term in order to empower landholders and the community to remain vigilant and in order to maximise investment in on-ground outcomes. All above mentioned funding options are relevant here.

ACKNOWLEDGEMENTS:

Australian Government
Department of Agriculture, Fisheries and Forestry
Department of the Environment and Heritage

Department of Primary Industries, Water & Environment
Tasmania

National Gorse TASKFORCE

Thanks go to Michael Michelmore, NSW NGT representative, Michele Haase and Birgitte Verbeek (NSW Department of Primary Industries), James Browning (New England Weeds Authority), Karen Forge (Southern New England Landcare), Ian Turnbull (Bellingen Shire Council), Paula Ash (Riverina Noxious Weeds Project Officer), Neil Hibberson (Greater Hume Shire Council), Bob Adams (Wagga Wagga Shire Council), Peter Ellison (Tumut Shire Council), Neville Plumb and Peter Deane (Palerang Shire Council), Phil Hansen (Greater Queanbeyan City Council), Ann Herbert (Bega Valley Shire Council), Malcolm Ross (Goulburn Mulwaree Shire Council), Paul Brown (Upper Lachlan Shire Council), David Pomery (Illawarra District Weeds Authority), Damien Minehan (Southern Slopes County Council), Graham Harding (Eurobodalla Shire Council), Jim Boyan and Ken Folkes (Wingecaribee Shire Council), Ian Lett and Dave Whiteman (Blue Mountains Shire Council), Geoff Price (Environment ACT), Geoff Butler (Geary's Gap/ Womboyn Landcare group), Jo Clarke (Snowy Rivers Shire Council), Ken Roberts (Bombala Shire Council), Marianna Anderson (Cooma Monaro Shire Council), Chris Banffy and Paul Downie (NSW Department of Conservation & Environment) and Luke McLachlan (Camden Shire Council).

REFERENCES

Agriculture & Resource Management Council of Australia & New Zealand, Australian & New Zealand Environment & Conservation Council and Forestry Ministers (2003).

Weeds of National Significance Gorse (Ulex europaeus) Strategic Plan. (National Weeds Strategy Executive Committee, Launceston, Tasmania).

Auld, B.A. and Medd, R.W. (1987).
Weeds - an illustrated botanical guide to the weeds of Australia. (Inkata Press).

Auld, L., Banffy, C., Garofalo, F., Ireland, C., Mahony, E. and Williams, M. (1998).
Gorse in the Blue Mountains.

Deane, P. (2005).
Report to Southern Tablelands and South Coast Noxious Plants Committee, New South Wales meeting on 7 July 2005.

Thackway, R.: McNaught, I. and Cunningham, D. (2005).
A national set of core attributes for surveying, mapping and monitoring Weeds of National Significance. (Bureau of Rural Sciences, Canberra).

Thorp, J.R. and Lynch, R. (2000).
The Determination of Weeds of National Significance. (National Weeds Strategy Executive Committee, Launceston, Tasmania).

FURTHER INFORMATION

Information provided in this article has been assembled to the best of the author's knowledge at the time of publication. Accumulation of additional information is paramount to create a total current picture for NSW. The author encourages people to contact her if this information is incorrect or they have additional information that would add value to what has been presented in this paper. Thank you.

Biography

Sandy Leighton has over 20 years experience in Natural Resource Management primarily working in the area of Integrated Pest Management. She started out her career as an entomologist and became involved in several community led weed biological control programs in Tasmania. Sandy cooperated in the development and delivery of a Weed Watch program in Tasmanian schools where students classroom reared and field released biocontrol agents. In addition she has worked as a weed education officer and facilitator within the NRM process in Southern Tasmania. Her appointment to the National Gorse Coordinator role has enabled her to combine the diverse skills she has developed over the years and she looks forward to continuing to work enthusiastically and cooperatively to reduce the extent of gorse throughout Australia.

Author details

Name: Sandy Leighton
Organisation: Department of Primary Industries, Water & Environment
Address: 13 St Johns avenue, New Town TASMANIA 7008
Phone: 03 6233 3197
Fax: 03 6228 5123
Mobile: 0437 098 903
Email: Sandy.Leighton@dpiwe.tas.gov.au

The National Serrated Tussock Survey – Serrated tussock resistance to the herbicide, flupropanate in Australia.

D.A. McLaren[1,3], S. Ramasamy[2,3], A.C. Lawrie[2], TA. Morfe[1,3] and G. Pritchard[1]
[1]Department of Primary Industries, Frankston Centre, PO Box 48 Frankston 3199.
[2]RMIT University, Bundoora West Campus, PO Box 71, Bundoora 3083
[3]CRC for Australian Weed Management

Abstract A population of serrated tussock at Diggers Rest just north-west of Melbourne has been identified as being resistant to the herbicide flupropanate. This has prompted a national mail survey of 5000 land managers impacted by serrated tussock across Australia. Survey results have shown that serrated tussock has spread widely throughout Victoria, NSW, ACT and Tasmania with 15 out of 399 respondents reporting resistance and requiring further investigation. The survey has also shown that serrated tussock is costing each land manager between $15,000 and $20,000 annually in control and lost production costs. This emphasises the importance of promoting integrated management of serrated tussock.

Keywords survey, serrated tussock, *Nassella trichotoma*, economic impact, herbicide resistance, flupropanate

Introduction

Serrated tussock (*Nassella trichotoma* Trin. & Rupr Barkworth) is a perennial, drought resistant tussock grass species that is native to the pampas grasslands of Argentina, Uruguay, Chile and Peru (Parodi 1930, Rosengurtt *et al.* 1970) and Bolivia (Walsh and Entwisle 1994). Serrated tussock is a proclaimed noxious weed in the Australian Capital Territory, New South Wales, Victoria, South Australia and Tasmania. It has been described as causing a greater reduction in pasture carrying capacity than any other weed in Australia with heavily infested paddocks in NSW carrying only 0.5 dry sheep equivalent (d.s.e.) per hectare compared to 7 to 15 d.s.e. on improved pasture without the weed (Parsons and Cuthbertson 1992). Serrated tussock is a Weed of National Significance (Thorp and Lynch, 2000) that has been estimated to conservatively cost Victoria $5 million per year (Nicholson *et al.* 1997) and the economy of New South Wales $40.3 million per year (Jones and Vere 1998). In 1977 it occupied 680,000 ha (Campbell 1977) and now occupies more than 870,000 ha in New South Wales with an estimated 2,000,000 ha at risk of infestation (Ian McGowan, NSW Department of Primary Industries, *Personal communication*)). In Victoria, serrated tussock was first collected at Broadmeadows (15 km NNW of Melbourne) in 1954 where it occupied 4 ha (Parsons, 1973). By 1979 it had spread to occupy approximately 30,000 ha (Lane *et al.* 1980) and by 1998 it occupied in excess of 130,000 ha (McLaren *et al.* 1998). Serrated tussock is also found in Tasmania where it is currently spread in scattered populations over an area of approximately 1000 ha (Christian Gonninon, Tasmanian Department of Primary Industries Water and Environment *personal communication*). The potential distribution of serrated tussock based on its current infestations in Australia has been estimated at 32 million ha with substantial areas of New South Wales, Victoria and Tasmania at risk of invasion (McLaren *et al.* 1998). Serrated tussock is being increasingly recognised as a serious environmental weed and the associated native vegetation being invaded by serrated tussock is described in McLaren *et al.* 1998.

Despite years of research, there are still limited control options for managing serrated tussock in Australia (Michalk *et al.* 1999). The only registered herbicides for control of serrated tussock in pastures are flupropanate, glyphosate, and 2,2-DPA. Flupropanate is widely regarded as the most selective and effective herbicide for controlling serrated tussock (Campbell and Vere 1995). Species such as phalaris, cocksfoot and kangaroo grass have some tolerance to flupropanate (Campbell 1979; Campbell *et el.* 1979; Campbell and Ridings 1988) while its residual action in the soil can prevent serrated tussock regrowing for three to five years (Campbell and Vere 1995). Flupropanate resistance has been identified in a population of serrated tussock in Victoria (Noble 2002). Serrated tussock plants suspected of being resistant to flupropanate were grown in a pot trial and treated with a range of flupropanate rates. The resistant serrated tussock survived application rates as high as 8L/ha which is four times the recommended rate used for controlling this species (Noble 2002). Similarly, petri dish dose response trials undertaken on serrated tussock seeds have shown that the flupropanate dose required to reduce the germination of seeds from resistant plants by 50% was approximately 10 times higher than for susceptible seeds (Graeme Pritchard, Victorian Department of Primary Industries, *Personal communication*) This has prompted a national survey to try and determine whether serrated tussock resistance to flupropanate is wide spread and to raise resistance awareness and promote integrated management of serrated tussock.

Materials and Methods

In November 2004, a tick-box questionnaire was sent out to land managers in Victoria, NSW, ACT and Tasmania. In Victoria and Tasmania, questionnaires were sent out directly to landholders that had been recorded with serrated tussock on the land they managed. This also included a mailing list of 1130 within the Melton Shire in VictoriaThe Melton Shire was targeted because the property identified with serrated tussock resistant to flupropanate was located within this Shire. A further 931 surveys were mailed directly to land managers recorded with serrated tussock on the Victorian Department of Sustainability and Environment's Integrated Pest Management System (IPMS). Twenty questionnaires were sent out to Victorian park rangers, 10 to Vic Roads and 30 directly to Victorian spray contractors. In Tasmania 275 questionnaires were mailed out directly to land managers recorded with serrated tussock. In NSW 338 surveys were sent directly to NSW Landcare groups within serrated tussock

infested locations while the remaining 2,265 surveys were sent to NSW and ACT Weeds Inspectors for distribution to land managers in their districts. The surveys were targeted to regions thought likely to be infested by serrated tussock. A total of 5000 surveys were sent (2125 to Victoria, 2450 to NSW, 150 to ACT and 275 to TAS). A colour CRC for Australian Weed Management Fact sheet entitled "Understanding the mechanisms behind herbicide resistance" was also sent out with the surveys to help land managers understand what herbicide resistance is and how it can be prevented. Each survey included a prepaid return envelope to aid land managers returning the survey.

Table 1: Serrated tussock infestations categorised by State, land use and density reported from survey.

STATE	Land use types	Serrated tussock infestation density (ha)				
		Dense	Medium	Scattered	Rare	Total
NSW	Pasture	878	1078	17909	19735	**39,600**
	Native	1,099	4,303	16,798	10,855	**33,055**
	Other	143	12	3,910	5,375	**9,439**
	Total	2,120	5,393	38,617	35,965	**82,094**
VIC	Pasture	37	371	2,353	2,754	**5,515**
	Native	6	195	939	816	**1,956**
	Other	99	70	225	247	**642**
	Total	142	636	3,517	3,817	**8,113**
TAS	Pasture	30	31	121	39	**221**
	Native	1	2	64	28	**95**
	Other	0	0	5	0	**5**
	Total	31	33	190	67	**321**
ACT	Pasture	190	25	2,130	1,067	**3,412**
	Native	370	1,030	5,976	537	**7,913**
	Other	0	0	45	150	**195**
	Total	560	1,055	8,151	1,754	**11,520**
Total Australia		**2,853**	**7,117**	**50,475**	**41,603**	**102,048**

Respondents were requested to provide information on the extent of land they manage and the coverage of serrated tussock infestation on their land. The infestations were categorized either as '**Dense** – monoculture or close to monoculture – very few native/other species present', '**Medium** – roughly equal proportions of serrated tussock to other native/pasture/crop species present', '**Scattered** - Native/pasture/crop species in much greater abundance than serrated tussock', '**Rare** – Single or very few serrated tussock plants present' or '**Absent**'. They were also asked to classify what proportion of these infestations occurred on pasture land, native vegetation or other (roadside, cropping, forestry etc). Respondents were also asked to indicate the costs as "material costs," "labour costs" "Time (days/year) cost" and "other costs" to control serrated tussock infestations in "pasture", "native vegetation" and "other" land classes. Questions were asked about chemical control including what herbicides they used for serrated tussock, the number of times they used these herbicides and the year they first used these herbicides. They were also asked whether they had noticed serrated tussock on the land they managed that had not died after two or more applications of a serrated tussock herbicide and whether they thought this could have been due to resistance.

Table 2: The annual costs of serrated tussock control reported from survey

STATE	Land use types	Annual total cost to control serrated tussock by State ($/yr).				Average per respondent ($/yr)
		Materials	Labour	Other	Total	
NSW	Pasture	165,714	177,110	23,970	**366,794**	**2,134**
	Native	50,180	116,172	87,570	**253,922**	**3,199**
	Other	15,347	41,286	14,410	**71,043**	**2,412**
	Total	**231,241**	**334,568**	**125,950**	**691,759**	**7,745**
VIC	Pasture	53,609	76,478	26,460	**156,547**	**1,010**
	Native	16,142	50,898	17,600	**84,640**	**918**
	Other	9,275	43,800	8,425	**61,500**	**1,934**
	Total	**79,026**	**171,176**	**52,485**	**302,687**	**3,862**
TAS	Pasture	2,050	5,390	3,350	**10,790**	**715**
	Native	2,325	4,650	2,500	**9,475**	**1,415**
	Other	0	0	0	**0**	-
	Total	**4,375**	**10,040**	**5,850**	**20,265**	**2,130**
ACT	Pasture	21,550	30,760	40,300	**92,610**	**5,438**
	Native	43,450	13,640	17,800	**74,890**	**3,755**
	Other	110	500	100	**710**	**212**
	Total	**65,110**	**44,900**	**58,200**	**168,210**	**9,405**
AUST	Total	**379,752**	**560,684**	**242,485**	**1,182,921**	

Results

Table 3: Annual total production loss by State ($/yr)

State	No. of Replies	Total, $	Average per respondent $
NSW	31	478,600	15,439
VIC	15	91,740	6,116
TAS	1	1,000	1,000
ACT	4	91,480	22,870
AUST	**51**	**662,820**	**12,996**

Table 4: Herbicides used to control serrated tussock (Number of respondents) and average years/times used.

State	Flupropanate No. reporting – Ave years/times used	Glyphosate No. reporting – Ave years/times used	Total No. reporting
NSW	96 – 10.7	68 – 7.6	164
VIC	57 – 5.1	120 – 5.6	177
TAS	7 – 1.4	4 – 6.0	11
ACT	10 – 10.9	11 – 3.8	21
AUST	**168 – 8.0**	**203 – 6.3**	**373**

reported on an entire district or region. In Victoria, the "Other" category recorded the largest area of dense serrated tussock. However, this was reported by a single landowner who did not provide contact details.

Economic impact Table 2 lists the annual costs of serrated tussock control expressed as materials, labour and other (other costs of serrated tussock not included in materials and labour) listed for land use and State affected. As expected, NSW, the state with the most significant serrated tussock infestations are spending the most money on serrated tussock control ($691,759/year and $7,745/respondent). However, land managers from the ACT are spending on average $9,405/repondent/year on serrated tussock control which is more than double that reported for Victoria ($3,862/respondent/year) and Tasmania ($2,130/repondent/year). Labour was recorded as the greatest cost component in all land use types except in native vegetation in the ACT where $43,450 was spent on materials compared to $13,640 estimated for labour. The annual total production losses caused by serrated tussock is listed in table 3. In total, production losses were estimated at $662,820 while the average losses

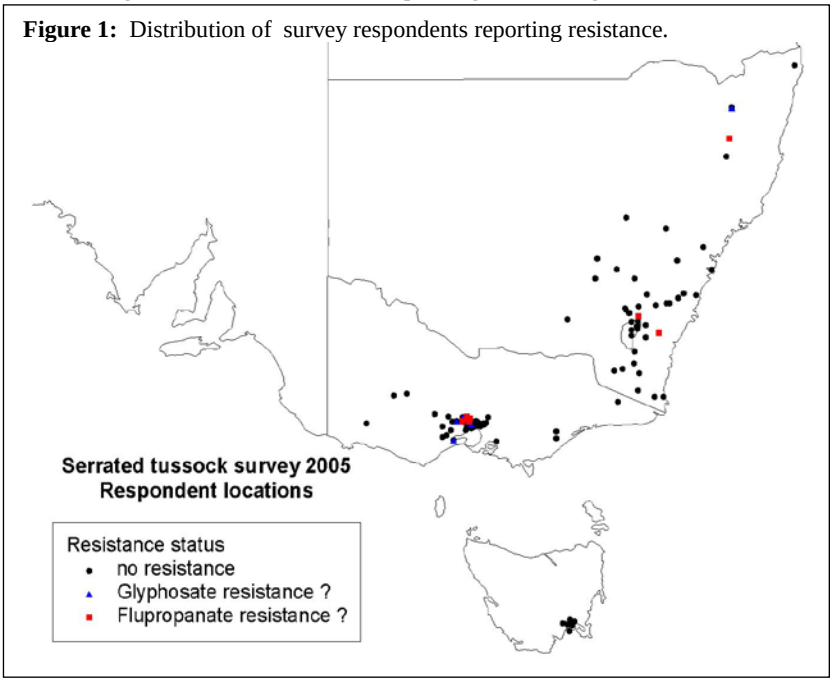
Distribution and type of infestation: A response rate of approximately 8% (399) was obtained while approximately 250 surveys were returned address unknown. The respondents reported on a total area of approximately 0.42 million ha consisting of pasture, native vegetation and other (roadsides, cropping, etc) across Australia. The respondents reported serrated tussock infestations totalling approximately 102,048 ha comprising 48,747 ha on pasture, 43,019 ha in native vegetation and 10,281 ha on other areas (roadsides, cropping etc). Of this total, some 82,094 ha was in NSW, 8,113 ha in Victoria, 11,520 ha in the ACT and 321 ha in Tasmania (Table 1).

The most significant serrated tussock infestations reported occur in NSW where the majority of dense and medium infestations were reported on native vegetation with more scattered and rare infestations reported on pasture land (Table 1). Similarly, in the ACT respondents reported greater areas of dense, medium and scattered serrated tussock infestations in native vegetation than pasture. However, in Victoria and Tasmania more serrated tussock was reported in pasture than in native vegetation. These results may also reflect that all the Victorian and Tasmanian land managers received surveys through direct mail. However, in NSW and the ACT, surveys were sent via weeds officers, environmental officers and agronomists for distribution to land managers. In some cases these professionals

Table 5: Survey respondents reporting resistance.

State	Flupropanate Resistance ?	Glyphosate Resistance ?
NSW	2	1
VIC	6 *	5
TAS	0	0
ACT	1	0
AUST	**9**	**6**

Figure 1: Distribution of survey respondents reporting resistance.



per respondent was approximately $13,000/year. In total, serrated tussock was estimated to be costing the respondents approximately $1.8 million in management costs and lost production or about $15-20,000/year/respondent.

Herbicide Resistance: Table 4 shows the number of respondents using flupropanate and glyphosate and average years/times used for control of serrated tussock compared by State. Almost twice as many respondents were reported using flupropanate to glyphosate in NSW and vice versa for Victoria. Flupropanate has been used on average more than ten years/times by respondents from NSW and the ACT. Glyphosate has been used more frequently than flupropanate in Victoria and Tasmania (Table 4.). The number of respondents reporting herbicide resistance is shown in Table 5. Serrated tussock resistance to flupropanate was identified by 9 land managers and resistance to glyphosate by 6 land managers (Figure 1.). All the Victorian flupropanate resistance reports were from properties in the Diggers Rest, Sydenham, Bulla locality just north of Melbourne.

Discussion

This survey has confirmed the massive impacts this weed is having on Australian agriculture with average annual serrated tussock costs ranging from $15,000 to $20,000 per year per respondent. This survey has also identified 9 (2%) properties reporting serrated tussock suspected of being resistant to flupropanate. A process of contacting these land managers and obtaining serrated tussock samples for testing resistance is underway. Similarly, six land managers have also expressed concern that glyphosate is not killing serrated tussock and that this could be due to resistance. The Victorian Department of Primary Industries has been working in collaboration with the Melton Shire Council to ensure that all serrated tussock on and surrounding the property confirmed with resistant serrated tussock is controlled. In addition, RMIT University in collaboration with the Victorian Department of Primary Industries have commenced a PhD project investigating the heritability and mechanisms causing resistance to flupropanate by serrated tussock. It is critical that land managers don't rely solely on one herbicide type to control serrated tussock. Land managers need to consider mechanical control, cropping, pasture rehabilitation, grazing management and a strategic use of herbicides to try and reduce the likelihood of resistance. This survey reinforces the need to practice integrated weed management to control serrated tussock.

References

Campbell, M.H. (1979) Selective removal of *Nassella trichotoma* from a *Phalaris aquatica* pasture. *Proceedings 7th Asian Pacific Weed Sciences Society Conference,* Sydney 1979, pp 129-130

Campbell, M. H. and D. T. Vere (1995). *Nassella trichotoma* (Nees) Arech. The Biology of Australian Weeds. R. H. Groves, Shepherd, R.C.H. and Richardson, R.G. Melbourne, R.G and F.J. Richardson. 1: 189-202.

Campbell, M.H. and Ridings, H.I. (1988) Tolerance of grazed and ungrazed *Phalaris aquatica* to glyphosate, tetrapion and 2,2-DPA. *Aust.J.Expt.Agric.* **28:** 747-751.

Campbell, M.H., Gilmour, A.R. and Vere, D.T. (1979) Effect of time and rate of application of herbicides on serrated tussock (*Nassella* trichotoma) and improved pasture species 2. Flupropanate *Aust.J.Expt.Agric.Anim.Husb.* **19:** 479-480.

Jones, R.E. and Vere, D.T. (1998). The economics of serrated tussock in New South Wales. *Plant Protection Quarterly* **13(2**), 70-76

Michalk, D., Kemp, D., Cambell, M. and McLaren, D.A. (1999) Control of serrated tussock – problems in developing IWM systems. *12th Aust.Weeds.Conf.* 12-16 September, West Point Convention Centre, Hobart Tasmania. pp 20-24.

Nicholson, C., Patterson, A. and Miller, L. (1997). The cost of serrated tussock control in central western Victoria. Unpublished report prepared for the Victorian serrated tussock working group.

Noble S. (2002) An investigation into the herbicide resistance of serrated tussock. *Honours thesis, RMIT University, Department of Applied Biology and Biotechnology pp 1-84.*

Parodi, L.R. (1930) . Ensayo fitogeographico sobre el partido de Pergamino. Revisita de la Facultad de Agronomia y Veterinaria. *Entrega* 1 VII: 65-289.

Parsons, W.T. (1973) *Noxious weeds of Victoria*. Inkata Press, Melbourne, Sydney.

Parsons, W.T. and Cuthbertson, E.G. (1992). *Noxious Weeds of Australia,* Inkata Press, Melbourne, Sydney.

Rosengurtt, B., Arrillaga De Maffei, B.R. and Izaguirre De Artucio, P. (1970). Gramineas Uruguayas *Universidad de la Republica. Departmento de publicaciones, coleccion ciencias 5. Montevideo.*

Thorp, J.R. and Lynch, R. (2000) *The determination of weeds of national significance.* National Weeds Strategy Executive Committee, Launceston.

Walsh, N.G. and Entwisle, T.J. (1994). Flora of Victoria. Vol 2. Ferns and allied plants, conifers and monocotyledons. *Inkata Press, Melbourne.*

Acknowledgments

The authors would also like to acknowledge the support provided by the Commonwealth Government through the Natural Heritage Trust for this manuscript. The Authors would also like to thank Michael Michelmore from NSW Agriculture for providing names and addresses of NSW Weeds inspectors in serrated tussock localities in NSW. We would also like to thank Christian Gonninon from the Tasmanian Department of Primary Industries, Water and Environment and Alan Brennan from the Shire of Melton in Victoria for supplying databases of land managers in serrated tussock localities. We would also like to thank the NSW and ACT Weeds inspectors who delivered the surveys to farmers and land managers.

Taking the wind out of willows: a national focus to willow management in Australia.

Sarah H. Clift
National Coordinator for Willows
Victorian Department of Primary Industries, Frankston
P.O. Box 48, Frankston, Victoria 3199
Sarah Holland-Clift@dpi.vic.gov.au

Summary Willows are among Australia's most serious riparian and wetland weeds and are listed as one of twenty Weeds of National Significance (WoNS). The National Willows Program is working to coordinate willow management across Australia by facilitating progress against the National Willows Strategic Plan. The major goals of this Plan are to halt the spread of willows, effectively manage current infestations and increase community support for management. This paper outlines some of the major challenges facing willow managers in Australia and how a national program can contribute to meeting these challenges. It also provides some case studies highlighting the significance of the problem and the benefits of successful management.

Keywords willows, *Salix*, impacts, integrated weed management, Weeds of National Significance (WoNS)

INTRODUCTION

Originally from Europe, Asia and North and South America, willows were introduced to Australia for a range of purposes, including basket making, cricket bat production, stream stabilisation, ornaments and shelter. Planting began soon after European settlement and was most extensive from the 1950s to 1970s to help control stream and gully erosion and for use as windbreaks. During this time, willows became a familiar icon of the Australian landscape.

Willows (*Salix* spp.) are now among the most serious riparian and wetland weeds in temperate Australia. In 1999, willows (except *S. babylonica*, *S.* x *calodendron* and *S.* x *reichardtii*) were listed as one of Australia's 20 Weeds of National Significance (WoNS), due to their highly invasive nature and impacts on stream and wetland hydrology and biodiversity. The WoNS program provides a focus on weeds for which a nationally coordinated action program would bring greatest benefits. To help guide national coordination, the National Willows Strategic Plan (2001) (pdf version available on www.weeds.org) was published in 2001, with the vision to 'stop willows destroying our waterways and wetlands'. The Plan aims to deliver three primary outcomes:

- Stop further spread of willows
- Manage the existing areas of willows
- Gain community support in managing the willow problem

Some of the major challenges to achieving these three goals include preventing further trade and planting; identifying and preventing the spread of key taxa; effective on-ground management including mapping, control, follow up and replacement with indigenous vegetation; the development and integration of biological control methods; and regulation of industries and people utilising willow taxa (e.g. the nursery and cricket bat industries).

This paper explores these challenges and how a national program can contribute to meeting such challenges. It also provides some case studies highlighting the national significance of the problem and the benefits of successful management.

STOP FURTHER SPREAD

Although willows already infest thousands of kilometres of watercourses throughout south-eastern Australia, only a fraction of their potential habitat has been invaded (Figure 1) (ARMCANZ, ANZECC & FM 2001). Willows may therefore spread far more widely, posing a serious threat to the riparian interface throughout southern Australia. Willows can either spread sexually (via seed) or vegetatively (via twigs or branches) or by both of these means. The seeds germinate on bare, wet sediments, while branches, attached or detached, root mainly on wet ground or in shallow water.

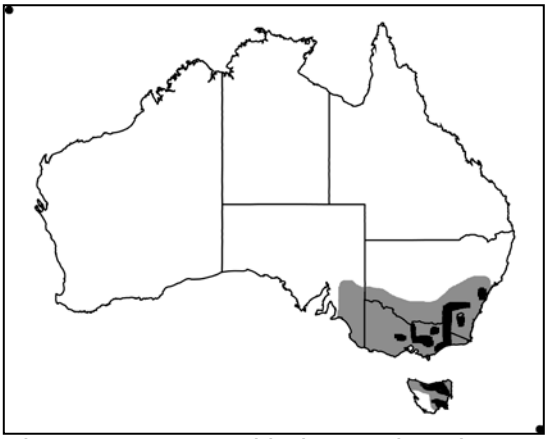


Figure 1. Present (dark areas) and Potential Distribution (grey areas) of willows in Australia (ARMCANZ, ANZECC & FM 2001)

To help prevent the further spread of willows, the Australian Quarantine and Inspection Service (AQIS) has restricted additional importation into Australia. Willows (except *Salix babylonica*, *S. x reichardtii* and *S. x calodendron*) are also not legally allowed to be sold, propagated or knowingly distributed in New South Wales or any other State or Territory except Victoria and the Northern Territory. In Victoria, the legislative status of willows is currently being assessed.

Although willows are listed collectively as 'one' of the 20 WoNS, there are at least 32 known naturalised willow taxa and 45 taxa have been sold through the nursery trade in Australia. At least 22 of these taxa are present within New South Wales and 27 have been sold by nurseries within the state (ARMCANZ, ANZECC & FM 2001).

The continued sale and planting of willows poses a major challenge to our ability to halt their spread and thus protect our waterways from further impacts. Even within states where the sale of most willows is illegal, prohibited taxa continue to be sold, sometimes under the label of a permitted taxon (e.g. *Salix matsudana* 'tortuosa' sold as *Salix babylonica* in Tasmania, pers. comm. Andrew Crane). In addition, willows have a remarkable ability to form hybrids, making accurate identification difficult (Cremer 1995). Almost all willow taxa are capable of hybridising with one or more other taxa (mostly within the same subgenus) if they flower simultaneously and fertile male and female plants grow near enough for pollination to occur (Cremer 2001). While some resulting hybrids may not flourish, some have proved to be more invasive and there is potential for strains to develop that are even better adapted to local conditions within Australia (Cremer 2001). Even the iconic weeping willow (*Salix babylonica*), one of three taxa excluded from the WoNS listing, has the potential to hybridise with other willow taxa (e.g. *S. matsudana* x *alba* and *S. fragilis*), with some of the resulting hybrids apparently more invasive than their parents (Cremer 2001).

An interesting example of willow hybridisation is the Kilmarnock Willow, which comprises a weeping pussy willow scion grafted onto an upright pussy willow rootstock. One such plant recently discovered in Tasmania comprised a female weeping scion grafted onto an upright male plant (Baker and Conod 2003). The upright male section had begun to sucker and catkin formation occurred

simultaneously on both sections of the plant. Seed collected from this plant was sown and successfully germinated (Baker and Conod 2003). Seed from this plant may be the source of the recently discovered northern infestation of wild pussy willows in Tasmania, found just 20km to the west, but further research is needed to confirm this (Baker and Conod 2003). A similar or identical product is for sale at some nurseries in Victoria, traded as Celtic Cascade ®, *Salix caprea* 'Pendula', or Kilmarnock Willow. At one nursery it is advertised as 'the plant you just can't kill'.

The buying and planting of all willows, including the three taxa not listed as WoNS, should always be approached with caution, given the ease with which they can hybridise and the potential for otherwise less invasive taxa to become more aggressive and unpredictable once hybridisation has occurred. It is therefore critical to ensure that compatible male and female plants are kept well away from each other to prevent the formation of viable seed.

The ability of willows to spread by seed highlights the national significance of the willow problem. Whereas vegetatively reproducing willows are generally confined to streams and are dispersed downstream, the great mobility of some seeding willows requires that effective control be coordinated across regions and states. For example, Cremer (2003) observed that the seed of *S. nigra* (black willow) had spread up to 50-100 km in every direction from a site near Tumut in New South Wales since it had been originally planted there 30 years earlier. In addition, Cremer (2003) observed that *S. cinerea* (grey sallow or wild pussy willow) seed can travel by air or water for tens of kilometres.

Such mobility provides these two seeding willows with the ability to move into streams and wetlands and other unexpected environments. *S. cinerea* has proven to be extremely adaptable, invading just about any boggy and intermittently moist sites, anywhere from sea level to above the alpine tree line (Cremer 2003). For example, the first known population of *S. cinerea* seedlings to occur in Tasmania was recently discovered along a road cutting near Hobart (pers. comm. Matthew Baker). Areas where vegetative willows are being removed could also easily be colonised by seeding willows if not adequately managed and rehabilitated. Infestations of seeding willows therefore urgently need to be identified and incorporated into a national control strategy.

The spread of *S. cinerea* can be slow, as specific conditions are required for successful seed germination. However, while spread may appear restricted for many years, a catastrophic explosion may occur at any time given the right conditions. Sites most likely to be invaded by *S. cinerea* are areas where bare, wet ground exists for a month following seed shed (around October / November) (Cremer 2001). Such conditions conducive to a population explosion of *S. cinerea* occurred at Wingecarribee Swamp in southern New South Wales in August 1998 (Cremer 2001). Heavy rains resulted in canyons of exposed bare wet peat which were invaded by 100,000 *S. cinerea* seedlings in November 1998 and a further 1,000,000 seedlings in November 1999.

Another more recent example has occurred in Victoria's Alpine National Park. Major bushfires in early 2003 resulted in significant stands of native vegetation being burnt. Subsequently, *S. cinerea* seedlings readily established in newly exposed moss beds. These beds form the initial collection and filtering point of a substantial part of Victoria's water catchment. Invasion of *S. cinerea* therefore not only threatens the value of the National Park but threatens water quality throughout the catchment. It has been suggested that this may necessitate increased government spending on water quality infrastructure improvement to compensate for the loss of these alpine moss beds (Parke 2005). A rapid response program was established to control new seedlings and their parent plants through partnership between Parks Victoria, North East Catchment Management Authority, Mt Hotham and Falls Creek Alpine Resort Management Boards, Southern Hydro Pty. Ltd. and 4WD Victoria. In one year of control effort so far, it is estimated that more than 50,000 seedlings have been removed and 50 km of mature willows

controlled (Mandar Services Pty. Ltd. 2005). Continued follow up over a number of years is now required to ensure that all plants are removed.

Such case studies demonstrate the clear need for accurate identification and control of the most invasive taxa, including early detection of and response to the establishment of seedlings and new stems.

MANAGE THE EXISTING AREAS

Effective and strategic management of willows is not a simple issue and needs to occur over many years as part of a broader program of riparian management and rehabilitation (ARMCANZ, ANZECC & FM 2001). Total eradication of willows is clearly not feasible, due to the extent and number of infestations (Groves and Panetta 2002). There is therefore a need to establish clearly defined priorities for control of populations that focus on geographic areas and willow taxa. However, further information is still required on the extent, rate and pattern of spread and impacts of certain willows (e.g. seeding willows), in order to best prioritise which areas and taxa to target. Gaining such information is hindered by difficulty in identifying different species, varieties and hybrids and by the inaccessibility of some areas due to difficult terrain or ownership consideration. Willow management also needs to be approached with the recognition of limited resources and within the constraints of funding bodies and funding periods. Identification and strategic planning, mapping and control of the most invasive willows are therefore the highest priorities in the national plan (ARMCANZ, ANZECC & FM 2001).

Numerous willow projects have been undertaken at local and regional scales across Victoria and Australia. While local management efforts are important, broadening the area of control to encompass adjoining areas and catchments that are contributing propagation material would be of most benefit. In this case, partnerships between affected land managers, such as that described for the Alpine National Park project, is the only way to achieve the desired outcome. Otherwise, there is a high chance of reinvasion by willows, and control efforts and funding may therefore be wasted. In addition, a staged control effort over many years is required, to allow the river to gradually adjust to the removal of willows. Willow control funds need to be managed to ensure monitoring and follow-up control occurs in treated areas in subsequent years, even if this means removing fewer willows in the short term.

Mechanical and chemical control methods for willows have been developed over many years. There are now a number of methods to choose from, with the best option dependent on the location, taxa and extent of the willow infestation. Given the complex nature of rivers and the need to understand geomorphological, hydrological and ecological concepts when removing willows, willow control along rivers generally requires expert advice from a number of specialists. Removal of mature willows generally also requires the help of an experienced contractor, due to the operational hazards associated with their removal.

A national best management and case studies guide for willows is currently being compiled to assist managers in adopting best practices in different environments and situations. It will contain detailed information on biology, impacts and identification, options for management in various situations, relevant case studies, management protocols, national data sheets, mapping guidelines and advice for funding applications. The guide is expected to be available free of charge in July 2006.

The recent arrival of the willow sawfly (*Nematus oligospilus*), and other potential organisms associated with willows, may shape future best management practice for willows. The willow sawfly was first found in Australia in Canberra in March 2004, and was already present in such high densities that, even if desired, eradication was not feasible. The sawfly is now well established in the ACT and surrounding areas and there have also been reports of its presence along the south coast of New South Wales, the Adelaide Hills of South Australia and in Keilor in Victoria (pers. comm. Eligio Bruzzese).

The arrival of the sawfly has already created some controversy, with speculation that it was deliberately introduced. It is not known, however, how this insect arrived in Australia - it has not been deliberately introduced as part of any official biological control program. The sawfly has been present in New Zealand since 1997 and is now common across the country, having dispersed at a rate of approximately 300 km per year. In New Zealand, the sawfly appears to be specific to certain willow taxa (Charles et al. 1999).

The potential severity and the dynamics of sawfly outbreaks in Australia are as yet largely unknown. However, it has already been observed on several willow taxa, including *S. fragilis*, *S. matsudana* and *S. babylonica*. By as early as January this year, the sawfly had almost completely defoliated *S. alba vitellina* and *S. fragilis* trees at a site near Canberra Airport, while having minimal affect on nearby *S. babylonica* weeping willow (pers. comm. Lynton Bond). Work is currently being undertaken nationally to assess the distribution and status of the sawfly and other organisms associated with willows in Australia, with a view to understanding their impacts and facilitating the development of a broader range of willow management options than is currently available.

GAIN COMMUNITY SUPPORT

Engendering support for the willow problem poses a major challenge to willow management in Australia due to the utilitarian and cultural values of willows. However, in order to prevent further spread and effectively manage current infestations of problem willows, community support is desperately needed.

It is only over the last 20 years or so that the problems with willows have been broadly recognised, and now the same trusts and boards that originally advocated their use often conduct extensive willow removal operations (ARMCANZ, ANZECC & FM 2001). Given this relatively dramatic shift in waterway management, it is not surprising that people still advocate the planting of willows and/or resist their removal. After all, why should such a useful and beautiful tree so suddenly become a target for those wishing to rehabilitate the environment?

The reason for such a profound shift in perspective has been the mounting evidence of the impacts that willows cause to both aquatic and riparian environments and their ability to so readily and aggressively colonise new areas. Despite having been previously planted along waterways to combat bank instability, willows actually form multitudes of stems that obstruct and divert floods and subsequently erode riverbanks, particularly along small, narrow rivers (Cremer 1999). Being deciduous, willows produce dense shade cover during summer, drop all of their leaves in autumn and remain bare for the winter, compared with native evergreens that provide a constant, less dense shade cover and drop their leaves gradually year round. The dense summer shade cover of willows combined with their impenetrable root system greatly inhibits both terrestrial and aquatic plant growth. In contrast to native trees, willows drop all of their leaves at once in autumn and the leaves break down more rapidly (Hladyz 2001). Such extreme variation in leaf cover and the pulse of nutrients entering the water can alter the temperature and oxygen content and subsequently cause changes to the primary production of algae (Lester et al. 1994) and to aquatic food webs (Glova and Sagar 1994; Read and Barmuta 1999).

A common misconception has been that willows provide good faunal habitat. Research has demonstrated that willows cause significant reductions in terrestrial and in-stream insects (Read and Barmuta 1999; Yeates and Barmuta 1999; Greenwood *et al*. 2004), platypus (pers. comm. Graeme Rooney) and birds (Holland 2002) when compared with native trees and shrubs. In addition, Holland (2002) found that willow-lined reaches did not provide much better habitat for terrestrial birds than did cleared reaches.

Several angling groups have become involved with removal programs in order to create more favourable habitats for fish. For example, $165,000 in funds collected from angling licences in Victoria is being dedicated to willow removal along the

banks of the Goulburn River near Thornton in order to improve trout fisheries. The New South Wales Council of Freshwater Anglers has developed a 'Willow Eradication Policy' for use in lobbying landholders, local councils and State government. Numerous other groups are also working towards managing the problem in Australia. In New South Wales, this includes numerous Landcare groups, Catchment Management Authorities, local governments, State Government departments and local landholders.

Gaining such community support can lead to early identification of potentially threatening adult or seedling willows. This is critical to our ability to most effectively manage willows with the limited resources available. For example, *S. cinerea* and other seeding willows may be growing in dams, wetlands, drainage lines and any other place that happens to remain moist for the month following seed shed. Without the support and active participation of landowners, it is extremely difficult to detect such plants out of sight of nearby roads.

A network of people who are able to identify, look out for and report on new outbreaks would be of great benefit to our ability to stop the spread of, and most effectively manage, current infestations. General community awareness of willow taxa has so far focussed on the most widespread willows in the context of large-scale removal programs. For example, crack willow (*Salix fragilis*) is widespread throughout Tasmania and Victoria and is widely recognised as an invasive plant, while other taxa are still highly valued. In southern New South Wales, there is greater awareness of the black willow (*Salix nigra*), because a targeted eradication and awareness campaign has taken place. By working together and addressing willows from a national perspective we can learn from the lessons of different states and regions and act on them before they become a problem.

CONCLUSION

Willows pose a significant challenge to the conservation and rehabilitation of many of Australia's temperate rivers and wetlands. The number of different taxa and their ability to rapidly disperse and to hybridise complicates our ability to manage them, as does their utilitarian and cultural value. To most effectively manage willows across Australia, a national management focus is clearly required. For example, the great mobility of some seeding willows requires that effective control is coordinated across regions and States, as local control will otherwise only be temporary. A national approach will help facilitate information sharing amongst regions and States to more effectively manage infestations and prevent spread into new areas. For a nationally coordinated effort to be a success, all landholders, Landcare groups, Catchment Management Authorities and public land managers need to work together to reduce the impacts of willows and improve and protect the health of our waterways for the future.

ACKNOWLEDGMENTS

The National WoNS Coordinator for Willows is funded by the Department of the Environment and Heritage and hosted by Department of Primary Industries, Victoria. I would like to thank Matthew Baker and Brooke Ryan for providing case studies, Graeme Rooney, Andrew Crane and Lynton Bond for providing personal communications and Ian Faithfull, John Weiss, Bob Wilson and Andrew Crane for their review of this paper.

DEDICATION

Australian willow expert Kurt Cremer recently passed away. Kurt was the original champion of the willow cause, pushing willows into the national spotlight and leading the way in willow research in Australia. Anyone who has ever been involved with willows will know Kurt's name and many knew him personally. His dedication to willow research and assisting people in the management of willows across Australia was impressive. Kurt has left a great legacy, and will be greatly missed.

REFERENCES

Agriculture & Resource Management Council of Australia & New Zealand (ARMCANZ), Australian & New Zealand Environment & Conservation Council (ANZECC) and Forestry Ministers (FM), (2001) 'Weeds of National Significance Willow (*Salix* taxa, *excluding S. babylonica, S.* x *calodendron* and *S.* x *reichardtii*) Strategic Plan' (National Weeds Strategy Executive Committee, Launceston). (pdf version at weeds.org.au).

Baker, M.L. and Conod, N. (2003). Wild pussy willows loose in Tasmania. *Tasweeds* 21: 4-6.

Charles, J.G, Allan, D.J., Froud, K.J. and Fung, L.E. (1999) A guide to willow sawfly in New Zealand. Horticulture and Food Research Institute of New Zealand. http://www.hortnet.co.nz/publications/guides/willow_sawfly/wsawfly.htm

Cremer, K. W. (1995) Willow identification for river management in Australia. CSIRO Forestry, Technical Paper 3. 22pp.

Cremer, K.W. (2001) 'Wild Pussy Willow' *Salix cinerea* – Priorities for Eradication. CSIRO Publications. www.ffp.csiro.au/publicat/articles/willows

Cremer, K.W. (2003). Introduced willows can become invasive pests in Australia. *Biodiversity* 4 (4), 17-24.

Glova, G. J. and Sagar, P. M. (1994) Comparison of fish and macroinvertebrate standing stock in relation to riparian willows (*Salix* spp.) in three New Zealand streams. *New Zealand Journal of Marine and Freshwater Research* 28, 255-266.

Greenwood, H., O'Dowd, D. J. and Lake, P. S. (2004) Willow (*Salix* x *rubens*) invasion of the riparian zone: impacts on terrestrial arthropod abundance and diversity. *Diversity and Distributions* 10, 485-492.

Holland (2002) Impacts of willows on riparian bird assemblages along the Tarago River, West Gippsland, Victoria. Honours thesis, Monash University, Australia.

Hladyz, S. (2001) Invasion of the riparian zone by basket willow (*Salix* x *rubens* Schrank): impacts on leaf litter decomposition. Honours thesis, Monash University, Australia.

Lester, P.J, Mitchell, S. F. and Scott, D. (1994) Effects of riparian willow trees (*Salix fragilis*) on macroinvertebrate densities in two small Central Ontago, New Zealand, streams. *New Zealand Journal of Marine and Freshwater Research* 28, 267-276.

Mandar Services Pty Ltd (2005) Parks Victoria Bogong Management Unit Willows Project Final Report to North East Catchment Management Authority. Prepared by Bob Jones, pp. 1-12.

Parke, G. (2005) Bogong Willows Extraction. *Trackwatch*. Summer 30th Anniversary Ball Edition, pp. 5-6. Four Wheel Drive Victoria.

Read, M. G. and Barmuta, L. A. (1999) Comparison of benthic communities adjacent to riparian native eucalypt and introduce willow vegetation. *Freshwater Biology* 42, 359-374.

Yeates, L. V. and Barmuta, L. A. (1999) The effects of willow and eucalypt leaves on feeding preference and growth of some Australian aquatic macroinvertebrates. *Australian Journal of Ecology* 24, 593-598.

Biography
Sarah Holland Clift is the National Coordinator for Willows under the Weeds of National Significance (WONS) program funded by Department of Environment and Heritage (DEH) and hosted by Department of Primary Industries (DPI) Victoria. Her major role is to coordinate the strategic management of willows in Australia, as guided by the National Willows Taskforce and National Willows Strategic Plan

Author details
Author: Sarah Holland Clift
Organisation: Department of Primary Industries Victoria
Address: PO Box 48 Frankston VIC 3199
Phone: (03) 9785 0188
Fax (03) 9785 2007
Email: Sarah.Holland-Clift@dpi.vic.gov.au

The Noxious Weeds Amendment Act 2005

Setting a new Direction for Weed Management in NSW

Sydney Lisle
NSW Department of Primary Industries – Orange NSW

Summary

The *Noxious Weeds Amendment Act 2005* received the Governors assent on 1 June 2005. This Act makes a number of amendments to the Noxious Weeds Act 1993 and brings the legislation into line with contemporary weed management principles. As with any legislation, and in particular Environmental Law, weeds law is evolutionary in nature and must change to reflect modern thinking and societies needs.

The *Noxious Weeds Amendment Act 2005* is the result of an extensive review of the principal Act, completed in 1998, which made a number of recommendations for reform. The most significant of these reforms is the change in the objectives of the Act from the reactive and punitive ones now in force to new, proactive ones that guide weed management priorities and direction. These objectives encompass four core principles: Prevent - Contain - Reduce – Monitor. Essentially, all other sections in the legislation are simply tools to allow us to achieve the objects.

The second fundamental change is in how weeds are brought within the scope of the legislation; how noxious weeds are declared. The five (5) new categories are based on impacts and need rather than obligations and the process itself is consultative and open and flexible. The new Weed Control Orders will allow objectives, obligations and even acceptable control methods to be tailored to the particular situation.

The new noxious weeds law in NSW is contemporary in its operation, flexible to adjust to changing needs, consultative to ensure the community has input and directive in providing an overarching policy and allowing effective enforcement where other methods fail to gain the cooperation of landholders.

Keywords. Legislation, change, consultation, flexibility, Weed Control Orders.

INTRODUCTION

The purpose of this paper is to present and discuss the recently passed *Noxious Weeds Amendment Act 2005*. This Act makes a number of changes to the *Noxious Weeds Act 1993* and to the way in which this, as one of our important weeds management tools, can be used.

Legislation is an essential part of our overall weed management program. It is undeniable that we will be faced with the need to use the punitive powers granted to us by the lawmakers of NSW to ensure our weed management programs are successful.

However, as weed management professionals we must never lose sight of the fact that the *Noxious Weeds Act 1993* is a tool to achieve and objective, not an objective in itself.

There has, and no doubt will continue to be, criticism about the legislation. Some see it as too harsh and restrictive, others as unnecessarily complicated and others as not being harsh enough.

There are widely divergent views of the purpose of Noxious Weeds legislation, its powers and constraints, and the manner in which it can be used. This is understandable due to the widely varying backgrounds and interests of those involved in weeds.

What is consistent amongst all but a very small majority is that legislation to control invasive plant species is necessary, and that it must change over time to accommodate the changing needs of our society.

Each Biennial Noxious Weeds Conference attracts an ever widening range of participants, speakers and subject material. No longer is it the exclusive domain of Weed Officers and the Department of Primary Industries, or even of NSW itself. This is clear evidence of the increasing level of involvement in weeds and the increasing participation at local, state, interstate, national and international levels. The legislation we use to help us must change with changing need.

This new Act represents a significant step forward, is innovative in many of its provisions and provides National leadership in a number of weed management issues.

Past History

There is no doubt that the law has changed significantly over the years and that this has been necessary. I doubt that anyone would agree that all of the law of yesteryear was fair, reasonable or suited to modern Australia.

Here are a couple of examples;

Historically, the House of Lords had the right to make legal decisions on Australian laws. Anyone who felt they did not receive justice (or felt they could escape it) and had exhausted all appeals up through the court system in Australia, could appeal to England. The Privy Council, if they supported the appeal, could overrule the decisions of the Australian High Court.

It was not until 3 March 1986, just 19 short years ago, that the Australia Act 1986 terminated the powers of the Parliament of the United Kingdom to make legislation for Australia. Australia was finally permitted the autonomy to make and administer its own laws without interference.

Most people would be familiar with the phrase penned by Charles Dickens in his 1838 novel "Oliver Twist"

"Please sir. I want some more"

However, fewer would be aware that another well known phrase was also written by the same hand in the same novel.

"…..*the law is an ass*".

William Blackstone, in his Commentaries on the Laws of England, written between 1765 and 1769, made this observation:

"*By marriage, the husband and wife are one person in law: that is, the very being of the woman is suspended during the marriage, or at least incorporated and consolidated into that of the husband: under who's wing, protection, and cover, she performs everything; Upon this principle….depend almost all legal rights*"

The statement "…..*the law is an ass*" was made by the Parochial Beadle, Mr Bumble, when confronted by the knowledge that the law considered him equally guilty of his wife's theft of a

locket belonging to Oliver's dying mother, as the law presumes the wife to act at the direction of the husband. Bumbles actual statement was

"If the law supposes that, the law is a ass – a idiot. If that's the eye of the law, the law is a bachelor;….."

The two examples illustrate how laws must change as knowledge and society change. Our weeds laws are no exception, they must change

Environmental Law

Environmental Law is relatively new and is still evolving. Modern weeds law should also be considered as Environmental Law as it now addresses the impacts of invasive plants on the environment and natural resources.

Bates (1982) in the preface to the 1st edition of his book "Environmental Law in Australia" makes this statement; *"The content of other law subjects such as torts or crime is well established by experience and tradition, but environmental law is still in its infancy….."*

Thirteen years later, in the preface to the 4th edition Bates (1995) makes this observation;

"Natural evolution is spawning a complete re-evaluation of planning and environmental management controls right across Australia and legislation which, in many cases, has stood for more than two decades is being replaced by more modern thinking. New environmental protection legislation, for example, is changing the long held focus of pollution management from control to prevention, introducing more flexibility to those regulated but at the same time underpinning the new incentives with tougher enforcement measures."

And, on page 1 of chapter 1 of the 4th edition, he notes "…*environmental law is still, comparatively speaking, very much in its infancy, having been spawned mostly by twentieth century parliamentary activity rather than by the process of well documented legal principles undergoing constant refinement in the courts."*

These statements reflect the rapidly changing environment in which our weeds laws need to function. We all must recognise that societies perceptions are changing, the needs of industry and the environment are changing and our knowledge is ever increasing. We must not only consider weeds on a local, regional and State-wide scale but must take into account weeds at the inter-state, national and global levels also.

NSW Noxious Weeds Legislation

In NSW, the system of weed management now in place dates back to the *Local Government (Shires) Act 1905*. This Act gave shire councils, in various specific and vague ways, powers and responsibilities for control of noxious weeds.

This Act was replaced by *Part XXII of the Local Government Act 1919, No41 – Noxious Plants*. This was routinely amended every few years up until its eventual replacement in 1993 by the *Noxious Weeds Act 1993.* However, the *Noxious Weeds Act 1993* did not make any startling changes to the way weeds were managed, remembering that the principal Act was routinely amended up until its replacement.

Now, our ever expanding knowledge provides as sound base upon which to build our weed management tools, which include legislation. This knowledge allows us to effectively assess weed risks, develop plans and strategies, predict cause and effect, identify invasion pathways and control the weeds.

However, it does little to guide us in what should be included in legislation because all legislation must also enshrine the factors of civil liberty, justice, fairness and equality, not to mention meeting the needs of the Government of the day.

REVIEWING THE NOXIOUS WEEDS ACT 1993

The amended Noxious Weeds legislation is the result of the formal review of the *Noxious Weeds Act 1993* completed in 1998

The review was conducted to meet three requirements of the NSW Government and of the Federal Government. These were:

1. A requirement in the Noxious Weeds Act 1993 itself. Section 76 required that the Act be reviewed as soon as possible after 5 years from the date of assent of the Act. This date was 4 May 1993.

2. The NSW Government's ongoing program of red-tape reduction and regulatory reform.

3. The Competition Principles Agreement, endorsed by Council of Australian Governments (COAG) in 1995, committed NSW to review of legislation that restricted competition.

In addition, the review met objectives in the National and NSW Weeds Strategies, both of which have goals for relevant legislation and identify the needs for reviewing the roles and responsibilities of stakeholders.

The review was undertaken by a review group chaired by NSW Agriculture and comprising members from key stakeholder groups. The review process included extensive industry, community and public consultation during which some 111 submissions were received.

A copy of the Review Groups final report can be found on the Department of Primary Industries website at www.agric.nsw.gov.au/reader/weed-legislation.

Review Recommendations.

The Review Group made a number of recommendations for change. These 19 recommendations were complex and, in actuality, comprised some 40 individual recommendations. These are detailed in Appendix 2.

The key thrust of these recommendations were

- That the Objectives of the Act be amended to clarify the purpose of the legislation and reflect contemporary weed management direction.
- That owners as well as occupiers have obligations to control noxious weeds.
- That the community be involved in the process for weed declaration.
- That all declarations should have a sunset clause.
- That restriction should remain on the sale and movement of noxious weeds.
- That adequate warning be given of new declarations.
- That there should be adequate quarantine powers.
- That the provisions in the Act relating to LCA supply of materials and equipment be removed.
- That there be a requirement for monitoring and reporting.
- That the current system, where obligations are specified in declaration categories, be replaced by a system where obligations are defined in management plans.
- That health effects not be used as a sole reason for declaration.
- That the Ministers power to make grants be expanded.

- That Local Government remains responsible for noxious weed control.

Some of these required legislative changes while others confirmed existing provisions or were procedural matters.

The two most important recommendations from the review are the change in the objectives of the Act and the change from simple declarations to declaration by way of management plans. The main intent of management plans was to provide increased flexibility in the way landholders could manage their weeds and comply with the legislation.

The next step was to convert these recommendations to law.

THE NOXIOUS WEEDS AMENDMENT BILL 2004.

Between the date of the review report, October 1998 and July 2004, there were continual attempts to bring about the amendments necessary to create the changes required.

The main barrier to the amendments was the declaration of noxious weeds by way of Weed Management Plans. This required the imposition of another Statutory Planning process on the community on top of those that already existed. This was further complicated by the number of plans that may be needed, given the large number of species and local control authorities involved.

In July 2004, a further proposal was made to declare weeds by way of Weed Control Orders, using a revised set of four Weed Control Categories. This was later amended to five categories to accommodate the repeal of the *Seeds Act 1982*.

This proposal was accepted by Cabinet and the *Noxious Weeds Amendment Bill 2004* was introduced to the Legislative Assembly (Lower House) on 9 November 2004.

The Bill was passed by the Legislative Assembly on 2 March 2005, was introduced to the Legislative Council (Upper House) on the same day, passed on 6 April 2005 and received the Governors Assent on 1 June 2005.

It is interesting to note that, apart from some amendments proposed by the Greens and the Outdoor recreation Party, the Bill passed through both houses unopposed.

It is now the *Noxious Weeds Amendment Act 2005.*

THE AMENDMENTS

1/ Objectives - The most important amendment is the change in the Objects of the Act.

The old objects reflected the compliance based approach to weed management previously in force.

To identify noxious 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
To provide a framework for the State-wide control of those noxious weeds by the Minister and local control authorities.

The new objects reflect the changing climate and real needs for effective weed management and are couched in outcome related terms.

(a) *To reduce the negative impact of weeds on the economy, community and environment of this State by establishing mechanisms to:*
(i) prevent the establishment in this State of significant new weeds, and
(ii) restrict the spread in this State of existing significant weeds, and
(iii) reduce the area in this State of existing significant weeds, and

(b) *to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State.*

In effect, almost everything that follows after the objects in the Act are simply tools to allow the objectives to be met.

2/ New Categories of Weeds - There will be 5 new Control Classes of noxious weeds instead of the current 13 (4 main categories and 9 sub-categories) these are

Class 1-State Prohibited Weeds – The intent of this category is to provide a high level of action to those weeds of state-wide significance.

The objective is to prevent the establishment of new weed species in NSW.

The weed is not present in NSW or is present to a limited extent.

The weed poses a potentially serious threat to primary production or the environment.

Class2-Regionally Prohibited Weeds – The intent of this category is to provide a high level of control on a regional or local basis. Weeds in this Class will be those that have a limited biological range and therefore do not require state-wide declaration and those that may be abundant in other parts of NSW but that can be prevented from establishing in new areas.

The objective is to prevent the establishment of new weed species in parts of NSW.

The weed is not present in the Local Control Area or region or is present to a limited extent.

The weed poses a potentially serious threat to primary production or the environment within the region.

Class 3 – Regionally Controlled Weeds – This Class is intended to provide for enforceable control where necessary on a local or regional basis. Weeds in this Class will be of isolated to moderate occurrence but capable of significant further spread and impact.

The weed is not widely distributed throughout the Local Control Area or parts of the Area.

The weed poses a serious threat to primary production or the environment.

Further spread in the Area or to another Area is likely.
Class 4 – Locally Controlled Weeds – This Class is intended to include common and widespread species as well as environmental weeds of more locally specific impact.

The weed is widely distributed throughout the Local Control Area or parts of the Area or

The weed poses a threat to primary production, the environment or human health.

Further spread in the Area or to another Area is likely

Class 5 – Restricted Plants –
These are plants that are likely, by sale of the plant, or seeds, or movement in the State or an area of the State, to spread in the State or outside the State

(this Class will include species previously listed under the Seeds Act)

The new categories of noxious weeds will allow the declaration and the categorisation of weeds to better reflect their significance and the danger they represent to the community and the environment.

3/ Declaration Processes - These will remain essentially the same as now, that is by Ministerial Order (Weed Control Order) published in the Government Gazette. However, the proposed Weed Control Order must be subject to public consultation.

The Weed Control Order will define the control obligations for the weed (s) and the control methods that may (not must) be used. This increases the flexibility by allowing landholders to implement contemporary management practices where these will clearly achieve the objectives of the legislation.

The Act now only places an obligation to control noxious weeds as required by the Order.

Removing these obligations from the Act allows a more flexible declaration process as each weed can be dealt with on its merits.

All declarations will have a maximum life of 5 years.

There are also provisions for emergency declaration, without the need for public consultation, and treatment of new weed threats that may emerge. An emergency declaration will have a limited life of 3 months.

Weed Control Orders will have flexibility to prescribe a wide range of obligations, actions and control methods. This can include quarantine matters, prohibition of sale etc. These matters are better dealt with in flexible orders rather than being in the Act itself, which would then bind both the land manager and the Local Control Authority (LCA) to the Act and only what was in the Act.

5/ Joint Arrangements - Another proposal in the Bill relates to achieving more effective weed management through joint activities. LCA's, in most cases the local government for the area, will be able to enter into agreements with other persons or organisations to assist them in undertaking their functions.

For example, both local control authorities and rural lands protection boards inspect rural lands for plant and animal pests respectively. The legislation will allow them to enter into joint arrangements for inspection of lands which will increase efficiency and the likelihood of detection of the pests and weeds. Groups of local control authorities will be able to enter into resource sharing arrangements that increase efficiency and effectiveness across their mutual borders.

6/ Owners and Occupiers Responsible - The legislation proposes to make owners and occupiers jointly responsible for noxious weed management rather than just the occupier.

It is often difficult to determine who an occupier is and what their land management responsibilities are. The owner can usually be readily identified. Ultimately, it is the landowner who should be responsible for the management of their land who will benefit from its improvement.

The legislation will remove the uncertainty as to who is responsible for weed management and ensure that land owners cannot ignore their land management responsibilities. While the Act will still specify the Occupier as being the person responsible for complying with the legislation, enforcement action can be taken against both the Occupier and the Owner.

7/ Monitoring and Reporting – LCA's will be required to monitor weeds and report on the levels of infestation and actions taken to control them.

An identified deficiency in the present system of weed management is the lack of information as to the levels of infestation of noxious weeds in the state and the actions being undertaken to control them. Without this information it is extremely difficult to effectively plan weed management or to measure our success. Monitoring weed distribution and associated activities is essential if weeds are to be managed in a strategic and effective manner.

The legislation will require LCA's to collect and record this information and to prepare reports for the NSW Government when requested. This task will not be onerous as many local control authorities already collect this information for their own purposes and to report for other purposes.

Noxious Weed Grants - The Minister for Primary Industries has the ability under the present legislation to provide grants to weed control authorities and other organisations. However, the current provisions are unnecessarily restrictive in only allowing these grants to be made to assist them in "carrying out their obligations" under the Act. The legislation will broaden this power to allow grants to be made to these organisations to assist them in "carrying out their obligations" and "to further the objectives of the legislation".

The number and type of organisations eligible for grants has not been changed.

Direction to Local Control Authority. – The legislation will make provision for the Minister to direct a LCA to exercise its functions under the Act.

LCA's are the front line for weed management in NSW. If they fail to fulfil their obligations, the effects on productivity and the environment can extend well beyond their boundaries. Lack of action by one LCA cannot be allowed to place broader weed management programs and the efforts of their neighbours in jeopardy.

As a safeguard, the proposal requires that the Minister for Primary Industries consults with the Minister for Local Government or other responsible Minister before such action is taken. This will ensure that this action is only taken in circumstances where no other option is available.

The Bill also removes the Ministers power to serve a Notice (ex Section 18 Notice) on an occupier as this is a duplication of the LCA powers.

The Minister will retain the power to serve a Notice on a Public Authority.

Movement of Weeds in Fodder, Grains, etc. - The Bill amends the restrictions on the movement of fodder and other materials. This includes extending the definition of "notifiable weeds" to include Class 1, 2 & 5 weeds.

A major source of spread of weeds is through the movement of weeds in seeds, fodder, turf, other materials and on machinery. There needs to be effective means of controlling this route of spread, in particular for those weeds that are not yet in NSW or are of limited distribution and with a high potential impact.

.

The *Seeds Act 1982* has been largely replaced by a code of conduct developed in conjunction with the Seed Industry Association of Australia, but some of the restrictions on weed seeds in seed offered for sale for sowing, which are in the current Seeds Act, need to be included in the proposed new Act.

All Notifiable Weeds are automatically banned from sale.

Supply of Services and Charges for Services - The Noxious Weeds Act 1993 allows LCA's to provide materials, equipment and services to landholders for noxious weed control. This was determined to be contrary to the National Competition Policy and will be removed.

However, the Local Government Act 1993 allows a local government to charge fees for services provided, including some that may relate to their noxious weed control functions.

In order to ensure that the objectives of the Noxious Weeds legislation is not frustrated by charging excessive fees, it is proposed that some of these charges be regulated.

This will not include "private works" but may include such things as inspection costs and administrative costs.

Aquatic Weed Management - Aquatic weeds are amongst the most devastating and difficult to manage noxious weeds in the state. The present legislation places the obligation for control of these weeds on the landholder who owns or adjoins the waterway. In addition, the current Act, while allowing a LCA to exempt landholders from these responsibilities in certain circumstances, does not then transfer the obligation to control to another party.

The legislation will continue to allow this exemption but the LCA will then be required to control the weed.

The nature of these plants, in particular floating aquatic weeds, makes control by the landholder difficult and can be inequitable in some circumstances. Floating weeds are moved by wind, tides and stream flow and cannot always be determined as any particular person's responsibilities.

The proposal will also allow the Minister to make such an exemption for control of floating aquatic weeds, in particular circumstances, by specifying the species, situation and control responsibilities in the Weed Control Order.

Remembering that any such Weed Control Order will be subject to public scrutiny and input. Such orders may be put in place where another organisation, other than the local control authority, for example a water management authority, accepts legal control.

Procedures for serving of Weed Control Notices. - The Bill makes changes to the procedures for serving of Weed Control Notices in the interest of efficiency, and procedural fairness.

LCA's will be required to give the land manager prior notice of the intent to serve a Weed Control Notice.

This change also includes mechanisms for the land manager to appeal to the local control authority. At present, the only appeal mechanism available under the Act is through the Land & Environment Court. This is a drawn out process that can be expensive for both parties.

Other Changes

Other proposals in the Bill include changes of a minor nature to bring existing sections into line with the changes made by the Bill. These changes include:

Changes to some provisions to include “owner” as well as “occupier” to cover the changes in responsibility.

Changes to include listing the persons who may sign a Certificate of Authority (authorising an Inspector or Authorised Officer) to specify these in the Act rather than by a regulation.

Changes to the notification of intent to enter a property from a particular day to a day or period of days.

It is interesting to note that, apart from some seven (7) amendments proposed by the Greens and the Outdoor recreation Party, the Bill passed through both houses unopposed. Only one of these amendments were agreed to.

The Bill has been checked against the nine (9) “Core Principles of State and Territory Weeds Legislation” listed by the Australian Weeds Committee as being necessary to ensure a consistent approach to weed management across Australia. It is consistent with virtually all of these.

This legislation is also strongly similar to the model proposed in the discussion paper by Andreas Glanznig “Making State Weed Laws Work” (WWF- Australia 2005).

The NSW amendments to its weeds law pre-date both of these papers.

CONCLUSION

Although not perfect, the amended legislation positions NSW to take the next step towards a truly effective, flexible and pro-active weed management system.

The new Objects of the Act clearly set the priorities and direction for weed management into the future.

- Prevent
- Restrict
- Reduce
- Monitor

The changes allow each weed to be treated on the basis of it impact, real or potential, rather than simply reacting to an invasion. We are now able to declare plants at levels that were not available beforehand and prohibit potential weed entry into NSW, either in trade or as contaminants.

We can declare weeds confident that the community has been informed had the opportunity to have their say. Tis will increase awareness and support for our weed programs.

The legislation recognises our obligation to protect other jurisdictions from invasion pathways over which we have control.

The amendments are workable and, if necessary, enforceable and will achieve improved weed management in NSW.

References

Bates, G.M. (1982), *Environmental Law in Australia*, Butterworths, Sydney Australia.

Bates, G.M. (1995), *Environmental Law in Australia 4th Edn*. Butterworths, Sydney Australia.

Blackstone, W (1765 - 1769), "*Commentaries on the Laws of England*", Series. Clarendon Press, Oxford

Dickens, C (1838) "*Oliver Twist*" Online at http://www. etext.library.adelaide.edu.au/d/dickens/charles/d54ot/index.html. accessed 28 July 2005

Glanznig, A. (2005) "*Making State Weed Laws Work*" WWF-Australia Issues Paper. WWF-Australia, Sydney.

NSW Government Review Group (1998) "*Review of the Noxious Weeds Act 1993 – Final Report*" NSW Department of Primary Industries. Orange.

Review Process.

APPENDIX 1

TERMS OF REFERENCE
REVIEW OF THE *NOXIOUS WEEDS ACT 1993*

1. The review of the *Noxious Weeds Act 1993* shall be conducted in accordance with the principles for legislation reviews set out in the Competition Principles Agreement. The guiding principle of the review is that legislation should not restrict competition unless it can be demonstrated that:

(a) the benefits of the restriction to the community as a whole outweigh the costs;
(b) the objectives of the legislation can only be achieved by restricting competition.

2. Without limiting the scope of the review, the review is to:
(a) clarify the objectives of the legislation, and their continuing appropriateness;
(b) identify the nature of the restrictive effects on competition;
(c) analyse the likely effect of any identified restriction on competition on the economy generally;
(d) assess and balance the costs and benefits of the restrictions identified, and
(e) consider feasible alterative means for achieving the same result, including non-legislative approaches.

3. When considering the matters in (2), the review should also:
(a) identify any issues of market failure which need to be, or are being addressed by the legislation, and
(b) consider whether the effects of the legislation contravene the competitive conduct rules in Part IV of the *Trade Practices Act 1974* (Cwth) and the NSW Competition Code.

4. The review shall consider and take account of relevant regulatory schemes in other Australian jurisdictions, and any recent reforms or reform proposals, including those relating to competition policy in those jurisdictions.

5. The review shall consult with and take submissions from farmers, Local Government, the Rural Lands Protection Boards, National Parks and Wildlife Service and other interested parties.

6. The Review Group will report to the Minister for Agriculture by 30 September 1998.

(source: *Review Of Noxious Weeds Act 1993 Final Report, NSW Government Review Group October 1998)*

APPENDIX 2

SUMMARY OF RECOMMENDATIONS
REVIEW OF THE *NOXIOUS WEEDS ACT 1993*

Proposed objectives for an Act to replace the *Noxious Weeds Act 1993*

1. To reduce the negative impact of weeds on the economy, community, industries and environment of NSW, in accordance with the principles of ecologically sustainable development, by the use of mechanisms to:
   - prevent the establishment in NSW of any significant new weeds;
   - restrict the spread in NSW of significant weeds that are already present but not widespread;
   - reduce the area of significant weeds with limited distributions where this is economically and ecologically feasible; and
   - facilitate community programs to reduce the impact of widespread weeds.

2. To increase public participation in weed management.

3. To ensure the community has access to relevant and meaningful information about weeds.

4. To ensure coordination of weed management by Government agencies, public authorities and private landholders.

4. To monitor and report on the effectiveness of weed management in NSW.
5.

Requirement to control noxious weeds

- The ability to impose requirements on occupiers or owners of land to control specified noxious weeds should be maintained, as it is the cornerstone of enforcing noxious weed control.
- The processes for community consultation and involvement should be strengthened to ensure that declarations address community priorities and have wide community support.
- In developing future noxious weed management plans, the potential effects on competition should be taken into account and these plans should also include communication and education activities.
- All declarations should have a ‘sunset clause’ and be routinely reviewed.

Restrictions on sale of noxious weeds

- The ability to impose restrictions on sale of noxious weeds should be maintained.
- There should be prior consultation with representative industry bodies, such as NIAN and PIJAC, so that exceptions can be made for those cultivars that would not compromise the weed control objectives.
- Adequate warning of new declarations must be given to ensure that any economic effects on plant nurseries or pet shops are minimised.

Restrictions on movement of material containing notifiable noxious weeds

- The ability to impose restrictions on the movement of soil, turf or other materials and products potentially contaminated by noxious weeds should be maintained.
- These restrictions should only be imposed as part of a management plan as described in chapter 6.

- The management plans should include strategies to ensure that relevant businesses and sections of the community are aware of their obligations.

Regarding the requirement for agricultural machinery to be cleaned and inspected at the Queensland border

- The requirement for agricultural machinery to be cleaned and inspected at the Queensland border should be maintained.

Quarantine powers

- There should be an ability to impose quarantine restrictions as part of a weed management plan where activities can be focussed on key pathways by which the weed may be introduced.

Supply of materials, equipment and services by local control authorities

- Section 37 should be deleted as it duplicates powers present in other legislation and the objective of the Act is not to regulate businesses.

Monitoring and reporting

- Requirements for monitoring the distribution and severity of noxious weed infestations should be included in the Act.
- Local control authorities should be required to provide information annually to NSW Agriculture on the distribution and severity of noxious weed infestations.
- NSW Agriculture should be required to collate this information into a database that is available to the public.
- NSW Agriculture must provide an annual report to Parliament, detailing outcomes achieved for noxious weed control and expenditure from the noxious weeds grant.
- To simplify reporting, these proposed requirements should be linked with State-of-Environment reporting.

Declaration process

That the current system, where obligations are specified in declaration categories, be replaced by a system where obligations are defined in management plans that have been approved by the Minister.

- That the process for developing these plans allows for extensive community involvement.
- That plans be subject to a public benefit test before they are approved by the Minister and have regard to the Competition Principles Agreement.
- That the plans must include quantifiable outcomes and be for a fixed period of not more than five years with a review of the outcomes before another plan is approved.
- That a plant that is a local native species may not be declared to be a noxious weed without approval of the Regional Vegetation Management Committee where such a committee exists.

Declaration of weeds that may cause health problems

That plants not be declared noxious solely because of their potential health effects.

Minister's powers

- That the Minister be able to make grants to enable the contracting of essential research identified in management plans for specific weeds.
- A more effective process for enforcing control by public authorities and local control authorities, that is perceived to be independent, needs to be developed.

Organisation responsible for enforcement

- Responsibility for enforcement of noxious weed control should stay with Local Government.
- Cooperation should be encouraged between councils and Rural Lands Protection Boards.

This recommendation was not accepted by the representative of the Rural Lands Protection Boards and reasons for this dissenting opinion are included in appendix G.

Who is responsible for carrying out noxious weed control?

- The owner should be responsible for noxious weed control.

(source: Review Of Noxious Weeds Act 1993 Final Report, NSW Government Review Group October 1998)

RECOMMENDATION 14 Weed control by public authorities (6.8)

- Public authorities should have the same requirement to control noxious weeds as private landholders and should be required to participate in the development of regional and local weed management plans.

RECOMMENDATION 15 Property Inspections (6.9)

- The requirement to give notice be modified to 'a day or days specified in the notice'.

RECOMMENDATION 16 Appeals against notices to control noxious weeds (6.10)

- The weed control program should continue while the appeal is heard, with compensation being awarded if the appeal is successful.

RECOMMENDATION 17 Advisory Committees (6.11)

- The role of Noxious Weeds Advisory Committee should be defined then membership reconsidered.

RECOMMENDATION 18 Interactions with other legislation - *Seeds Act* (6.12)

- The relationship between the *Seeds Act 1982* and *Noxious Weeds Act 1993* will need to be considered when the final report from the review of the *Seeds Act 1982* is available.

RECOMMENDATION 19 Interactions with other legislation - precedence (6.13)

- The *Noxious Weeds Act* should have precedence.
- Cognisance of the objectives of other Acts should be taken during the implementation of the Noxious Weeds Act.

Biography

Commenced in Noxious Weed and Pest Animal management in 1984 with the then Victorian Department of Crown Lands & Survey.

Since then has held a number of positions in the various restructured Victorian Departments mainly in pests & weeds but also including work in plantation forestry, soil conservation, landcare, public land management, National Parks and so on.

Undertook a project position as Manager- Pests & Stockroutes Compliance Project. with the Queensland Department of Natural Resources and Mines. Developing compliance policy, operations manuals and enforcement training.

.....
Current position - State Coordinator, Weeds NSW Department of Primary Industries
Biosecurity Compliance & Mines Safety, Emergency & Strategic Response Division.....
Responsible for implementation of legislation, strategic planning and noxious weeds policy.

Author details
Name: **Sydney Lisle** .....
Organisation: **NSW Department of Primary Industries** .....
Address: **161 Kite Street (Locked bag 21) ORANGE NSW 2800** .....
Phone:**02-63913187** ..... Fax **02-63913508** .....
Mobile: **0427800162**.....
Email: **sydney.lisle@dpi.nsw.gov.au** .....

Why Declare?

The role of government in weed management

Philip Blackmore
Noxious Plants Advisory Officer
NSW Department of Primary Industries
Armidale

Abstract

Noxious weeds were created by statute in NSW in 1906 as a method to deal with external costs created by weed spread. Legislation was imposed when the common law was found not to apply. This approach is inherently a tax on landholders as it may require control of weeds that might not otherwise be controlled. Consequently, weed declarations should only be made that maximise public benefit. Typically, these will be weeds that are not common but have potential to spread and to cause harm. Many existing declarations do not meet this condition. Weed declaration is a politico-legal process but to assist the Minister in making declarations, a technical test is applied to proposed candidates. The test measures six different aspects relating to weed spread and weed control. The application of the precautionary principle to interpreting test results and review of the current status of widespread noxious weeds could improve the outcomes of noxious weed programs.

INTRODUCTION

Management of noxious weeds are significant state and local government programs in New South Wales (NSW). In 2004-5 the Minister for Primary Industries allocated $7.38 million to support local government noxious weed programs (NSW Government, 2005). This amount must be at least matched by local councils (local control authorities). The amount spent by private landholders controlling noxious weeds is not known. Noxious weed legislation imposes an obligation on occupiers of land to control declared weeds on that land. Consequently, when a weed is declared noxious, an infringement of personal liberty is imposed on occupiers of land where that weed occurs. Any proposal to declare a weed noxious must establish that this loss is justified by a corresponding benefit to the community (Smith, 1987). An examination of harm caused by weed spread and potential remedies to this harm will help to justify the concept of noxious weeds. It will also explain circumstances in which weed declaration is beneficial and where it is redundant.

THE TROUBLE WITH WEED SPREAD

The harm caused by weeds

A weed may cause harm to agricultural industries through competition, direct injury or obstruction. It may harm the environment by causing biodiversity loss or loss of amenity. It could damage human health or simply look unsightly. A weed may also cause any combination of these problems. (Sindel, 2000). However, undesirable features of weeds are not in themselves justification for noxious weed declaration. A weed may be poisonous or its seeds cause wool fault but in the absence of livestock, the weed is unlikely to have a significant impact unless it spreads to new areas. Even if it should spread, harmful features do not ensure success of a species that has been introduced to a new location.

Pheloung (1994) described a range of characteristics that weeds may possess. Successful weeds are likely to have a combination of these characteristics:

i. reproduction — the plant may produce viable propagules, be self-fertile, hybridise naturally, seed prolifically or have a short generative period.

ii. competitive advantage and persistence — the plant may have broad climatic suitability, be drought tolerant, allelopathic, grow on infertile soils, be a climber, a grass or a nitrogen fixing shrub, be tolerant of shade, form dense thickets, tolerate fire or form a persistent seed bank.

The first group of biological attributes relates directly to weed spread from an existing location to a new location, while the second group relates to weed establishment and persistence at all locations. Together they equate to weed potential. That is, the potential of a weed to spread from an existing location to a new location and to establish in the new area.

Weed spread defined

Spread of a weed species is the occupation of new areas. (Auld *et al.*, 1978/9). This definition may be refined to "the movement and subsequent establishment of a weed species in new management areas" (Michael Michelmore, pers. comm.). Weed spread is the creation of new infestations in previously uninfested areas, not infilling or increase in density of an existing localised infestation.

Weed dispersal

The propagules of a weed must be dispersed in order for the weed to spread. Panetta and Scanlan (1995) analysed the modes of dispersal for the 233 non-native noxious weeds described in Parsons and Cuthbertson (1992). Three distinct categories of dispersal were observed:

i. physical (seeds moved by wind and / or water),
ii. wild and feral animals, (including birds),
iii. human (including movement on vehicles and machinery, as contaminants of plant products and movement by domestic animals).

Weed species may be dispersed by one or any combination of these modes. However, when weed dispersal is largely through human agency, seeds are generally moved further and in larger numbers than by other vectors, creating secondary infestations at greater distances from primary infestations and leading to the form of spread known as jump dispersal (Panetta and Scanlan, 1995). Species that can be dispersed in this manner tend to spread at a faster rate than species being dispersed from one location (Auld *et al.*, 1978/9; Moody and Mack, 1988; Wilson and Lee, 1989).

ECONOMICS OF WEED SPREAD & POTENTIAL FREE MARKET REMEDIES

Externalities

In a wholly free market economy, the control of weeds by landholders is a decision for the market, where individual landholders decide the optimum level of weed control for their use of the land (Menz and Auld, 1977). However, when a landholder is adversely affected by weeds spreading from neighbouring land, that do not otherwise occur on his own land, an external cost is caused to the landholder. Externalities are side effects on third parties, caused by the undertaking of an activity by an individual, not taken into consideration by that individual (Menz and Auld, 1977; Pannell, 1994; Jones, 2000).

Externalities can occur as both costs and benefits. For example, a landholder buys some hay to feed livestock. The hay introduces a new weed to his property. Over time, the weed establishes and begins to spread to neighbouring properties. The neighbouring landholders experience an external cost due to the spreading weed. These landholders did not introduce the weed and received no benefit from the hay, yet they suffer the harm caused by the weed and bear the cost of its control. Conversely, should the landholder control the new weed incursion before it begins to spread, the neighbours will receive an external benefit, as they will not compensate the landholder for carrying out the control work.

Can the market control weed spread?

In a free market economy, a landholder cannot be forced, other than by moral suasion, to control weeds spreading from his land. In such circumstances, an affected neighbour must either buy the infested land and impose a personally acceptable level of weed control to that land or control the weeds as they emerge on his own land. Ultimately, the landholder with spreading weeds may be forced out of business by associated poor farm management and the neighbour can then buy the run-down property at a discount and control the weeds himself.

The failings of the market as a solution to weed spread are obvious. In the direct purchase option, the neighbour may not be able to afford to buy the affected land and the landholder may not wish to sell. If the neighbour's gambit is to wait for the landholder to become insolvent, the process may take so long that the neighbour's own financial position could be adversely affected by the spreading weeds and prevent the purchase. If the neighbour chooses simply to control the weeds as they spread to his property, he has a control cost in perpetuity that is not of his own making. That is, an external cost.

Externalities and lack of information (about effective control measures), are examples of market failure (Menz and Auld, 1977; Pannell, 1994; Jones, 2000). Market failure occurs when outcomes of the competitive market do not properly allocate resources and maximise economic efficiency. Market failure may justify government intervention (Jones, 2000).

Can the common law control weed spread?

In NSW prior to 1906, liability for weed control on private property was in the realm of the common law, governed by the maxim *Sic utere tuo ut alienum non laedus*, which is taken to mean "you must use your own land (or goods) in such a way as to not injure another" (Menz and Auld, 1977). However, in 1890 an English case, *Giles v Walker* (the thistledown case), tested this maxim in relation to the spread of weeds from one property to another. The Lord Chief Justice stated that "there can be no duty as between adjoining occupiers to cut thistles, which are the natural growth of the soil" (Gardner, 1998).

The High Court of Australia, in *Sparke v Osborne* (1908) 7 CLR 51, in an extension of *Giles v Walker*, found that "a person was liable for damage caused by weeds only if the weed growth was encouraged by the intervention of his human act. Normal farming operations did not constitute such intervention" (Menz and Auld, 1977; Gardner, 1998).

However, in 1932 the common law in relation to the duty of occupiers to abate a nuisance arising from things naturally on land was reviewed by Goodhart (1932, cited in Gardner, 1998) who concluded that "the correct principle seems to be that an occupier of land is liable for a nuisance of which he knows or ought to know, whether that nuisance is caused by himself, his predecessor in title, a third person or by nature." This was a return to the maxim *Sic utere tuo ut alienum non laedus*, that had previously been rejected by the courts in relation to weed spread.

This opinion was endorsed by the High Court of Australia in *Hargrave v Goldman* (1963) 110 CLR 40 (HC) and the Privy Council (1966) 115 CLR 458 (PC). However the Privy Council qualified the duty of an individual to the extent that "what it is reasonable to expect of him in the circumstances" in both a physical and financial sense. A reciprocal duty was also imposed on neighbours to take similar reasonable steps to protect their own interests. This duty might include creation of a barrier or buffer zone or providing financial assistance to carry out works on the neighbours land. This is the common law as it is applied today (Gardner, 1998). Although the duty of landholders at common law to prevent the spread of weeds to neighbouring land has developed considerably since *Sparke v Osborne* in 1908, the common law still does not provide an unrestricted remedy to individuals harmed by weeds spreading to their property from neighbouring property. At best, a landholder has only a qualified remedy at common law to the nuisance of weeds spreading from neighbouring land.

COMMUNITY EXPECTATIONS OF GOVERNMENT IN WEED MANAGEMENT

As both market and common law fail to prevent weed spread, the only socially acceptable solution is a form of government intervention (Menz and Auld, 1977; Pannell, 1994; Jones, 2000). The usual form of government intervention is noxious weed legislation that imposes a duty on occupiers to prevent spread of particular weed species from their land to adjoining land. The faster the rate of spread, the greater is the rationale for early government intervention. The community expects such legislation to be enforced.

Governments may also fund research to find better means of control and extension to overcome lack of information of both the means and benefits of weed management. However, extension alone cannot address the problem of weed spread where a landholder has no interest in controlling the weeds.

The legal concept of noxious weeds was first introduced to Australia in 1852 by the then province of South Australia. The legislation, “an Act for preventing the further spread of the Scotch Thistle”, commonly known as the Thistle Act, was instituted due to the perceived loss of pasture caused by the spread of an introduced thistle species (Parsons and Cuthbertson, 1992). Similar legislation was soon enacted in Victoria. 1856 saw “an Act to make provision for the eradication of certain thistle plants and the Bathurst Burr” (19 Vict. No.14) (Parsons, 1973). This legislation is remarkably similar, both in intent and approach to the current noxious weed legislation in NSW. Noxious weed legislation was introduced in New South Wales as a section (Section 45) of the Local Government Extension Act 1906.

In NSW noxious weeds are administered through and subject to, the Noxious Weeds Act (1993). This relatively recent piece of legislation empowers the Minister to declare weeds without reference to technical advice. This means that noxious weeds may be seen largely as a politico-legal concept. This may suit many members of the community to whom the technical aspects of noxious weed declarations are frequently unknown and who often confuse “noxious” with “obnoxious” (Smith, 1987).

Noxious weeds legislation imposes external costs on landholders by requiring control of weeds they might not otherwise choose to control. One persons weed is often another person’s valued plant, or at least a plant of no consequence. This makes noxious weeds legislation in effect a tax on affected landholders, which should not be used without good reason.

Arguments against the noxious weed concept

Prior to 1993, the Local Government Act 1919, required landholders to take reasonable and effective measures to eradicate noxious weeds from their land. Moore (1975) considered that such legislation had failed, as it had been unsuccessful in almost all cases of achieving its objective of eradication of a weed species. The opinion was expressed that noxious weeds had become a self sustaining industry! Moore (1971) had earlier called for governments to abandon noxious weeds legislation as it had been an implicit failure in his opinion. Menz and Auld (1977) also expressed doubts about the community benefit of noxious weed legislation, particularly in relation to widespread weeds.

Amor and Twentyman (1974) called into question the value of programs of enforced weed control. They thought that some conspicuous species had been declared apparently for no other reason, suggesting that weed declarations were more influenced by a perceived political need to be seen to doing something, rather than with any real achievement.

These negative perceptions of the value of noxious weed legislation and its observed failures to eradicate or even contain noxious weeds were challenged by Panetta and Scanlan (1995) who considered that little effort had been made by the critics to assess the potential benefits from reducing the rate of spread of an invading species, as opposed to the largely unrealistic goal of eradication.

WHAT DEFINES "NOXIOUSNESS"?

To ensure maximum public benefit from a weed declaration, candidates for declaration must be subject to uniform assessment. This assessment will become a definition of weed noxiousness. Any such test must take into account a range of factors. The primary factors are those that cause external costs. These are weed spread and how spread may be prevented.

Tests for weed potential

Some level of prediction is needed as to which species are likely to spread, before it happens, if government intervention is to be effective. But there are no genetic, physiological or ecological characteristics that enable weediness to be predicted with certainty. That is, the potential of a particular taxon to naturalise and to spread (Panetta, 1993; Williamson and Fitter, 1996; Scott, 2000; Mack *et al.*, 2000).

However, species with a broadly defined range of weedy characteristics can be recognised (Hobbs and Humphries, 1995; Rejmánek, 2001). Biological pointers to weediness in some species within a genus have been identified (Rejmánek and Richardson, 1996). Yet, the most reliable basis for predicting weediness in a species is weedy behaviour of that species in a similar climate either in Australia or overseas (Hazard, 1988; Panetta, 1993). This is the method generally used to determine weed potential in a species being proposed for declaration in NSW. However, some species may not be particularly weedy in their home range but become weedier in a new situation (Parsons and Cuthbertson, 1992).

To balance these contradictions when developing a more effective screening test for proposed plant introductions to Australia, a range of biological attributes have been identified that, in combination, suggest that a plant species or variety may be likely to demonstrate weedy behaviour (Panetta *et al.*, 1994, cited in Pheloung, 2001). These attributes are now used in the Australian Quarantine and Inspection Service weed risk assessment for proposed plant imports. The same test may have value in helping to determine candidates for noxious weed declaration, in particular, sleeper weeds.

Sleeper weeds

Sleeper weeds may be defined as invasive plants that have naturalised in a region but not yet increased their population size exponentially (Groves, 2000). The initial phase of slow spread is often termed the lag phase and can last 70-100 years (Hobbs and Humphries, 1995). This lag phase is characteristic of sleeper weeds. It has frequently been observed that the area invaded by a weed increases slowly at first, then apparently the weed becomes widespread as represented in figure 1, at which time it is recognised as a problem. However if is difficult to determine whether the initial spread represents a lag phase of a two phased pattern of expansion or whether the expansion is exponential, that is, with a constant proportional rate of increase (Cousens and Mortimer, 1995; Mack *et al.*, 2000). A two phased invasion might be caused by an environmental event, such as a drought or a particularly wet series of seasons.

Grice and Ainsworth (2003) argue that sleeper weeds are not merely naturalised alien species in a lag phase of population growth but can be assigned to one of six general categories that relate to either the characteristics of the species, the environment in which the species has naturalised or to perceptions of the observer.

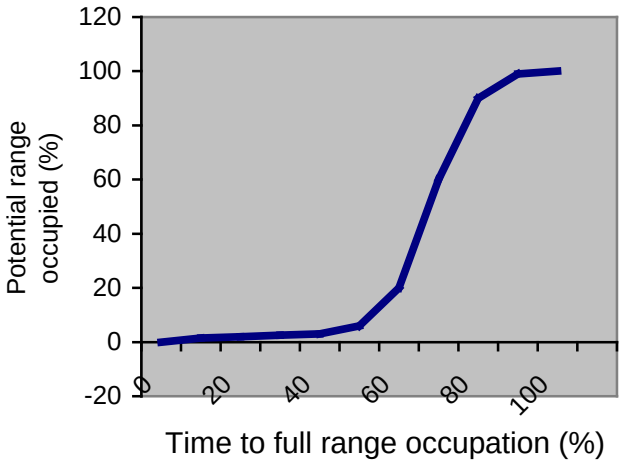


Figure 1. A stylized representation of the spread of a weed species over time (Hobbs and Humphries, 1995).

The importance of sleeper weeds is that they do not necessarily fit in the commonly applied test for weed potential used in NSW, that the weed has demonstrated weediness either overseas or in other parts of Australia or NSW. Thus a sleeper weed may be spreading widely but at a slow rate and so is not identified as a candidate for declaration until government intervention has little chance of stopping further spread.

Harmful characteristics of weeds

Harmful characteristics of weeds can be divided into two groups:

i.	directly harmful	spines, burrs, poisonous, allergy causing, obstruct harvesting, harbour pests or diseases
ii.	competitive features	fast growing, deep rooted, large leaf area, reproductively fecund, allelopathic and shade tolerant

The first group of characteristics may be seen as being inherently undesirable while the second group aids persistence. Many weed species can cause harm by the expression of features from both groups but some species may have features from only one group, for example, tiger pear in the first group and Coolatai grass from the second. However, many desirable species, particularly pasture plants and annual crops, also have features from the second group (eg annual ryegrass) or both groups (eg grain sorghum and phalaris). Such species may cause harm in some situations.

The greatest challenge for assessing declaration proposals is predicting if a species will cause harm (Panetta *et al.*, 2001). Weeds in the first group of harmful characteristics are easily identified but weeds that are solely in the second group may not be identified sufficiently early for regulated control to be of value.

Weed distribution

The potential for effective use of noxious weeds legislation is greatest during the earliest stages of weed invasion. A weed that has spread across most of its potential range should not be declared noxious and such a weed if declared should be removed from the list. Enforcement against such weed species consumes scarce resources that might be used more effectively to reduce rates of spread of recent invaders or to exclude potential invaders (Amor and Twentyman, 1974; Moore, 1975; Panetta and Scanlan, 1995; Hobbs and Humphries, 1995; Carter, 2000, Panetta and Timmins, 2004).

In figure 2, Hobbs and Humphries (1995) demonstrate graphically the advantages to society of intervening at an early stage of weed invasion, compared with waiting until the weed is widespread.

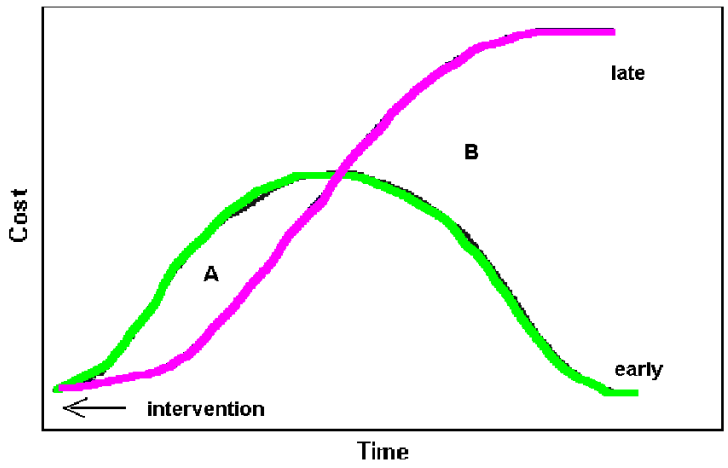


Figure 2. **Total social cost of a plant invasion (incorporating the costs of damage due to the invasion and the costs of control) in relation to the timing of intervention (early v. late). Costs of early expenditure (area A) and the resulting benefit (area B) are shown (Hobbs and Humphries, 1995).**

Carter (2000) considered that enforced control programs for widespread weeds could be anti-competitive and inefficient because the legislation assumes that the controlling authority makes better decisions about weed control and land management than individual landholders. Hobbs and Humphries (1995) qualified the argument against using government intervention for widespread weeds to the extent that species that are currently not abundant but that are present in many locations should also receive priority attention. This priority would apply only if the species was easy to locate in the field (John Hosking, pers. comm.).

In figure 3, Carter (2000) demonstrated the difficulties of determining the stage of a weed invasion. At any one point in time it can be difficult to know if the invasion is at stage (a), (b) or (c). This suggests that intervention should ideally take place as soon as a weed has been observed to have naturalised.

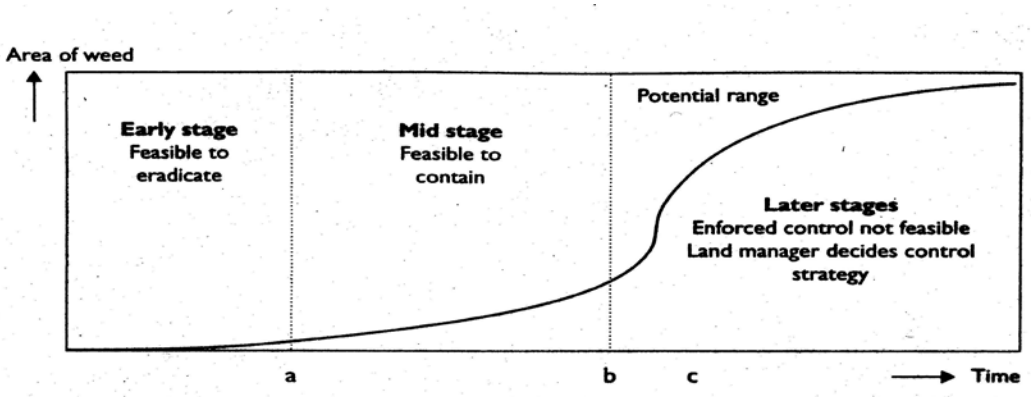


Figure 3. **A typical expansion curve for a weed species up to the limit of its potential range (Carter, 2000).**

The distribution of a species is best determined by a survey and mapping program, although such a program is only a means to an end, not an end in itself.

Realistic Control Measures

Administration of noxious weeds is ultimately a regulatory process. Consequently, any private landholder who is required to control a noxious weed must have available a reasonable method of achieving control or enforcement will fail in the courts.

The local control authority must also implement an effective and realistic weed management program to maintain public confidence and support for continued declaration of a weed. A properly resourced management plan developed by the local control authority with achievable objectives and realistic milestones will demonstrate the intent of the authority (Panetta and Scanlan, 1995; Carter, 2000). Actions of the plan will depend on the intended outcome. The greater the rate of spread of a weed species, the more aggressive the control response needs to be to economically suppress the infestation (Menz *et al.*, 1980-81). However, Panetta and Scanlan (1995), suggest that, given all noxious weed programs operate within limited budgets, the decision to declare a species should be coupled with a decision to remove another from the list of declarations.

Two types of control program are available to local control authorities:

i) eradication

Moore (1975) considered eradication to be an unrealistic objective. Carter (2000) considered that an eradication program was only likely to be effective if:

- the weed occupies a small area, that cannot be reinvaded from adjoining areas;
- All of the infested area is known;
- the weed is easy to find at low density;
- the control method kills all plants before maturity;
- a long lived seed bank is not established or if a small seed bank has been created, recruitments from the seed bank can be destroyed before they set seed;
- if the plant has produced seeds they have not been dispersed; and
- the budget allows initial treatment, regular surveys and control for several years.

Consequently, eradication should only be considered an option where the weed incursion meets these conditions. An example is outbreaks of Parthenium weed in NSW on farms, commercial premises and roadsides.

ii) containment

Although eradication is often the stated goal of weeds declared noxious, prevention of spread is often the operational goal (Menz *et al.*, 1980-81). Successful containment depends more on commitment and continuing diligence than on the effectiveness of specific tools (Mack *et al.*, 2000). Moore (1975), however, considered that once a weed had become naturalised at a number of locations for several years, even at low levels of infestation, attempts at containment were futile as such a weed would eventually spread to the limits of its range. This is an unduly pessimistic attitude that fails to appreciate benefits of slowing the rate of spread.

Weed management programs that aim to solely restrict spread of a weed population (i.e. containment) by controlling light infestations only and ignoring medium and heavy infestations in an infested area are the most expensive, particularly where there is a high rate of spread from the heavily infested area. This method of containment is expensive as it requires control work in perpetuity. Containment programs must also aim to suppress seed production in medium and heavily infested areas (Menz *et al.*, 1980-81; Auld *et al.*, 1987).

However, Moody and Mack (1988) demonstrated that eradicating newly established satellite infestations will more effectively contain a spreading weed population than by only controlling the main focus of infestation. Therefore, it is apparent that formation of new satellite

infestations should be minimised in any containment program. This can only be achieved if seed dispersal from the main focus is controlled (Panetta and Scanlan, 1995).

Containment and seed dispersal

Noxious weed legislation could be expected to have most control over formation of secondary infestations when weeds are totally reliant on humans for their dispersal. Consequently, there must be a strong commitment to limiting seed dispersal, especially by human activity if government intervention is to be successful (Panetta and Scanlan, 1995). Conversely, legislation would be least effective at limiting spread of species spread mainly by natural forces or wild animals. However, while weed spread by birds and by wind cannot be regulated, landholders who are responsible for controlling weeds spread by birds or by wind can be.

Local control authorities are able to implement some actions that will limit seed dispersal, such as appropriate roadside management. Inspection and monitoring both public and private land are also an important part of any noxious weed program to ensure new incursions and satellite infestations are discovered and controlled and seed production at established infestations is minimised.

THE TEST FOR NOXIOUSNESS IN NSW

As recently as 1987 no published test for the assessment of proposed noxious weeds existed in NSW. (Smith, 1987). A list of guidelines was applied to weeds being proposed for declaration but these were not allowed to interfere with the political imperative (Peter Gray, pers. comm.). The current test was formally adopted as policy, NWAC Policy No.1 – Declaration of Weeds, by the Noxious Weeds Advisory Committee in 1995 (John Fisher, pers. comm.). This test was developed over time to deal with the challenge of market failure and to formalise assessment of weed declaration proposals. Candidates for declaration must meet all of the test criteria:

- Weed Potential — The weed must have the potential to spread and become established in the area, and
- Need — The weed has, or could have, serious adverse effects on agriculture, the environment or human health, and
- Means — There must be reasonable and enforceable means available to control the weed, and
- Intent — There must be a firm intention by the local control authority to implement a planned program to control the weed as categorised, and
- Distribution — The weed does not occur in NSW, or is of limited distribution and has the potential to become more widespread, and
- Benefit — A significant benefit to agriculture, the environment, or the community can be expected from the declaration

(Noxious Weeds Advisory Committee, 2002)

It should be noted that many weeds currently declared in NSW could not satisfy the limited distribution test.

Implementation of noxious weed legislation will consume increasingly scarce government resources. Therefore, it is necessary to ensure that species are declared noxious only when declaration can be expected to have a manifestly beneficial outcome (Panetta and Scanlan, 1995). This is fine sentiment which is spoilt by difficulty in establishing true public benefit. One persons weed may be another persons useful plant, be it an invasive pasture species, soil stabiliser or ornamental. In these cases government intervention should only take place where net benefits from controlling the weed are positive (Auld *et al.*, 1987).

The best public policy based on efficient use of public money will be that which maximises net social returns, that is, benefits in relation to costs (including costs of achieving compliance). However, social benefits arise only from reduction in risk of weed spread (Menz and Auld, 1977). This calls into question continued declaration of widespread weeds.

CONCLUSIONS

Noxious weeds as a statutory concept have existed in NSW for 99 years and much longer in South Australia and Victoria. Originally enacted to curb harmful effects associated with weed spread at a time when control options were limited, noxious weed legislation became socially necessary when the common law was found to provide no remedy for weed spread across property boundaries. Noxious weed legislation can continue to be relevant while ever weeds that cause an external cost to neighbours are targeted. These are mainly weeds that have the potential to cause harm but are not yet widespread. However, it is apparent that many weeds currently declared in NSW do not meet this proviso. These weeds have often been declared for many years and the community has become conditioned by publicity and tradition to regard them as undesirable (Amor and Twentyman, 1974). Critical review of the declared status of widespread noxious weeds is essential, a process that will be advanced by recent amendments to noxious weed legislation in NSW. However, the option of leaving management of invasive and harmful weeds to the market may not be socially acceptable.

The current test for weed declaration is predictive in nature but unfortunately not in application. Too often, local control authorities wait until a naturalised species is starting to invade and have an impact on agriculture or the environment before the species is proposed for declaration. By the time such species are declared they are often already too well established for government intervention to be of value. This may be due to the test providing insufficient guidance to local control authorities on predictors of weed spread. A test with prompts, such as the Weed Risk Assessment System (Pheloung, 1994) may be a useful adjunct to the Weed Potential criterion, especially when applied in conjunction with the existing criteria (Panetta *et al.*, 2001).

Intervention to control new infestations at the earliest possible stage is more likely to produce a successful outcome than waiting to see if the weed species does in reality cause problems (Moore, 1975; Hobbs and Humphries, 1995). Instead of waiting to see if new invaders cause harm, it may be of value to apply the precautionary principle to potentially invasive species. A modification of this principle, as expressed in the National Weed Strategy (Anon., 1999) might be “it is better to erroneously declare noxious a weed that might confer a net benefit than to erroneously fail to declare a weed that might confer a net burden to agriculture, the environment or to human health”.

REFERENCES

Amor, R.L. and Twentyman, J.D. (1974). Objectives of and objections to Australian noxious weed legislation. *Journal of the Australian Institute of Agricultural Science.* **40:** 194-203.

Anon. (1999). The national weeds strategy. 2nd edition. Commonwealth of Australia, Canberra.

Auld, B.A., Menz, K.M. and Monaghan, N.M. (1978/79). Dynamics of weed spread: implications for policies of public control. *Protection Ecology,* **1:** 141-8.

Auld, B.A., Menz, K.M. and Tisdell, C.A. (1987). *Weed Control Economics.* Academic Press, London.

Carter, R.J. (2000). Principles of regional weed management and quarantine. In *Australian Weed Management Systems,* ed. B.M. Sindel, pp 83-104. R.G. and F.J. Richardson, Melbourne.

Cousens, R. and Mortimer, M. (1995). *Dynamics of weed populations.* Cambridge University Press, Cambridge.

Gardner, A. (1998). The duty of care for sustainable land management. *The Australasian Journal of Natural Resources Law and Policy,* **5(1):** 29-63.

Goodhart, A.L. (1932). Liability for things naturally on the land. 4 *Cambridge Law Journal* 13.

Grice, A.C. and Ainsworth, N. (2003). Sleeper weeds – a useful concept? *Plant Protection Quarterly,* **18(1):** 35-9.

Groves, R.H. (2000). Sleeper weeds. *Proceedings of the Twelfth Australian Weeds Conference,* pp 632-6. Hobart, Tasmania. September 1999.

Hazard, W.H.L. (1988). Introducing, crop pasture and ornamental species into Australia – the riskof introducing new weeds. *Australian Plant Introduction Review,* **19:** 19-36.

Hobbs, R.J. and Humphries, S.E. (1995). An integrated approach to the ecology and management of plant invasions. *Conservation Biology,* **9(4):** 761-70.

Jones, R.E. (2000). The economics of weed control. In *Australian Weed Management Systems,* ed. B.M. Sindel, pp 267-83. R.G. and F.J. Richardson, Melbourne.

Mack, R.N., Simberloff, D., Lonsdale, W.M., Evans, H., Clout, M. and Bazzaz, F.A. (2000). Biotic invasions: causes, epidemiology, global consequences and control. *Ecological Applications,* **10(3):** 689-710.

Menz, K.M. and Auld, B.A. (1977). Galvanised burr, control and public policy towards weeds. *Search,* **8:** 281-7.

Menz, K.M., Coote, B.G. and Auld, B.A. (1980-81). Spatial aspects of weed control. *Agricultural Systems,* **6:** 67-75.

Moody, M.E. and Mack, R.N. (1988). Controlling the spread of plant invasions: the importanceof nascent foci. *Journal of Applied Ecology,* **25:** 1009-21.

Moore, R.M. (1971). Weeds and weed control in Australia. *Journal of the Australian Institute of Agricultural Science.* **37:** 181-91.

Moore, R.M. (1975). An ecologists concept of a noxious weed – plant outlaw? *Journal of the Australian Institute of Agricultural Science.* **41:** 119-21.

NSW Government (2005). Summary of noxious weeds grant paid 2004/2005. url *http://www.agric.nsw.gov.au/reader/weeds/grantspaid0405*

Noxious Weeds Advisory Committee (2002). Policy No. 1 - Policy on declaration of noxious weeds. url *http://www.agric.nsw.gov.au/reader/weeds-policy/policy1*

Panetta, F.D. (1993). A system of assessing proposed plant introductions for weed potential. *Plant Protection Quarterly,* **8(1):** 10-14.

Panetta, F.D., Mackey, A.P., Virtue, J.G. and Groves, R.H. (2001). Weed risk assessment: core issues and future directions. In *Weed Risk Assessment,* eds. R.H. Groves, F. D. Panetta and J.G. Virtue, pp 231-40. CSIRO Publishing, Collingwood, Australia.

Panetta, F.D., Pheloung, P.C., Lonsdale, M., Jacobs, S., Mulvaney, M., and Wright, W. (1994). Screening plants for weediness: a procedure for assessing species proposed for introduction into Australia. A report commissioned by the Australian Weeds Committee.

Panetta, F.D. and Scanlan, J.C. (1995). Human involvement in the spread of noxious weeds: what plants should be declared and when should control be enforced? *Plant Protection Quarterly,* **10(2):** 69-74.

Panetta, F.D. and Timmins, S.M. (2004). Evaluating the feasibility of eradication for terrestrial weed incursions. *Plant Protection Quarterly,* **19(1):** 5-11.

Pannell, D.J. (1994). Economic justifications for government involvement in weed management:, a catalogue of market failures. *Plant Protection Quarterly,* **9(4):** 131-7.

Parsons, W.T. (1973). *Noxious Weeds of Victoria,* Inkata Press, Melbourne, Australia.

Parsons, W.T. and Cuthbertson, E.G., (1992). *Noxious Weeds of Australia,* Inkata Press, Melbourne, Australia.

Pheloung, P.C. (1994). The weed risk assessment system. url *http://www.daff.gov.au* > *Biosecurity Australia > weed assessment of new plant imports.*

Pheloung, P.C. (2001). Weed risk assessments for plant introductions to Australia. In *Weed RiskAssessment,* eds. R.H. Groves, F. D. Panetta and J.G. Virtue, pp 83-92. CSIRO Publishing, Collingwood, Australia.

Rejmánek, M. (2001). What tools do we have to detect invasive plant species? In *Weed RiskAssessment,* eds. R.H. Groves, F. D. Panetta and J.G. Virtue, pp 3-9. CSIRO Publishing, Collingwood, Australia.

Rejmánek. M. and Richardson, D.M. (1996). What makes some plant species more invasive? *Ecology,* **77** 1655-61

Scott, J.K. (2000). Weed invasion, distribution and succession. In *Australian Weed Management Systems,* ed. B.M. Sindel, pp 83-104. R.G. and F.J. Richardson, Melbourne, Australia.

Sindel, B.M. (2000). Weeds and their impact. In *Australian Weed Management Systems,* ed. B.M. Sindel, pp 3-18. R.G. and F.J. Richardson, Melbourne, Australia.

Smith, L.W. (1987). The theory and practice of noxious weed declaration. *Proceedings of the Eighth Australian Weeds Conference,* pp 315-20. Sydney, NSW. September 1987.

Williamson, M. and Fitter, A. (1996). The varying success of invaders. *Ecology,* **77** 1661-6.

Wilson, J.B. and Lee, W.G. (1989). Infiltration invasion. *Functional Ecology,* **3** 379-82.

Biography
Philip Blackmore was educated at Hawkesbury Agricultural College and Charles Sturt University. He has worked for NSW DPI and its predecessors for 20 years. Philip has been an inspector at Glebe Island and Flemington Markets and transferred to Armidale to "oversee the orderly demise of the New England pome fruit industry". He has been Noxious Plants Advisory Officer at Armidale for 9 years.

Author Details
Name: Philip Blackmore
Organisation: NSW Dept of Primary Industries
Address: P O Box 991 Armidale 2350
Phone: 6776 5008
Fax 6772 8664
Mobile: 0427 311 824
Email: philip.blackmore@dpi.nsw.gov.au

Role of Councils and Councillors
Managing Noxious Weeds in NSW

Lloyd Kingham
Local Government Weed Management Facilitator
NSW Department of Primary Industries Wagga Wagga

The tiers of government and the process of making laws

- Australia has three tiers or levels of government.
    - The Federal Government looks after trade, telecommunications, currency and defence.
    - The State Government looks after health, schools, police and transport.
    - Local Government looks after libraries, waste disposal, planning and building approvals, parks and sports areas, and community services.
- After a State Election, the State Governor asks the party who has the majority in the lower house of parliament to form a government.
    - Leading Members of the majority party become Ministers, the chief Minister is called the Premier.
    - This group of Ministers (called the Ministry, Cabinet or Executive) are in charge of government departments and agencies.
- Parliament makes laws, Cabinet administers them.
- The review of the Noxious Weeds Act (1993) followed the normal process of a Bill through the Lower and Upper houses of Parliament.
    - Review and public consultation in 1997 and 1998
    - Bill introduced, read a first time, read a second time and debated before heading to a Parliamentary Committee for amendments. (November 2004)
    - After a 3rd reading the Bill is sent to the Upper House where the process is repeated. Any amendments suggested are passed as messages between the lower and upper house until both agree with the wording.
    - When the State Governor assents to the Bill it is called an Act. (1st June 2005)
    - The Act is due to commence 1st December 2005. Until this date, the existing Noxious Weeds Act 1993 is still in force.

The prescribed role of Local Government under the *Noxious Weeds Amendment Act 2005*

- The objectives of the *Noxious Weeds Amendment Act 2005* (the Act) agreed by Parliament are

  "a) to reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:
  (i) prevent establishment in this State of significant new weeds, and
  (ii) restrict the spread in this State of existing significant weeds, and
  (iii) reduce the area in this State of existing significant weeds and

  (b) to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State"
- The Noxious Weeds Act has subordinate legislation known as "statutory rules" or regulations, and are the tools which allow the Acts objectives to be achieved.

- The regulations cannot impose requirements on the community that are in excess of those imposed by the Act.
    - All regulations are made by the authority of an Act of Parliament, but do not need to be passed by Parliament.
    - However any Member may move a motion to disallow a regulation within 15 sitting days of it being tabled. (December 2005)
- NSW Department of Primary Industries is responsible for drawing up regulations and reviewing weed control orders.
- The organisations responsible for implementing the Act are termed “local control authorities”.
- Local control authorities are usually the local government for the area, or a purpose formed County Council.

Specific Sections of the Noxious Weeds Amendment Act 2005 referring to the roles of Local control authorities

“Section 36 Noxious weed control functions of local control authorities

A local control authority has the following noxious weed control functions in relation to the area for which it is the local control authority (the local area):

(a) responsibility for the control of noxious weeds by occupiers of land (other than public authorities or local control authorities),

(b) control of noxious weeds on land owned or occupied by the local control authority and on certain roads and watercourses, rivers or inland waters as provided by this Act,

(c) to ensure, so far as practicable, that owners and occupiers of land (other than public authorities or other local control authorities) carry out obligations to control noxious weeds imposed under this Act,

(d) to develop, implement, co-ordinate and review noxious weed control policies and noxious weed control programs,

(e) inspection of land within the local area in connection with its noxious weed control functions,

(f) to report, at the request of the Minister, on the carrying out of the local control authority’s functions under this Act,

(g) to co-operate with local control authorities of adjoining areas to control noxious weeds, where appropriate,

(h) any other functions that are conferred or imposed on the local control authority by or under this Act.

Section 37 Record keeping obligations of local control authorities

(1) A local control authority must monitor the presence of noxious weeds in its local area and keep records of the following matters:

(a) the presence and distribution of noxious weeds in the local area,

(b) the implementation of the authority’s weed control policy and weed control programs,

(c) any other matters prescribed by the regulations.

(2) A local control authority must, if required to do so by the Director-General, report to the Director-General on the presence and distribution of noxious weeds in the local area and on its weed control policy and weed control programs and their implementation.”

Notes about the Act which interest Councillors.

Funding

- It is the local control authority’s responsibility to ensure it provides adequate resources to allow it to discharge its functions under the Act.

- Funding may be made available to local control authorities to assist them to implement the Act, and to provide reports on the effectiveness of their weed management activities.
- Funding is mostly through a Noxious Weeds Grant, allocated by the Minister.
- The Noxious Weeds Grant is an annual Treasury allocation, which should be seen as an enhancement rather than an income stream assured by the Act.

Weed Declaration

- The Act doesn't differentiate between environmental weeds and weeds of agricultural production.
- Weeds are declared noxious if they are considered to be of such importance that the NSW Government has deemed it necessary to impose enforced control on the community.
- A weed may be declared noxious if its control provides a benefit to the community over and above the cost of implementing control programs.

Councillors role in Noxious Weeds Management

In your Shire

- It is the local control authority's responsibility to ensure it provides adequate resources to allow it to discharge its functions under the Act.
- Some Councils have introduced an environmental levy to help cover expenses imposed by the broader community for higher environmental standards.
- The legal mechanisms which allow Local Government employees to enforce the Act are written into the Act. Councillors have a major role in endorsing protocols and developing policies for the way in which Noxious Weeds management is carried out in their area.
    - Examples of actions which can be set out in Council endorsed protocols and policies include;
        - Fines using Self Enforced Infringement Notices,
        - Prosecutions to enforce weed control,
        - The promotion of Integrated Weed Management above annual spraying.
- Noxious Weed Reporting can also be useful when submitting State of the Environment Reports.
- Councillors can help promote the importance of controlling weeds declared in their area.
- Councillors can also ensure that their weeds staff attend ongoing approved training and professional development.
- Councillors can help promote the importance of competent Noxious Weeds Officers and help to get Industrial (Pay scale) Recognition of the job.

In your Region

- Regional Weeds Advisory Committees agree on regional priorities for Noxious Weed declarations and control, and may submit applications for funding. Councillors, State and Local Government Staff and other agencies sit on these committees.

In New South Wales

- The Noxious Weeds Advisory Committee (NWAC) advises the Minister for Primary Industries on all matters relating to significant weeds. Currently Local Government has 3 representatives on this committee.

- NWAC is a Ministerial Advisory Committee, made up of members who are Ministerial Appointments. The avenue for Councils and Councillors into NWAC is via their representative organisation, Local Government and Shires Association (LGSA). The LGSA must deal with NWAC through its representatives.

Summary

- Local Government plays a crucial role in controlling, monitoring and reporting on the extent of noxious weeds in NSW each year.
- Councillors can get involved in weed control from ensuring their weed officers are supported by Council endorsed protocols, right through to representing the Local Government and Shires Association on the Minister appointed Noxious Weeds Advisory Committee.

ACKNOWLEDGEMENTS
Special thanks to the NSW Department of Primary Industries Weeds Unit who helped me with constructive comments during the preparation of this paper, especially Richard Carter, Syd Lisle, and Stephen Johnson. Thanks also must go to the Mayors, General Managers and Weeds Officers of the 75 Councils I have met this year, for showing me the many ways that the work can be done.

REFERENCES

Burton, J. and McCaffery, A. (2004). “Noxious Weed Handbook for Councils and Councillors”. NSW Department of Primary Industries.

Noxious Weeds Act 1993 (NSW)

Noxious Weeds Amendment Bill 2005 (NSW) Viewed 5th August 2005 <www.parliament.nsw.gov.au/prod/parlment/NSWBills.nsf/0/2A6E4941AA1A8732CA256F47002EDF48>

Parliament of New South Wales, Parliament of NSW. Viewed 1st August 2005 <www.parliament.nsw.gov.au/prod/web/common.nsf/key/ResourcesSystem>

The discovery of Mexican Feather Grass (*Nassella tenuissima*) in Tamworth, New South Wales, Australia.

Natasha Soar
Project Officer, Horticulture
Tamworth Regional Council, P.O. Box 555, Tamworth 2340.

Abstract

The confirmed existence of Mexican feather grass in the northwest slopes and plains region of NSW is cause for concern and continued vigilance. The ability of this plant to infiltrate suburban backyards has been underestimated, and has occurred through the avenue of a landscaping business.

Being geographically located near the New England region, the awareness of the damage caused by serrated tussock (*Nassella trichotoma*) is obvious; however, Mexican feather grass has the potential to invade a far greater range of land.

This possible invasion could impact on the environment in a variety of ways;

- Firstly, the ability to modify natural ecosystems and alter flora and faunal habitats resulting in decreased biodiversity.
- Secondly, weeds can easily spread to private lands, reducing grazing and production rationalities.
- Thirdly, the spread of such a weed may reduce the capital viability of land for pursuits such as tourism.

The eradication of this weed is possible in areas like Tamworth, where isolated cases have been discovered.

Introduction

Mexican feather grass has been sold in gardens and nurseries throughout Victoria and New South Wales since the 1990s (McLaren *et al*. 2003, Jacobs *et al.* 1998). This plant has been sold under a variety of names, some of which are; *Stipa tenuissima*, elegant spear grass, white tussock, ponytail grass, *Stipa tenaccissima* and Texas tussock grass (Maguire, DPI factsheet). This plant is a native of Argentina, Chile, New Mexico and Texas, where it has been catalogued as a non-preferred species that can become dominant in environments under continual heavy grazing (McLaren *et al*. 2003).

Mexican feather grass is very similar to the already established serrated tussock, the primary difference being noticed when it is in seed. Mexican feather grass seeds have a long bristle like awn extending from the end of the seed for approximately 4.5-9 cm, which is much larger than the seed of serrated tussock (Maguire, DPI factsheet). The principle danger in the appearance of Mexican feather grass is that it seeds freely, so that any established plants have the capacity to develop into future infestations.

Method

In the incident occurring at Tamworth, New South Wales, an unusual species of grass was found to be growing at a local pre-school. A sample of the plant was taken in August 2004, by one of Council's Noxious Weeds Officers, Tony Lawler, and delivered to the local branch of NSW Agriculture. Dr John Hosking delivered the specimen to the National Herbarium in Sydney, where it was positively identified as being Mexican feather grass, *Nassella tenuissima*.

Contact was made with the Director of the pre-school, and it was confirmed that the pre-school had been landscaped approximately 9 years previously. The Director of the pre-school was questioned as to whether she knew of anyone who may have taken cuttings or sections of the plant. The Director stated that she had some of the plants growing in her own private residence, and also supplied the name of the landscaping company that the pre-school had employed.

Contact was made with the landscaping company, it was confirmed that they had landscaped the pre-school about 7 or 8 years previously. Information as to where the plants were sourced was not forthcoming.

The plants at the pre-school were inspected again, it was confirmed that there were numerous plants in the gardens. Photos were taken of the plants in situ, and 7 plants in varying stages of maturity were removed and transported to the Calala branch of NSW Agriculture under the care of Alan Maguire.

All of the remaining Mexican feather grass plants were removed from the pre-school grounds and an inspection was made on the Director's private residence and the surrounding lands of the pre-school and home. No other evidence of the plant was found in these localities, however, one further property in Tamworth was found to have a number of the plants growing. These specimens were also removed.

The Noxious Weeds Officers examined the plants to ensure that they could identify it in the future. A media campaign was initiated in the local press to raise awareness with the public, as well as a display with a live specimen being located in the foyer of the main Council building.

The three sites of where Mexican feather grass was located are being monitored on a monthly basis, and future weeds will be removed and reported on as required.

Discussion

It has been established that Mexican feather grass is not native to Australia and that it is considered to be undesirable in its original environments, following will be a discussion as to why this plant could be so dangerous if allowed to become established.

In a study undertaken by Groves, Austin and Kaye (2003) using 7 species of grasses representing the ecological groups of annuals and perennials in differing soil nutrient levels. It was found that the majority of the grass species did not flourish with extremely high nutrient levels, however, the introduced types showed different response patterns to the native grasses with varied nutrient levels. The results obtained suggest that Australian perennial grasses are not as competitive as introduced species in environments indicative of 'improved' grasslands. Landscapes having little or no history of sheep grazing maintain a dominance of native grasses. Serrated tussock has the potential to invade more the 32 million hectares of Australia, in areas including native grasslands, grassy woodlands, drier forests and rocky scrubland (Casonato *et al*. 2002). With Mexican feather grass being closely related to serrated tussock this ability to colonise and out-compete other species is further enhanced (Morfe *et al.* 2002). Morfe, Weiss and McLaren (2002) simulated the spread of serrated tussock and Mexican feather grass over a 30 year period to gauge the influence of high/low yields and high/low prices in regards to farm initiated responses. It was found that Mexican feather

grass was a more adaptable species than serrated tussock, and would be a more prevalent colonizer over a greater area.

To further emphasise the danger that Mexican feather grass could pose to the environment, McLaren, Whattam, Blood, Stajsic and Hore (2003) climate matched the plant to discover potential distributions in Australia. The results revealed that as this plant has a broader climatic profile than serrated tussock, it could potentially invade an area six times greater than *Nassella trichotoma* currently does. Serrated tussock is currently thought to inhabit 32 million hectares of land (Morfe *et al.* 2002), with a projected estimate of 192 million hectares for Mexican feather grass.

Weed management is a major issue, affecting many sectors of the community, environment and economy. A study by the Queensland Local Government Association has demonstrated that for every dollar invested in weed management initiatives, the public receives up to $3.70 in benefits. The majority of these benefits are of a non-production type, which flows predominantly to the wider community. (AEC Group 2002). This study also showed that eradication was the most desirable form of control, although not possible in all circumstances. Prevention methods provided the greatest return on investments, various methods need to be applied as not all situations can be eradicated, prevented or stereotyped. Biological control methods, when successful, were believed to generate higher returns on investment than manual means. Preliminary surveys are being conducted in Argentina, as to the potential for biological control successes on serrated tussock (Anderson *et al.* 2002). Perhaps in the future this may extend to species such as Mexican feather grass, in regions where it cannot be eradicated or prevented.

Conclusions

To conclude, this paper has outlined some of the dangers that Mexican feather grass could pose to the Australian environment if allowed to become established. The example of Mexican feather grass being found in Tamworth, New South Wales, was discussed including the steps that were taken to eradicate the plants. Finally, a brief description of the viability of weed control was mentioned, using the examples provided by the Local Government Association of Queensland.

References

AEC Group (2002). 'Economic impact of State and Local Government expenditure on weed and pest management in Queensland'. (Local Government Association of Queensland, Fortitude Valley).

Anderson, F., Pettit, W., Briese, D.T. and McLaren, D.A. (2002). Biological control of serrated tussock and Chilean needlegrass. *Plant Protection Quarterly*, Vol. 17 (3), 104-111.

Casonato, S.G., Lawrie, A.C., McLaren, D.A and Butler, K.L. (2002). Variation in size and seed germination in Australian serrated tussock. *Plant Protection Quarterly*, Vol. 17 (3),111-114.

Groves, R.H., Austin, M.P. and Kaye, P.E. (2003).Competition between Australian native and introduced grasses along a nutrient gradient. *Austral Ecology*, Vol. 28, 491-498.

Jacobs, S.W.L., Everett, J. and Torres, M.A. (1998). *Nassella tenuissima* (Graminae) recorded from Australia, a potential new weed related to serrated tussock. *Telopea,* Vol. 8 (1), 41-46.

Maguire, A. Mexican feather grass – *Nassella tenuissimia*. NSW Department of Primary Industries Factsheet.

McLaren, D.A., Whattam, M., Blood, K., Stajsic, V. and Hore, R. (2003). Mexican feather grass (Nassella tenuissima) – a potential disaster for Australia. *Proceedings of the Twelfth Australian Weeds Conference*, 658-662.

Morfe, T.A., Weiss, J. and McLaren, D.A. (2002). Economics of serrated tussock and Mexican feather grass in Victoria: Why we need to act now. *Plant Protection Quarterly*, Vol. 17 (3),86-94.

Chilean Needle Grass

Chilean Needle Grass was first discovered in Cowra Shire in December 1999, it was in the seeding stage when found, growing along a road in the parrish of Walli.
An intensive inspection program was then done to ascertain the area infested and extent of spread
(Map)
Inspection revealed one property with a heavily infested area of 80 ha.
We are fortunate that this property is about 95% arable
Two adjoining properties had isolated and scattered areas over paddocks adjoining the main infestation.
Three properties downstream on a watercourse had heavy infestation along the top water level, but not on the remainder of the property.
Three small outbreaks were found 15km. South East of the main out break, on a road leading to a second property owned by a landholder from the primary site.
A fifth outbreak was found about 40 km South West of the prime site on the Main TSR from Cowra to Forbes. There appears to be no link between this and the prime site.
Where the Weed came from, no one knows, but the previous owner was a dealer in sheep, so that could mean anywhere. Locals are of the opinion that it has been on the prime property 20 or more years.
Personnel from the Keith Turnbull institute made me aware of the weed in the mid nineties when I was visiting there.

Council has a management plan in place with the aim TO MANAGE AND SUPRESS CHILEAN NEEDLE GRASS INFESTATIONS AND TO PREVENT FURTHER ESTABLISHMENT WITHIN THE LACHLAN VALLEY.

Native species under threat
Located within a few hundred metres, from the Woodstock infestation is a remnant Grassy White box Woodland area, one of a few areas left in the State to have these indigenous species. This area is classed as Nationally significant, thus we have a National significant threatened species under threat from a Nationally significant weed.
How do we control an introduced perennial Grass weed, if its allowed to infest this Grassy White Box Woodland area? How do we control a perennial grass in a perennial grass?
It appears to out compete most pasture species both introduced and native.
Comments from the audience regarding their experience please.

Control actions in place
The 80 ha area is being cultivated each year and sown to rye corn, no plants can be found, in this crop, on inspection in Nov.
We are fortunate that the owner is a horse breeder and farrier, and runs mainly horses which I believe has been an aid in preventing spread as they do not have a coat that could easily transport seed, like say sheep
The surrounding areas are either, cultivated and sown to oats, or are spot treated using glyphosate annually.
The top water level downstream is checked and treated with glyphosate annually.
All roads in the area are checked and treated annually, some areas where the heavy infestation occurred are boom sprayed each Spring, as a precautionary measure.

Expected range

The infestations at present are from about the 400 metre level and up to the 500 metre level, while the infestation on the Forbes Rd., is at about the 290 metre level.
The area most at risk is the area from 400m up to 700m which is where serrated tussock starts to appear.
Whether Chilean needle grass could displace serrated tussock, or vice versa is a matter of conjecture.
Has anyone in the audience had any experience or comment in this regard
Cowra Shire's area is 275,000 ha. About 20% of the total area is considered Chilean Needle Grass's range or some 50,000 ha

Benefits
The expected benefits from this program are
Maintaining Agricultural production
Decreasing future potential costs
Minimised stock health problems
Maintenance of a certified seed industry and a source of clean fodder
Preserving a National Significant Grassy White Box Woodland area

Take home message

Be observant.
Learn to identify grass species
Go to a Chilean Needle Grass Field day
Help stop Chilean Needle Grass dead in it's tracks
We are.

Umina Beach 2257

Dear Madam

Re: Noxious Weed Inquiry,

This is to advise that I am unable to give you a weed report on the blocks identified in your last letter.
This can only be done through a solicitor acting for a purchaser.

In regard to your inquiry re: how to control cat heads I advise as follows,
Cat Heads, sometimes referred to as Caltrops are an opportunistic weed that takes advantage of bare ground condition that are a result of the prolonged drought.
1998 was the last year we received average rainfall in this Shire, since then we have had little winter rain and what rain we did have fell mostly in the summer.
These conditions leave farm land devoid of good pastures, and town blocks and nature strips, due to water restrictions, devoid of lawn type grasses.
When summer storms occur, coupled with the above conditions, weeds quickly colonise these areas.
In particular Cat heads and Khaki weed are the plants of most concern in towns and villages, while Bathurst Burr, Nightshade and Heliotrope are a major concern to farmers
Cat heads can set seed within three weeks after germination therefore constant vigilance and control by chipping and or spraying must be carried out regularly.
If the drought ever breaks and we return to normal rainfall patterns, landholders will be able to re sow pastures and lawns, resulting in some of these problems being alleviated.

I have attached a colour brochure of weeds in the Lachlan Region for your information

Yours faithfully,

K. Nelligan
Noxious Plants Inspector

Mesquite & Parkinsonia – a Thorny Threat to New South Wales

March, N.A[1] & Mackenzie, D.[2]
[1] Department of Natural Resources & Mines
[2] Bourke Shire Council

INTRODUCTION

Mesquite (*Prosopis* spp.) and Parkinsonia (*Parkinsonia aculeata)* are two of Australia's worst weeds. They are exotic thorny shrubs that currently affect about 2 million hectares but have the potential to invade over 75% of mainland Australia. The discovery of a number of new infestations in western NSW highlights their potential to become major weeds of the grazing lands. Diligence is needed to ensure all infestations of these weeds are found and effectively managed.

IDENTIFYING MESQUITE AND PARKINSONIA

There are four species of mesquite (*Prosopis* spp.) present in Australia, together with various hybrids (van Klinken & Campbell, 2001). Although mesquite, depending on the species, may vary from a large spreading tree to a multi-stemmed shrub, it has a number of features that aid identification. These include 'lamb's tail' shaped flowers, stout thorns, zigzag green to red branches, fern-like leaves and seed pods with slight constrictions between the seeds. NSW is thought to have *P.velutina*, *P.glandulosa* var. *torreyana* and a *P.velutina x P.glandulosa* var. *torreyana* hybrid (van Klinken & Campbell, 2001). These are all multi-stemmed shrubs that typically grow 3-5 metres high.

Parkinsonia can also be distinguished by a number of key features. The leaves are particularly distinctive having a long flattened leaf stalk with tiny leaflets along each side. The flowers are about 20mm in diameter, five-petalled and predominantly yellow – the top petal may be partly or completely orange. Branches are smooth barked and green, although older bark is dark and rough. Parkinsonia grows as a shrub to about 5 metres.

Mesquite and parkinsonia may be confused with a number of native (eg. Prickly wattle, *Acacia victoriae*) and exotic (Mimosa bush, *Acacia farnesiana*) plants. It is critical that positive identification is sought before the implementation of control measures.

THE THREAT

Mesquite is not just one of Australia's worst weeds, but also a contender as the worst rangeland weed in the world. Native to the Americas, it is a major weed in countries as varied as Hawaii, East Timor, Pakistan, India, Botswana, Namibia, Ethiopia, Kenya and South Africa, (van Klinken, *Pers. Comm*., 2005).

Parkinsonia is native to a similar geographic area as mesquite – the southern United States, Central America and northern South America. It has naturalised in Hawaii, India, Pakistan, the Middle East, Italy, Cyprus, Greece, South Africa, Kenya and Israel (van Klinken, *Pers. Comm*., 2005).

Both mesquite and parkinsonia are well adapted to arid and semi-arid environments. They can grow in an extremely wide range of soil and climatic conditions and survive extended drought periods because seed banks are long-lived, the seeds themselves spread easily, and seedlings are particularly hardy.

Mesquite seeds are primarily spread by stock that seek out the sugar and protein rich pods, while parkinsonia pods are primarily spread by water movement down creeks and river systems and possibly in mud adhering to animals. Dramatic population explosions can occur as a result of mass germination and establishment events associated with high rainfall years (Department of Natural Resources, Mines and Energy, 2003).

CURRENT AND POTENTIAL DISTRIBUTION

Mesquite and parkinsonia were introduced into Australia late in the nineteenth century for shade, ornamental or fodder value (Department of Natural Resources, Mines and Energy, 2003). While major infestations occur across large areas of Northern Australia, in NSW these weeds are currently limited to isolated infestations in western parts of the state.

Mesquite occurrences are mostly small scale and are present in the Bourke, Coonamble, Cobar, Murrumbidgee and Broken Hill areas. The infestation at Broken Hill is the largest with about 8 kilometres of a creek system moderately to densely infested (McCormick, *Pers. Comm*., 2005). Mesquite is thought to have been present on at least 43 pastoral properties (van Klinken & Campbell, 2001) and total 27,000 hectares (NSW Department of Primary Industries, 2005).

Until 2003 it was thought that there were only a handful of parkinsonia plants in NSW. This changed with the discovery of a significant infestation on the Narran River in the Angledool area north of Lightning Ridge. Several kilometres of the river system was found to be infested with about 250 hectares affected in total. The presence of parkinsonia in this area is a major threat to the ecologically important and Ramsar listed Narran Lake. Further infestations of parkinsonia have now been found in the Bourke and Mungindi areas.

NSW DPI have 73 recordings for mesquite and 11 for parkinsonia in their state database (Figure 1).

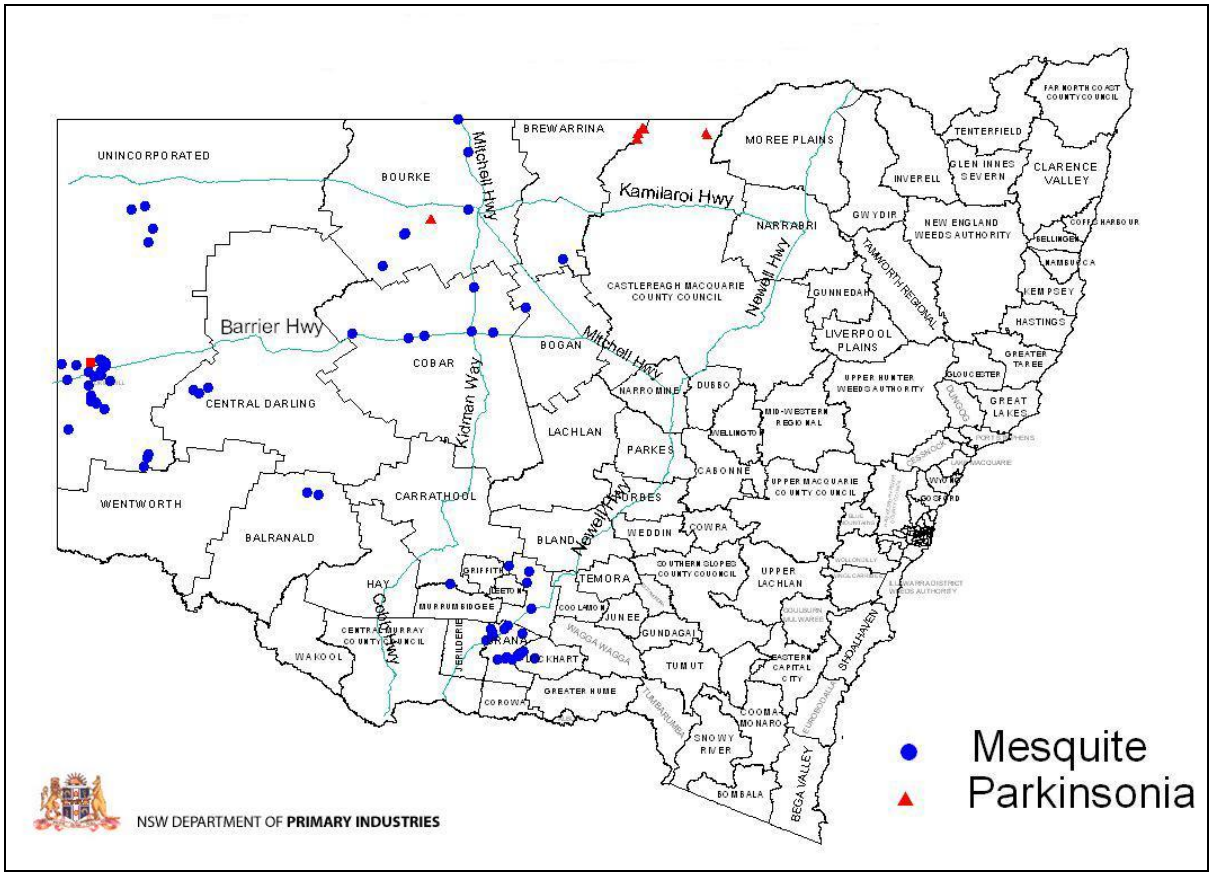


Figure 1. Mesquite and parkinsonia occurrences as reported to NSW DPI. Note: additional occurrence of parkinsonia at Broken Hill added by author based on personal observations.

Most of western NSW is susceptible to invasion by these weeds. Even in areas of low climatic suitability, such as the Murrumbidgee region, mesquite is established, flowering, podding and spreading rapidly.

IMPACTS

Mesquite and parkinsonia have major impacts on both agriculture and the environment. They form dense impenetrable thickets which reduce pasture production, hinder and increase the cost of mustering, damage vehicles and restrict access for both people and animals. Infestations also destroy wildlife habitat, reduce biodiversity and provide a refuge for feral animals.

The Mardie station case study provides a warning against complacency regarding mesquite. Mesquite was originally planted at Mardie station in the Pilbara region of Western Australia in the 1930s. While this region has an average rainfall of only about 300mm, occasional cyclones provide an opportunity for mass establishment. By the mid-1950s, mesquite had spread to about 7,500 hectares and by the 1990s had covered 150,000 hectares (van Klinken, *Pers. Comm*., 2005). About 30,000 hectares is now impenetrable thorny thicket. It is estimated that a one–off treatment of all mesquite in the Pilbara region would cost $30 million.

CURRENT AND FUTURE ACTION

As a response to the discovery of several parkinsonia infestations, the Department of Primary Industries formed the NSW Prickle Bush Working Group in 2003. This group, comprised of agency, local government and community representatives, has developed action plans for mesquite and parkinsonia based on the respective national strategies for these weeds.

The group aims to control all known infestations over a 5 year period and facilitate the detection of new outbreaks. This will require a coordinated effort incorporating awareness, strategic surveys and control programs:

Awareness

There is generally a low awareness of mesquite and parkinsonia in NSW – in terms of both identification and potential threat. An awareness campaign focussing on identification is required to ensure detection of established infestations and new outbreaks. NSW weed officers' site visits to interstate infestations have greatly aided knowledge of the potential threat and the acquisition of identification skills.

Strategic surveys

Surveys are required of all sites where mesquite and parkinsonia have been previously recorded (i.e. herbarium and agency records). Priority should be given to inspecting the vicinity of old homesteads, water facilities and stock yards at such sites.

Control

Various control programs have been in place for mesquite since 1970 but these have generally lacked a long term, consistent and coordinated approach to follow-up monitoring and treatment (van Klinken & Campbell, 2001). As a result there has been an historical pattern of periodic suppression followed by the inevitable re-emergence and expansion of infestations. Control programs are now in place for mesquite and parkinsonia in the Coonamble, Brewarrina, Bourke, Angledool, Murrumbidgee and Broken Hill areas. A commitment to follow-up actions over a number of years is needed to ensure effective management and, where possible, eradication.

CONCLUSION

Mesquite and parkinsonia are two of the most serious exotic weed threats facing NSW. While infestations are generally small, and in their early stages of invasion, there is an opportunity to achieve a major reduction in both the number and area of infestations. However, this opportunity is matched by the challenge of ensuring an early detection capacity and an awareness of the potential threat of these weeds. The NSW Prickle Bush Working Group is providing the direction and means for this to be achieved.

REFERENCES

Department of Natural Resources, Mines and Energy 2003, Mesquite—best practice manual: control and management options for mesquite (Prosopis spp.) in Australia, NRM&E, Queensland.

Department of Natural Resources, Mines and Energy 2004, Parkinsonia—national case studies manual: approaches to the management of parkinsonia (*Parkinsonia aculeata*) in Australia, NRM&E, Queensland.

Department of Primary Industries, 2005, New South Wales Parkinsonia and Mesquite Action Plan (draft).

van Klinken, RD & Campbell, S. 2001, 'The biology of Australian weeds. 37 Prosopis species', Plant Protection Quarterly, vol. 16 no.1.

Working Together -
A Cooperative Approach to Weed Management

Ann Herbert
Manager – Noxious Weeds
Bega Valley Shire Council, Bega

ABSTRACT

The Bega Valley Shire Weeds Strategy was developed from a series of facilitated workshops held across the Shire. Representatives from all land management agencies were invited to participate with interested private landholders in these facilitated discussions and the workshop sessions.
The initial process of purging pent up grievances from the past was essential before people could move forward and take on a positive role by identifying goals and setting realistic targets. The strategy is based on the ideas, strategies and recommendations from each of the local area community consultations and is a direct result of their energy, enthusiasm and commitment to weed control. Community input continues through local Weeds Committees that meet with Council and other agency staff to review the past year's achievements and develop new Annual Action Plans for priority weeds. Community-Council cooperation has markedly improved, as has collaboration between agencies in developing and implementing weed management, education and awareness programs. This process has resulted in changed attitudes and perceptions of what should and can be achieved in more effective weed management with limited resources.

Keywords Community commitment, attitudes, cooperation, accountability, peer pressure, effective weed management.

Introduction

There was a community perception that little was being achieved by Council in the management of weeds on roadsides, on Council managed land or via the property inspection program. The seeming lack of follow-up on private land inspections and the belief that Council was not using its powers under the *Noxious Weeds Act 1993* to ensure compliance were a further source of criticism.

There had been community consultations in the past but it was believed that little was actually done to achieve stated goals. As well, many in the community believed there was a lack of cooperation between Council, other agencies and the community in general.

Action was needed to restore community confidence in weed management in the Shire and develop better links with other government agencies in joint weed management programs. A series of meetings between community members, Council and representatives of other government land management agencies to develop a Shire Weeds Strategy was organized.

Methods

Natural Heritage Trust funding provided the opportunity to embark on community workshops and develop a Shire Weeds Strategy with strong community input and participation of Council and other agencies. Up to five workshops were to take place at each of five locations in the Shire.

It was important to ensure that the workshops did not become bogged down in restating what had happened in the past. A professional facilitator with a good understanding of local area agricultural and environmental issues was engaged to lead the meetings. The facilitator's brief was to engage the community to devise a Community Weeds Strategy for the Shire.

The process had a local community approach involving a number of steps. The most important was to interest community members and representatives of other agencies to attend a series of facilitated community workshops. Key community and agency personnel were identified and individually contacted to encourage attendance. The workshops were also widely advertised through local media and by posters placed at retail and other outlets.

Everyone was given an opportunity to contribute to discussion. Individual issues were raised and given recognition by the meeting in general and Council staff in particular.

Each series of workshops followed a similar pattern. They:

- Visited the past - got grievances out in the open, listed them, and then used them as stepping-stones to the future;
- Looked forward - turned the focus from past problems to future directions (listed community concerns, listed desired outcomes to ensure that the problems of the past do not become the problems of the future, identified critical factors for success, identified categories and group factors under headings, prioritized within categories, and developed an action plan to achieve the community determined goals).
- Identified specific actions to achieve goal;
- Identified those responsible for ensuring goals are achieved by target dates.

Following the third round of workshops, Council and other agencies met to identify responsibilities and timeframes. These were recorded.

Following these meetings the facilitator and Shire Weeds Officers met and developed the Draft Strategy. Feedback was sought from community members and other agencies at the fourth round of meetings to ensure the strategy encompassed their objectives.

The Strategy was then completed and presented to each community group and agency representatives for adoption along with the annual Action Plan derived from this document.

The Strategy is used as a guide in developing annual Action Plans and is reviewed every two years and updated as required.

Results

Initially, workshops were held throughout the Shire. Following the second workshop for one area, the meetings were discontinued due to lack of interest and poor attendance. At the other four venues, the number of participants remained high, with over 250 people attending the initial series of workshops. The level of commitment was strong with over 150 continuing to attend throughout and others joining at subsequent workshops.

Representatives of land management agencies - NSW Agriculture, National Parks and Wildlife Service, Department of Infrastructure, Planning and Natural Resources, State Forests, Rural Lands Protection Board, the South East Catchment Management Board and Far South Coast Landcare Association -

attended all relevant workshops. Following the development of the Draft Strategy these representatives met with Council to identify tasks and set target dates for their completion.

The Draft Strategy was then presented to all participants for review - the final copy prepared and launched seven months after the initial meetings. All agencies and Council endorsed the document. The Voluntary Biological Diversity Strategy Management Team formed by a South East Catchment Management Taskforce Group also endorsed it.

The education program outlined in the document has resulted in the development and release of the booklet *Weeds of the NSW South Coast* in all coastal shires south of Sydney and the development and installation of roadside and saleyard education and awareness signage.

Joint projects have been undertaken by agencies and Council. As well, two Landcare groups have formed Adopt-A-Road sub-groups that control small outbreaks of weeds and report others to Council for a joint management program.

The numbers of community members who choose to attend the review meetings indicate a solid belief that the process is working.

Discussion

Community feedback following the development of the Strategy has been very positive. Council's weeds team has an increased commitment to working with the community through the Weeds Committees and with individuals. Council and other land management agencies cooperate more closely in the development and implementation of joint weed control projects.

The community is very supportive of the inspection program and actions taken by Council if there is non-compliance with a Weed Control Notice. Council now has a better understanding of community concerns, the community of Council constraints and the weed management process at local, Shire-wide and regional levels.

The consultation process has resulted in a more targeted weed management program, with a high level of community commitment. Cooperation between Council and community has improved, with each group having a better understanding of the other's weed management priorities and problems.

ACKNOWLEDGMENTS

This work was made possible with grant funding provided by the Natural Heritage Trust. Terry Irwin capably facilitated all the community meetings. His expertise assisted in ensuring a successful outcome. Harry Kemp, NSW Agriculture, provided valuable input, advice, support and refreshments. Without the continued commitment of community members throughout the consultation process, it would not have been successful.

Speakers biography

Alan Smith grew up in a- small rural farming community. He served an apprenticeship, working for 14 years as a motor mechanic on various vehicles and farm machinery, before joining the Eden Pastures Protection Board (RLPB) as a Noxious Animal and Weed Inspector for 3 years. In 1982, Alan became the first fulltime Noxious Weed Inspector for the newly created Bega Valley Shire Council. Alan has an Associate Diploma in Agricultural Protection and with a lifetime of experiences is familiar with community attitudes and perceptions to authority and regulation.

Author who will present the paper

Name: **Alan R. Smith**
Organisation: **Bega Valley Shire Council**
Address: **PO Box 492 Bega NSW 2550**
Phone: **02) 6499 2141**
Fax **02) 6499 2200**
Mobile: **0427 949 549**
Email: **council@begavalley.nsw.au** **(Attention: Alan Smith).**

Rural Land Incentives Program
Working with the Community

Jamie Wright
Environmental Scientist
Hornsby Shire Council

Paul Marynissen
Noxious Weeds Officer
Hornsby Shire Council

Background

Hornsby Shire Council has developed an innovative program for biodiversity conservation on private property. The program encourages landholders to conserve and enhance native vegetation, potential fauna habitat and water quality through a combination of education and incentives. These include, individual property visits, educational workshops, subsidies for on-ground works linked to property management plans and annual payments based on size, condition and conservation value of bushland on the property. The program has built on a similar program developed by the Surf Coast Shire in Victoria and is being used by the Department of Infrastructure and Conservation to trial environmental property planning courses. Council staff have developed strong relationships with landholders enabling free flowing exchange of information, access to Council facilities and expertise, in addition to financial incentives for environmental works.

Who is eligible?

Property owner/ occupiers within the Hornsby Shire with blocks two hectares or over. Council has allowed residents with slightly smaller blocks or who have a second property outside the Shire to participate in the property management planning courses but they are not eligible to receive incentives.

Who is participating?

Participants range from new residents to the Shire to people who are life long residents in the area.

Rural residential/Hobby farmers, retirees and new residents to the rural areas of the Shire have been the most enthusiastic about the program. The majority of participants to date appear to be financially secure and often are keen to obtain information and knowledge rather than financial incentive.

The response from property owners who make a living from the property has not been as enthusiastic. This may be because some residents are uncomfortable inviting Council officers onto their properties when their only previous experience with Council officers has been regarding compliance issues. Council officers try to reinforce the fact that they are not entering there properties in a regulatory role. Staff are currently looking at methods to overcome this hurdle.

What has been successful?

Excellent property plans have been developed through the planning courses and by using the self guided plans. Most participants have invested considerable effort into developing relevant plans that they can work from and update over time. In most cases this has been the first time participants have documented their long term plans for their property.

Field trips to participants properties have proven to be very valuable. Such field trips have involved the land owners or managers showing participants around their property, particularly areas that they have worked on such as weed control, revegetation and creek restoration areas. Owners can give personal and practical tips to the group such as what techniques have worked or not worked, helpful local suppliers, how to encourage native fauna, pest control etc.

Council has found that participants respond well to having other residents talk directly to them. Often their own environmental issues become less daunting after seeing what others have achieved.

Participants have been very interested in gaining any information on their local environment. In addition to providing reference books, brochures, relevant website lists etc., a laptop computer is taken to courses and field days with GIS data such as threatened species records, soil/ vegetation maps, creeks catchment boundaries, aerial photographs etc. This has been an important tool to assist participants develop a better understanding of how their properties fit into the local environment.

By attending property planning courses and workshops, participants start to develop relationships with other land holders in there area. Getting together with their neighbours and talking about common interests and land management issues has been very valuable.

Participants can access Councils native nursery and are able to grow there own plants free of charge or have varying input into the process with a corresponding final cost. Some participants have taken knowledge gained by volunteering at the nursery and started their own small nurseries to propagate plants for their properties.

Council Officers have identified new populations of vulnerable and threatened flora species and larger areas of endangered ecological communities whilst carrying out property visits. In turn Council has been able to provide information to the resident on how best to manage these natural resources.

Challenges and what has not worked so well

As the majority of the properties that are involved are less than 4.5 hectares influences from outside the property boundary are often great.

Some of the issues include-

- Run off from adjoining properties can encourage weed growth, sedimentation, water quality issues;
- Domestic pets wandering, potentially impacting wildlife and livestock;
- Bush fire management and Asset Protection Zones; and
- Noxious and environmental weed encroachment from neighbouring lands

Council staff do what they can to help in these situations but often it is difficult to come up with practical solutions for all.

In 2003 Council engaged a Green Corps team for six months to assist land holders with on ground works. The group worked on nine properties in this time carrying out activities such as weed control, planting, rock stabilisation of creek lines and installation of sediment basins.

The Green Corps team carried out good work, however it took a great deal of Council resources to coordinate and set up with tools, equipment and materials. The most successful sites were where the resident became actively involved in the work alongside the Green Corps team or if they could not, assisted by providing facilities such as tea coffee, fridge etc. Assisting the team was difficult for some residents as they had work commitments during the week.

Council now use contract bush regenerators to assist land holders in carrying out such activities usually in six half day sessions where the land holder works along side the regenerator who teaches skills such as plant identification, weed control techniques etc.

Property Management In Progress

Esme Wood, a resident of Hornsby Shire since 1935, has contributed a great deal to the community and is currently an active member of three Bushcare groups. Her two hectare property supports the endangered ecological community, Sydney Turpentine Ironbark Forest with an ephemeral creek through it.

Esme responded to an expression of interest for the Rural Land Incentive program. Two council officers visited her property and gave recommendations on weed management and water quality management. She completed a two day property management planning course and submitted her plan to Council. This plan was approved, qualifying her for financial incentives.

Over the past two years assistance that has been given to Esme has included:

- assistance and subsidised materials for developing a property plan;
- Green Corps team carrying out primary weed control work in the creek line removing large area of *Aurndo donax* (Giant Reed);
- biodiversity credit cash payments to be used for anything the resident believes is worthwhile, ongoing; and
- yearly funding for weed control (contract bush regenerator) to maintain the area opened up after primary weed control.

In 2004 Esme finalised a Voluntary Conservation Agreement with the National Parks and Wildlife.

Benefits to Council

Council benefits from the program in the following ways:

- better understanding of native and exotic vegetation in the Shire as much of the Shires bushland is privately owned;
- open lines of communication with residents;
- reduction of impacts on adjoining Council reserves and Regional Park by improving bushland higher in the catchment and water quality which enters highly productive estuarine environments; and
- access to local natural and cultural historic information such as private flora and fauna records and information about past land uses.

This type of information and open communication can be extremely valuable in assisting Council manage its own resources in adjoining properties.

Future directions

As the program continues, Council would like to develop aspects of the program. These include-

- encouraging local business, (nurseries, horticultural and agricultural), to become more active in the program;
- assisting the development of networks with land holders in the same catchment.
- targeting properties with threatened vegetation communities.
- expanding links with National Parks and Wildlife's Land for Wildlife program and other relevant Council programs such as Gardens for Wildlife workshops; and
- trialling Green Corps or Work for the Dole program on more specific projects, ie concentrate on one or two sites in a six month program.

Speakers biography

Paul Marynissen is a Noxious Weeds Officer & Horticulturist who has worked with weeds in the local government areas of Wyong, Greater Taree and Hornsby.

Jamie Wright is an Environmental Scientist, Environmental Weeds, and has worked in private enterprise & State and Local government. His main role with Hornsby Shire Council is contract bush regeneration management and working with private landholders to conserve, enhance and manage native flora & fauna.

Speaker details

Paul Marynissen
Hornsby Shire Council
296 Pacific Highway Hornsby NSW 2077
(02) 9847 6976
0438 103143
pmarynissen@hornsby.nsw.gov.au

Retired and willing –
Harnessing the Community to Control Weeds

Steven Wilson
Manager – Noxious Weeds
Port Stephens Council, Port Stephens

ABSTRACT

One of the Council's key roles is to harness community's ability to facilitate collective action against weeds of concern to the people who live, visit and work in Port Stephens. This presentation will contain an overview of the successful utilisation of cornrnunity effort to control weeds, particularly Bitou Bush and Lantana.

It looks at how Port Stephen Council is facilitating and supporting the community to achieve a substantial reduction in the impact of weeds and raises the question whether this phenomenon can be transferred to other weeds of concern such as Alligator Weed.

Developing a Bush Regeneration Plan to protect Biodiversity and Cultural Heritage in Natural areas

Case Study – Glenrock State Conservation Area & Awabakal Nature Reserve

Mellesa Schroder (Senior Ranger –Pest Management) & Tiffany Knott (Ranger)
Department of Environment & Conservation – Parks & Wildlife Division,
Hunter Region, 12B Teramby Rd Nelson Bay, 2315, 0249848207

Introduction

It has not been until the last couple of decades that the impact of weeds on biodiversity has become more widely accepted. Introduced species (weeds) were recognised in the Commonwealth and State Biodiversity Strategies as one of many Threatening processes impacting on biodiversity (BDAC 1992). National Parks and Nature Reserves are conserved for their natural and cultural heritage so it is important to identify the weeds that are likely to have significant impacts on these values.

Despite the awareness that weeds impact on natural systems we still largely manage and develop strategies on an individual weed basis. It is important for all weed control programs to consider a landscape approach. A landscape approach involves identifying and managing all the different types of weeds that may occur and treating their causes. In urban bushland reserves multiple weeds are a common management issue and their causes diverse.

Weed invasion throughout the urban bushland of Glenrock State Conservation Area and Awabakal Nature Reserve is a major threat to the reserve's values. Over 75 weed species have been recorded to occur, many of these weeds invade natural areas. The current weed infestations within the reserve outweigh the resources available to treat all weed infestations simultaneously.

The Bush Regeneration Plan developed for Glenrock and Awabakal provides a different approach to traditional weed management. This is achieved by shifting away from just controlling individual weeds but understanding and treating the causes of weed invasion. This includes storm water management, track and trail rationalisation and integration of fire management. The Plan divides the reserve into key management areas and develops priorities to focus weed control programs in areas that protect the reserve's values. Weed control programs target **all** weed species in high priority areas.

Background

Glenrock State Conservation Area (Glenrock) and Awabakal Nature Reserve (Awabakal) are significant natural, cultural and recreational resources in the Lower Hunter Region. Both areas conserve over 700 hectares of remnant native vegetation which have largely been removed or severely modified throughout the Lower Hunter. The reserves occur east and south of the cities of Lake Macquarie and Newcastle and provide a coastal landscape within a natural setting.

Despite the past landuse and the proliferation of weeds both Glenrock and Awabakal support 21 distinct vegetation communities, 11 are recognised as nationally significant (Bell 1998). Glenrock also has a floristic diversity index of 72.26 species/hectare, this index places it in the top five of the twenty conservation reserves in the Sydney basin region(Griffin nrm, 2002).

A number of threatened flora species can be found in both reserves. Two disjunct populations of *Diuris praecox* (a rare and restricted donkey orchid), occur in Glenrock,

Cynanchum elegans (a vine), occurs in the Flaggy creek catchment of Glenrock and *Eucalyptus camfieldii* (a stringy bark), occurs in Awabakal. *Tetratheca juncea* occurs in both reserves. Two locations of the Endangered Ecological Community, Littoral Rainforest, also occurs in Glenrock – the last of this community in the Newcastle area. Several rare species have also been listed to occur within the reserves, including *Rulingia hermannifolia. Macrozamia pauli-guilielmi ssp. flexuosa* (a burrawang).

No systematic fauna survey has been undertaken within the reserves, although 140 species of birds have been recorded in or nearby, including the following threatened species, powerful owl (*Ninox strenua*), masked owl (*Tyto novaehollandiae*), regents honeyeaters (*Xanthomyza phrygia*), swift parrots (*Lathamus discolor*), and turquoise parrots (*Neophema pulchella*). The noisy pitta (*Pitta versicolor*) is also known to occur here at the southern limit of its distribution. Threatened mammal species include, common bent wing bat (*Miniopterus schreibersii*), little bent wing bat (*Miniopterus australis*), grey-headed flying fox (*Pteropus poliocephelus*), and the squirrel glider (*Petaurus norfolcensis*).

Many of the fauna species occurring in the reserves are considered common on a regional scale, however their occurrence in a small isolated bushland remnant surrounded by urban infrastructure is significant. Those populations surviving in the reserves are under increasing pressure.

Glenrock has been a site of industry for thousands of years, with the Awabakal Aboriginal people quarrying and trading rhyolitic tuff throughout the Hunter. A major walking track through the reserve was once a significant Aboriginal pathway, and numerous Aboriginal sites remain in the reserve. The reserve is also located in the heart of the Newcastle coal measures and has been a coal mining centre since the early days of European settlement. Coal mining relics covering the period from the early 1800's to the 1970's remain along the banks of flaggy creek, in and around Glenrock Lagoon and along Burwood Beach. Other historic sites include the remains of Australia's first commissioned Copper Smelter and the remains of at least three market garden ventures from the early 1900's.

Glenrock has been recognised as a Cultural Landscape with State, Regional and Local Significance based on the collective values of its natural, Aboriginal and historic sites and is listed on the State Heritage Register (Griffin nrm, 2002). While Awabakal NR, contains Redhead lagoon, recognised as a coastal wetland of a type that is poorly conserved or under threat state wide. It is also an important refuge for water birds.

While recognised for their considerable cultural heritage value, it was often the formation of these historic sites together with the provision of utilities, and more recently, recreational pursuits that have had and continue to have, such a profound impact on the natural heritage values of Glenrock and Awabakal. These impacts have included: vegetation clearance and fragmentation, proliferation of tracks, trails and easements, erosion, sedimentation, refuse dumping, high nutrient loadings, and the alteration of fire regimes.

Weed invasion following on from these impacts is now a considerable threat to the biodiversity remaining in the reserves. Weed mapping identified 75 species (Winning 1998), of these 22 (including 5 noxious weeds) are recognised as environmental weeds capable of invading natural vegetation communities, these include Morning Glory (*Ipomea spp.),*Privet's (*Ligustrum spp.)*, Cassia (*Senna pendula*)Asparagus Fern (*Protoasparagus aethiopicus var densiflorus*). Three Weeds of National Significance also occur in the reserve including, Lantana *Lantana camara*, Bitou Bush *Chrysanthemoides monilifera*, and Blackberry *Rubus sp.* Lantana and Bitou Bush being the weeds most widespread in both reserves.

In Glenrock few areas of the reserve are free of weeds, 70% (364ha) of the 520 hectare reserve has infestations at a density of 41-70%. In Awabakal infestations are less dense with 10%(24ha) of the 244 hectares at a density of 41-70%. Isolated infestations of weeds dispersed by birds, such as Bitou Bush, Camphor Laurel (*Cinnamomum camphora*) are

scattered throughout both reserves. In both reserves infestations occur along the boundaries, within previously cleared areas, the coastal strip and watercourses.

Weed programs have been undertaken in the reserves since 1994 and evolved primarily around areas where community groups were undertaking works and in locations where threatened species or noxious weeds occurred. Although weed control was effective in these areas there was no overall strategy and the long term success of weed control was difficult to ascertain. In 2002 a Draft Bush Regeneration Plan was prepared to address these concerns.

The plan aims to address both the causes of weed invasion – vegetation clearance, fragmentation, altered fire regimes, refuse dumping and high nutrient levels – as well as controlling the weeds themselves. It focuses weed control effort on the intact core of the reserves, and on areas with threatened species or cultural heritage sites of significance.

Developing a plan

During development of the Bush Regeneration Plan a number of other areas of research were under way, or had reached conclusion – all of which formed an invaluable resource for the development of the plan. These included, weed mapping, a vegetation survey, a Conservation Management and Cultural Tourism Plan for Glenrock's cultural landscape, a Fire Management Plan for both reserves, and a review of recreation and access in the reserves. Due to this research the following information was able to be gathered – history of use, type and distribution of vegetation communities, distribution of weeds and their abundance, appropriate fire regimes for different vegetation communities, sedimentation and nutrient levels in creeks, and the location and condition of tracks and trails.

The above information enabled us to build up a detailed picture of the issues contributing to weed invasion and proliferation in the reserves. It was obvious that a multifaceted approach was required to manage the many problems contributing to weed invasion. The plan therefore aims to address the following, in addition to weed control:

Refuse Dumping – Close proximity to urban areas has lead to refuse dumping and garden escapes. Community education, fencing, and closing certain roads from sunset to sunrise should reduce this issue.

Stormwater and Urban Runoff – elevated nutrient levels, high water velocity and stream bank erosion are major factors in weed distribution and establishment in both reserves, but particularly in Glenrock. To determine the level of the problem, and to motivate local government to address these problems in the urban area, several University students undertook water quality and quantity research in the catchment. A stormwater management plan has been developed by Lake Macquarie City Council, in direct response to the Bush Regeneration Strategy and student research, which will clean up stormwater in urban areas prior to it entering the reserves.

Easements – Glenrock contains many electricity easements. These fragment the reserve and allow weed growth to intrude along easement edges. A sewerage easement also traverses the reserve and tends to surcharge during high rainfall, contributing nutrient rich effluent to areas adjacent to the pipeline. Changes to current management practises, such as washing down of tractor tyres and replacing slashing with a rope-wick applicator on electricity easements with weed spraying adjacent to the sewerage pipeline, should help to reduce weed spread and proliferation.

Fire History – considering the extent of the weed problem in the reserves it is important that fire planning coordinates with pest planning. In those areas listed for prescribed burning follow up weeding will take place. For those areas where lack of fire is impacting on biodiversity and/or promoting weed growth appropriate fire regimes will be reintroduced which will assist in weed control.

Past Landuse – Historical sites are generally heavily infested with weeds due to past land clearing. An added complication is that many of these sites are State Heritage listed. Weed removal on these sites must consider the role of weeds in stabilising and protecting cultural

remains. In other situations weed removal is required to conserve historic fabric. In both situations special techniques should be used to minimise impacts.
Tracks & trails – Numerous ad hoc trails fragment the reserves. Erosion, compaction and track duplication are common problems. Those tracks/trails not designated as part of the track network in the reserves will be closed and rehabilitated. An Access plan is currently in development that will determine those tracks/trails to be retained in the track network, all others will be rehabilitated.

Establishing Management Areas

As the problems were numerous throughout the reserves and resources limited, the reserves were broken up into management areas based on vegetation type, topography and prior weed control effort. Each management area identifies the type/s of vegetation communities, any threatened species or significant ecological communities, weed distribution, management issues pertaining to each area and the presence or absence of cultural heritage sites. The causes of weed invasion, such as stormwater, easements and the like, will be addressed over the long term. In the short term weed control is ongoing. To assist in this effort, a system of prioritisation for weed control in the management areas was applied to enable us to maximise management effort by focussing on management areas of high conservation value.

The following criteria were used to determine priorities in each management area,

1. Isolated Infestations – isolated weed infestations of a high priority species or a new weed incursion which is known to be a problem in other areas.
2. Program already commenced – follow-up will be continued to maximise the benefits of previous control programs
3. High Ecological Value – including threatened species, endangered ecological communities or regionally significant vegetation communities
4. Cultural Heritage –State heritage listed cultural heritage sites
5. Community Profile/Recreational Area – active community bush regeneration groups or have a high recreational focus
6. High Priority Weeds – areas with weed species identified as a high priority for treatment
7. Co-ordinated Programs – Management areas which have coordinated programs being undertaken with Local Government.

An area with Threatened species (directly affected by weed invasion) or an isolated weed infestation is automatically given a high priority. An area with five or more criteria is also given a high priority, those with 3-4 criteria are given a medium priority and those with 1-2 criteria a low priority.

Weed control on heritage sites is assisting in weed control generally, even though these sites are considered ‘bad areas’ in Bush Regeneration terminology. These sites have separate funding for initial and follow up weeding so that works here add to our weed control efforts – rather than taking needed funds away form Threatened Species and areas of high ecological value.

Community Volunteer Programs

A number of community bush regeneration groups undertake weed control in the reserves. These groups were involved in developing the strategy and encouraged to support weed control program priorities being focussed not only on volunteer areas but a refocus to incorporate high conservation and cultural heritage sites. With the assistance of community groups working in a number of high priority areas these programs have been further enhanced.

Monitoring Success of the program

Monitoring is often the neglected part of weed management, we become so focussed on removing weeds that we forget to demonstrate the effectiveness of programs. Monitoring in the reserves will include:

- mapping of the distribution and density across the reserves every ten years (bitou bush will be mapped every five years as part of the NSW Bitou Bush Strategy)
- Photo points established in high priority areas.
- Sites identified as a high priority in the NSW Bitou Bush Threat Abatement Plan (NPWS 2004) will be monitored as part of this plan.
- Continual information recorded on GIS regarding treatment areas, new weed incursions, biological control agent distribution.
- Monitoring of storm water quality/quantity

Conclusions

Weed infestations threaten the natural and cultural heritage of Glenrock and Awabakal. The Bush Regeneration Plan is the first step in a strategic approach to regenerating native bushland in these reserves. By adequately managing the causes of weed invasion we will more effectively manage the weed problem into the future.

Focussing on stormwater management, integrating fire management, changing management practises on easements and rehabilitating tracks/trails should lead to a reduction in weed spread and proliferation in the reserves in the longer term and therefore a reduction in the costs associated with weed control.

The plan has raised community awareness regarding the impact of weeds on biodiversity and cultural heritage. The identification of priorities ensures resources are directed to high priority sites that protect biodiversity and this has helped redirect community group effort to sites of high value.

Weed control programs have been refocussed and are now protecting the reserve's values, a number of cultural heritage sites and a linked range of vegetation communities in the core of the reserve, including endangered ecological littoral rainforests, five threatened plant species and 11 nationally significant vegetation communities.

References

BDAC (1992) A national strategy for the conservation of Australia's biological Diversity. Biological Diversity Advisory Committee, Department of Arts, Sport, the Environment and Territories:Canberra

Bell,S.A.J (1998) Glenrock SRA & Awabakal NR – Vegetation Survey, Volume 1:Main Report, Volume 2; Community Profiles, Unpublished Report for the NPWS

Griffin (2002) Cultural Landscape Conservation Management Plan, unpublished report prepared for NPWS

NPWS (1997) Glenrock State Recreation Area – Plan of Management, NSW National Parks & Wildlife Service

NPWS(2003) Draft Fire Management Plan, NSW NPWS

NPWS (2002) Hunter Region Pest Strategy, NSW NPWS

NPWS (2004) Draft NSW Threat Abatement Plan – Invasion of Native Plant communities by bitou bush/boneseed (*Chrysanthemoides monilifera*), Department of Environment and Conservation

NPWS (2005) Bush Regeneration Plan for Glenrock SCA and Awabakal NR, unpublished Department of Environment & Conservation

Winning, G (1998) Weed maps of Glenrock SRA & Awabakal NR, Unpublished report for the NPWS

Presenters details

Name: Mellesa Schroder (Senior Ranger – Pest Management – Hunter Region) Tiffany Knott (Ranger – Hunter Coast)
Organisation: Department of Environment and Conservation (National Parks & Wildlife)
Address:12b Teramby Road Nelson Bay
Phone: 49848200
Fax: 49815913
Mobile: 0429144879
Email:mel.schroder@environment.nsw.gov

13th Biennial Weeds Conference, Orange 20 – 22 Sep 2005.

Paper title:

"Conservation Volunteers role in weed control."

Paper prepared by John Fry Regional Manager Bathurst CVA office.
Submitted in conjunction with the delivery of a power point presentation for a workshop to be held on Sep 22 2005.

Conservation Volunteers Australia; background:

Conservation Volunteers Australia (CVA) founded in 1982, is Australia's leading practical conservation organization. CVA operates in all States and Territories and is both not for profit and non-political.

CVA core business is to enable volunteers to join well managed and enjoyable practical conservation projects across Australia. CVA also delivers a range of training courses and operates local and international nature based holidays.

Note:

This presentation is an overview of the role of various volunteer groups from a regional CVA perspective, and it does not necessarily represent the views of the CVA Board and Executive.

1. Weed management challenges in urban and semi rural bushland areas:

The majority of community volunteer weed control efforts are concentrated in urban and semi urban bushland and riparian areas with relatively high visitation rates. Like most of post colonial Australian landscapes, historically, these areas have been poorly managed and problems such as rising water tables – salinity, erosion, feral species and pollution need to be managed along with invasive weeds. Most of the weed focus is at the urban bushland interface where "weeds", defined as unwanted plants in a bushland location occur.

Public, business and industry perception of the problems can be a major inhibitor of progress in the restoration of bushland. Some see bushland as a fire hazard that is habitat for pest animals and dangerous native animals and insects, and accordingly offer no support for, or have no involvement in conservation work in these areas, except as a dumping area for garden cuttings or even household rubbish if no peer pressure or penalty notice is evident. Fear and ignorance need to be addressed before any progress can be made. The obvious benefits such as improved local micro climates, improved predator prey relationships, amenity value, soil and salinity control, water and air cleaning are not understood or, even worse, completely ignored.

A major component of weed removal and bushland restoration is public education of real values of these areas to the community and the minimal costs to tax and rate payers and industry once the area is stabilised. While the dollar costs of weeds to agricultural production is well documented, the real cost of weeds in urban areas is often overlooked or underestimated.

Even with local community support, lack council and agency support due to the prevailing political climates can also be a major inhibiting factor in managing bushland weeds. Bushland weeds are not generally seen as a great source of votes in most elections. If a particular broader environmental issue is favored by a vocal wider community group, bushland restoration and weed work can often be put on hold for a considerable time, and inevitably bushland restoration and weed removal costs will increase exponentially.

Adequate funding is often a major problem, when the local political, and or family priorities are moved from bushland to more familiar areas such as “roads, rates, rubbish, recreation, jobs, food, entertainment,” etc. Environmental grants have to cover a wide range of problems, and weed removal is often seen as the responsibility of individual land managers and not the job of agencies except in a regulatory and compliance role, so the weed problem can become an orphan passed form one agency the next, much to the frustration of community volunteers and trustees involved in weed management.

Response plans and ongoing management plans for the national weed problem are an ongoing moral or social obligation for local, state and federal agencies, in partnership with community groups and individuals. Agencies may have the capacity to place conditions of development consent on developments and land transfers involving bushland areas, but often choose not to, due to being seen as being over prescriptive or inhibiting development.

Pressure from developers responding to consumer demand is constant, and often a major factor in land disturbance, which often leads to weed infestations in urban and semi urban zones. Developer contributions to environmental restoration are often made in good faith, but can often be lost in a maze of agency revenue holding accounts and investments, and can be difficult to track, and may not be used for the intended purpose.

Previous site uses and upstream infestations can present many challenges to weed management bodies. Former industrial sites, public utilities sites and storage areas can harbor and spread weeds for many years because the sites may be polluted and dangerous or have development holdups such as rezoning or ownership disputes. These areas are a major challenge to weed management and need to be addressed at all levels of government.

Given the challenges to urban weed management and the ongoing hard work by volunteers, the overall situation is improving as government bodies respond to community requests. New research is indicating that weeds can be used to advantage in some areas, in pioneering degraded areas, adding biomass, and as protection for emerging plants. More discussion and trials are needed in this area along with existing control measures. With global factors such as climate change, the weed situation is set to change in the near future.

2. Overview of target weeds in Central West NSW:

Community conservation volunteers in the Central West and the Blue Mountains areas of NSW have a number of priority weeds in bushland areas that need constant work to hold at present rates of infestation. Currently there is little chance of reducing the weed densities in many bush remnants in catchments such as the Macquarie and Cox's rivers with the current levels of volunteers. However, good progress has been made in recent years with invasive weeds control in larger areas controlled by agencies that have weed control as part of their core business, such as Councils, National Parks and Wildlife, State Forests and Department of Lands that engage in large scale spraying programs. Some see high volume spray application as a great danger to the environment as Australia spends over $500 million on herbicides each year, more research is required to reduce spray the volumes entering the food chain.

Out of more than 50 weeds in the Upper Macquarie catchment, the weeds usually removed by volunteers by the cut and paint, stem injection or hand pulling methods are Willows, African Boxthorn, Blackberry, Gorse, Broom, Privet, Tree of Heaven, Tussock, Radiata, and various garden plant escapees. These weeds are often found in or at the edge of bush remnants and are readily spread by water, wind and animals. Many other bushland weeds are not controlled by volunteers as they require foliar spraying and volunteers generally do not use spray equipment. In sensitive bushland areas and endangered ecological communities, foliar spraying is not recommended due to the dangers of off target kills.

3. Recruiting community volunteers in weed management:

Conservation volunteers involved in bushland weed control come from many sections of the community, including interested urban residents, neighbours of busland, members of Landcare and Bushcare groups, fishing clubs, school and university groups, Green Reserve volunteers, service clubs, church groups, corporate and business groups.

Recruiting volunteers requires a detailed knowledge of the community and the project work, the experience and knowledge gains for the volunteers, and often requires time on logistical issues, advertising, health and safety, and maintaining databases. Many people volunteer for a number of reasons, including meeting like minded people, to gain practical experience after years of study and seeing new places.

4. Relationships with weed control contractors:

Volunteers generally do not directly compete with bushland weed control businesses, because of the level and complexity of the work performed. Contractors normally have agreed outputs and have highly specialized staff, equipment and personal protection. Volunteers often undertake target weed removal as opposed to broad scale bush regeneration which requires a deeper knowledge of plant biology and weed identification.

In some areas conservation volunteers work along bush regeneration contractors to boost the environmental outcomes, and the volunteers can gain valuable on the job training.

5. Community and business partnerships in weed work:

Business and incorporated bodies often sponsor volunteer work in weed management. Some examples are: “Revive our wetlands” – a 3 year CVA program sponsored by BHP Billiton involving 15 thousand volunteer days across Australia to restore natural and constructed wetlands in 10 priority locations and many other sites chosen by an expression of interest process. “Towards a Greener Future” - a CVA program sponsored by Boral and Landcare Australia Ltd to provide assistance to restore degraded areas involving bushland health and weed removal. “Making Tracks” a CVA walking track restoration program which engages volunteers to help minimize the impact of tracks on native vegetation, control weeds, and protect native habitat and promote environmental awareness.

Many local business also sponsor volunteer restoration work, more businesses are seeing this work as part of their social responsibility to local communities and staff are encouraged to volunteer on projects when possible.

6. Awareness and public profile of weed work:

General local media generated by regular volunteer activities is always a positive human interest story for the media. The volunteer stories are usually welcomed by the media, although weed removal work has to be enhanced by associated work such as tree planting, track work and native species work.

Some weed work can by reported on by association. An example may be a wild plant rescue volunteer day which involves planting natives to control weeds.

7. Outcomes:

There are thousands of volunteers groups involved in weed control across Australia, from small “pocket” urban bushland areas to vast areas of wilderness or desert involving volunteers on 2 week projects in remote areas. There are over 100 incorporated Landcare, Bushcare, Coastcare, Rangecare and Rivercare networks in New South Wales, and these networks can involve several groups and many bushland sites and farming properties. The time spent across Australia on weed bushland removal alone is almost to difficult to measure. In a typical month, nationally CVA removes 10ha of weeds, excluding projects which have extended distances between weed areas.

8. Safety and training:

Volunteer safety is CVA’s highest priority, and should be for all community volunteer groups. Weeding is generally perceived as a low risk activity, but the hazards are real and must be assessed accordingly. Anecdotal evidence suggests many minor accidents and serious near misses go unreported. As more volunteers are being attracted to bushland weed work, there is more obligation placed on volunteer coordinators to address safety issues.

Before any on ground work commences, all hazards should be identified and recorded, and the risks discussed with all volunteers. This is not a one off process as the risks can change as the work day evolves and new volunteers arrive on site.

CVA, being Australia’s largest practical volunteer organization has developed an ongoing internal safety culture since 1982. It is fair to say safety has come a long way since then. In response to many enquiries from community volunteer groups CVA has recently offered its safety systems to all volunteer groups across Australia.

“In Safe Hands” (IHS) is a safety toolkit specifically designed for volunteer groups. IHS is an inexpensive risk management package that trains volunteer managers to effectively manage on site hazards and argue for lower insurance premiums.

Bibliography:

Bush Regeneration. R. Buchanan.

Save The Bush Toolkit. Greening Australia.

Ecological Status of the Upper Macquarie River. D.Goldney.

Burrendong Land management Program. NSW Agriculture.

Feral Future. T. Lowe.

Weeds of National Significance. J. Thorp.

State of the Environment Australia. Dept of Environment.

www.weeds.org

www.conservationvolunteers.org.au

Biography:
John Anthony Fry, born in Bathurst 1954, Graduated CSU 1985. Regional Manager for Conservation Volunteers Australia Bathurst office, 7 years including 4 years of supervision of the Regional Bushcare Facilitator. 6 years Bathurst City Council in civil engineering, 6 years project manager Evans Shire Council including NHT Envirofund Landcare and Bushcare on ground project manager. Practical conservation worker for 25 years, Founding member Peel Landcare, member of Greening Bathurst, Macquarie Rivercare, Bathurst Vegetation plan forum, Yerranderie management committee.

Author details:
John Fry; Regional Manager for Conservation Volunteers Australia Bathurst.
Bassett House
193 George St
BATHURST NSW 2795
Ph: (02) 6331 7711
Fax: (02) 6331 7744
Mob: 0404 828 923
email: jfry@cva.org.au

Weed Management and Control – the Whole Picture

HLA – Envirosciences Pty Limited
P O Box 3148 Singleton NSW
Dee Murdoch – Senior Rehabilitation Scientist

Overview

- HLA-Envirosciences
- "Time spent in reconnaissance is rarely wasted"
- Use of Palm Pilot and weed management
- Case studies

HLA –Envirosciences

- Environmental and OHS based consultancy
- 170 staff, offices nation wide
- Staff owned, Australian company
- Paper based on work of Hunter based projects

Planning – the key to success

- Where – define the project area
- What – WON's ,noxious, and environmental
- How - physical, chemical , biological and
- Why – agricultural , social , environmental, aesthetic

Timing of control strategies

- Know your plant
- When does it flower fruit and seed
- When will it be practical to undertake control
- Align this info to the Plan

Annual Works Schedule's

- What to control
- How to control
- When to control
- Constraints e.g. with holding times
- Budget

Information is power

- Always check registration of herbicides before recommending / using them
- Use the www e.g Pestgenie
- Check the MSDS
- What are the alternatives to herbicides
- Monitoring

Reporting

- Update on legislation
- Review of health and safety plan and risk assessments
- Stakeholder consultation
- Provide overview of on ground works
- What worked, what didn't
- New control techniques
- Monitoring
- Works schedule for the next time frame

Palm Pilot and Monitoring

- Rapid assessment tool
- Recording weed distribution and densities in the field
- Used on projects for Defence, power generation industry, mining and catchment weed mapping projects
- The HLA mapping approach has been integrated into a digital palm pilot mapping system, which is called "HLA Weed Mapping".

The system includes:

- Data entry and mapping capability for weed distribution;
- Weed control; and
- Weed monitoring.

Case Studies

1. **National Guidelines for the Management of Feral Animals, Weeds and Overabundant Native Species**
    - Where
        - National – Department of Defence
    - What
        - Framework for minimising the risk from new species;
        - Framework for managing established species by the preparation and implementation of Site-Specific Management Plans;
        - Includes stakeholder consultation, communications, monitoring and evaluation and review mechanisms
    - How
        - Based on an extensive literature review and site user survey
    - Why
        - Ensure the consistent and sustainable management of FWOS using best practice approaches on the Defence Estate

2. **Biological Control for Pear species**
    - Where
        - Warkworth Sands – Hunter Valley
        - Department of Defence land
    - What
        - Prickly Pear

- Creeping Pear
- Tiger Pear

- How
  - Biological control
  - Steamwand®
- Why
  - Movement of herbicide through soil
  - Non target impact
  - Large populations and biological control offer cost effective and sustainable approach

3. Singleton Military Area

- Where
  - Singleton Military Area – Largest unreserved tract of native vegetation in the Hunter valley used as active military training area
- What
  - Three year contract for on ground works, monitoring and reporting
- How
  - Annual Works Schedule compiled in May of each year
  - Seasonal priorities
  - Emergency actions
  - Linked to GIS – incorporating threatened species, heritage, topography, military context and vegetation communities
- Why
  - Ensuring Defence training capability of military personnel whilst aligning to industry best practice for land management

Project Health and Safety Plan

- Prepared to manage the health and safety of HLA personnel and subcontractors involved in weed management and control
- Focuses on the risks and control measures

4. Eraring Energy and Blackberry

- Where
  - Eraring Energy – Lake Macquarie
- What
  - Blackberry, rabbits and foxes
- How
  - Weed control to eradicate feral species habitat
  - Baiting using Pindone and 1080
- Why
  - Reduce erosion and weed seed spread
  - Reduce negative impact on small mammals from foxes
  - Management of *Tetratheca juncea*

5. Galenia in Post mining rehabilitation

- Where
  - Open cut coal mines – Hunter Valley
- What
  - *Galenia pubescens*
- How
  - Boom and spot spraying using Grazon DS and Glyphosate
- Why
  - Profound impact on mine site rehab especially pasture

The Future

- Australia has 2 800 foreign weeds
- Weeds cost us $4 billion each year
- In contrast salinity costs only $ 0.2 billion
- As an industry we need innovative, smart and sustainable approaches to weed management and control
- This HLA paper has provided a glimpse of projects we are working and we thank you for this opportunity to share our knowledge and experiences

This HLA paper has provided a glimpse of projects we are working on and we thank you for this opportunity to share our knowledge and experiences

Author details
Name: Dee Murdoch
Organisation: HLA-Envirosciences Pty Ltd
Address: P O BOX 3148 Singleton
Phone:0265712822 Fax 0265712959
Mobile:0408489689
Email:dmurdoch@hla-enviro.com.au

Where are we now and where are we going?

Peter Scott, Diploma of Land Management
Senior Weeds Officer
Liverpool Plains Shire Council

Background

At the past three biennial conferences, I have heard many interesting papers delivered and opinions expressed. At the time of delivery they can be quite absorbing, but it is not until later that they become a source of positive or negative stimulus. Revisiting papers to access information is when I have gleaned most. Initial perceptions provoke and stimulate the thought processes, and combining additional knowledge with a few years of relevant experience tends to create questions. This has resulted in my search for explanations to persistent and puzzling situations that continually emerge.

Whilst framing this paper I have been mindful of the two-page document *About NSW Department of Primary Industries* 2005 (www.dpi.nsw.gov.au) and in particular, comments involving history, visions and the responsibilities implied.

The release of the *Economic Impact of Weeds in Australia* (Sinden et al. 2004) is without a doubt a defining moment and a beginning for a new focus on *Weeds The Real Cost*.

A review of the broader management and co-ordination of noxious weeds control in NSW (the Gledhill report) was initiated by Minister McDonald in early 2003. What part did the Department of Primary Industries (formerly NSW Agriculture) play in compiling the final report? (released July 2005) Some of the collated information may have been a useful starting point and indicator, had it been available to the public prior to revision of the Noxious Weeds Act. Many submissions were tendered to minimize ambiguity and confusion, endeavouring to make it more relevant.

Where does our Department stand on unifying or standardising noxious weeds lists, not just locally and within New South Wales but nationally too? Weeds don't know about Local Government boundary lines on maps, or the confusion and inconsistencies they create. Robert Gledhill was mindful of this. If a weed is a problem, Local Control Authorities should be able to deal with it irrespectively.

Weeds not formally on lists as noxious weeds appear as major environmental projects in specific areas, attracting large amounts of funding.

Our Department offered funds for unspecified projects not previously submitted. Should they take a more proactive leadership role and place other prioritised projects ahead of those previously submitted, including a Weeds of National Significance (WONS) project, which did not receive funding? Should they take a more proactive approach to obtain available funds, not just cut and divide to fit some projects? In other words a shifting of the goal posts?

Where are we now, and where are we going?

The question is, where do the various bureaucrats and their advisors really stand on many of the issues Noxious Weeds Officers are faced with everyday? Where better to ask questions than at a Biennial Noxious Weeds Conference, provided by our Department, run by weeds officers for weeds officers? Someone will have answers, an opportunity for all.

This is just some of the mix motivating me to put pen to paper for your consideration.

My intention is to provoke and stimulate healthy, positive discussion founded on science and fact, leading to tangible resolutions. This may take us out of our present comfort zones to challenge, confront and resolve some issues.

I have an extensive farming and grazing background, with experience in intensive livestock production and flood irrigation. This has now been capped by six years as a Noxious Weeds Inspector, in which time I have been involved with several successful court action outcomes. Like many of my peers attending here, I have recently attained my Diploma In Land Management to assist me in my role as a Noxious Weeds Inspector.

I support the vision statement that provides "an emphasis on delivering front line services" by "providing a stronger voice for primary industries in Government decision-making by leading an informed debate on primary industry issues." *About Our Sector*, DPI Handout (2005). Where would we go for answers if the Department was not available?

Documentation - As It Stands

We have confusion because several weed lists exist. Included are Noxious Weeds, a list of twenty WONS weeds. There are additional lists of Aquatic Weeds, Pasture Weeds, Crop Weeds, Woody Weeds, the all-inclusive Environmental Weeds plus a Key Threatening Process list, Environment Australia Alert list and soon an Invasive Native Species list.

The significance of weeds listed as Noxious can be lost within the various lists and categories. They can at times be seen to diminish or expand in importance, depending on the circumstance of the discussion. The Noxious Weeds list clearly is dysfunctional and its ideals are fraught with inconsistencies. Given an 1852 premiss, its relevance is brought into question today.

As weeds officers, more and more is being asked of us. The public expects us to take an increasingly prominent and proactive role in dealing with "other weeds" outside our core business. The lack of consistency and coordination is a major issue. The public remains confused. I understand that the Australian Weeds Committee (AWC) has recognised this and is putting together a working group to review and amalgamate the lists. Our Department will have a seat on this group. This may bring a new common standard for the industry to follow.

Consider the theme of this, the 13th Biennial Noxious Weeds Conference: *Weeds The Real Cost.* Consider also the paper titles and content of the past three Biennial Noxious Weeds conferences. Is it a coincidence that an increased number are more general and all encompassing of WEEDS, not just specifically Noxious Weeds?

Mr. Ian McDonald, MLC, New South Wales Minister for Primary Industries states in his opening comment in the *Department of Primary Industry Noxious Weed Handbook for Councils and Councillors*, "Weed management is without a doubt one of the major environmental challenges facing Australia today." With a little help from our Department colleagues, I hope we can convince his Cabinet and Treasury colleagues as well as some Councils, of this fact before it is too late.

Is it time to bring ALL WEEDS into focus?

Is it time to bring ALL WEEDS into focus to be dealt with on a scientific but locally prioritised basis, with relevance to their location and impact?
A weed is a weed, regardless of where it occurs and what it impacts on.

- Should one category be considered in isolation without taking into account the presence of the other weeds?
- Should all the available funds be allocated much more liberally across broader categories of weeds, not just Noxious, but WONS, and Environmental weeds etc?

Dollars are available from various sources for some categories or projects but not others. Funding occurs in a piecemeal manner with little funding for follow-up works at times.

Major references for these questions are found in the publication *The Economic Impact Of Weeds In Australia* by the CRC for Australian Weed Management #8 (Sinden et al 2004). This detailed, in-depth and highly acclaimed study provides credible information that could well be the basis to establish direction for new actions in weed control.

The authors acknowledge the enormous localised impact and value of volunteer labour injected into projects to control weeds. These numerous groups are passionate, very energetic, genuinely well intentioned and spread across the broader spectrum of the community profile. They, as a group and as individuals, firmly believe their efforts are justified and will make a difference. This positive attitude is an asset to be harnessed. It is sincere, well founded and should be applauded.

However, as described by Dr John Stockard (March 2003), their efforts can be ineffective and wasteful unless securely placed within framework of a wider workable strategy that effectively delivers monitoring with response and maintenance actions. He also lists as a barrier to success that, within a control program, unskilled control efforts can “open up for invasion” threatened communities at risk, by species successors.

The continued support, involvement and participation of these groups should however remain a high priority and be retained as an integral component in any credible strategy. Even with the best of intentions they should not be isolated and expected to undertake or be relied on for weed control.

Who is better situated to oversee and coordinate any such future action?

Is it to be our Department of Primary Industries? There is, however, a considerable list of possible contenders including: the newly formed Catchment Management Authorities, Department of Infrastructure Planning and Natural Resources, or an arm of The Co-operative Research Centre, Rural Lands Protection Boards, Landcare, Australian Weed Committee or do we just leave it to Local Government and Noxious Weed Authorities? They all have an eye on “Weeds and the real cost”.

Caution- Would any change be necessary, an advantage or just be a duplication of existing bureaucracy, and any paralysis within?

Answer- I suggest that not any one single entity is the answer but a composite system of interacting organizations within a strategic framework with our DPI and the LCAs prominent.

Weeds, Cost, Impact.

Sinden et al (2004 p 39) in *The Economic Impact of Weeds in Australia* state that:

> "Weeds clearly lead to significant adverse impacts for the community, but so do many other issues of resource management. Consider the impact of three kinds of land degradation namely salinity, sodicity and acidity (see table 8.1). According to Hajkowicz and Young (2002), acidity and sodicity are more serious immediate problems than salinity, although salinity is much more likely to cause off-site or external effects. Further, salinity may increase more rapidly than other forms of land degradation.
>
> **Weeds have a higher impact at the farm gate than any of these three kinds of land degradation.** The lowest estimate of the net impact of weeds ($3,442m) is an order of magnitude higher than the gross estimates at farm gate given for salinity ($187m), acidity ($1,585m) or sodicity ($1,035m). When all other possible impacts are added in, the highest cost of salinity ($3,500m) is equal to the lowest for weeds. But the salinity estimate includes the multiplier and secondary effects of lost business that are explicitly excluded from the weeds estimate because a portion of these impacts may not be true net impacts for the community as a whole."

Table 8.1 Opportunity costs and financial costs of other resource management issues. **(**Sinden et al p.40)

Issues and Impacts	**Annual Costs**	**Year**
Dryland Salinity		
Lost agricultural production	130m	Undated
Lost agricultural production: gross farm gate value	187m	1996/97
Lost agricultural production: net farm gate value	200m	2003
Lost agricultural production, environmental damage	1b	2001
Lost agricultural production, costs of control, lost business	3.5b	2002
Infrastructure and water quality damage	700m	2020
Infrastructure damage	100m	Undated
Sodicity	**Annual Cost**	**Year**
Lost agricultural production: gross farm gate benefit	1035m	1996/97
Soil acidity		
Lost agricultural production: gross farm gate value	$300	2001
Lost agricultural production: gross farm gate benefit	$1585m	1996/97

The changing landscape and land use.

Dr Rachel McFayden, Chief Executive of the Australian Weed Management CRC, is quoted as saying that

> "The eight worst weeds in Australia have already taken over 20 million hectares of countryside, despite strenuous efforts and huge expense to control them. The bad news is that we are finding 20 new weeds established in the wild every year - things that have escaped from peoples' gardens, ponds or aquariums. So without a national effort the problem is likely to worsen exponentially." (Rural Roundup in *The Quirindi Advocate* 13.7.2005)

The ever-expanding number of hobby and lifestyle blocks in existence, along with neglected or unoccupied holdings, is having a far greater influence than realised on "expected compliance outcomes" of inspection programs. These properties, both big and small, all have neighbours.

Lack of control and weed spread on many of these properties is a major de-motivator that can subside into apathy for those who would otherwise control their weeds. This is not to be understated as it can be interpreted as a double or corrupt standard.

Local Control Authorities may find enforcement difficult when they are not able to or do not control noxious weeds in areas of their own responsibility. This situation is also heightened but not always understood when the very obvious Public Lands: State Rail line corridors, State Forests, National Parks and Crown Land Reserves are seen to be or appear to be and are non-compliant. If misleading or inaccurate press articles appear, incorrectly describing this, an official response is warranted to rectify any misrepresentation put forward. An example of this occurred in the Country Leader (May 2, 2005), regarding Lantana in Dorrigo National Park.

> "There is also a strong expectation among local control authorities and the community that public authorities will control weeds on their land as an example for private landholders." (Cummins and Mooney 2001)

Has the public's stance and perception of weeds within the environment been grossly underestimated by authorities? The mood of the community at large demands that weeds be dealt with and relegated to far less dominance on the landscape. That is to say weeds in general. The distinctions are rarely considered or understood and this is why we have so many community-based volunteer groups establishing themselves to deal with and control non-noxious weeds.

> "The absence of compliance as a prerequisite for the successful strategy outcome of weed control plans renders them less valuable, approaching useless. " (Stockard 2003)

Public Perception

Perception is reality but reality is not always perceived.

Dr John Stockard also states that

> "Many planners, 'enforcers' (and politicians) believe the public won't cop 'compulsory', and will 'buck' at attempts to be guided in the management of private property. A minority of users consider "property rights' under siege. However many [I would insist "Most"] landowners lament, lack of enforcement when they suffer infestations from their neighbours' weeds.
>
> Meanwhile, public roadsides, waterways, reserves, recreation and remaining 'pristine' areas are being smothered. Even in 'easy' cases like the manageable urban block that impacts surrounding natural areas, where weed control and control authorities could easily assert, 'That plant is weedy and has potential to affect rural and natural areas. You can't have it', - enforcement isn't attempted. The culture prevails, the excuse that 'community education and awareness' achieves the best outcomes. So why isn't it working? Awareness is an ancillary, back-up tactic, a follow-up method for achieving long term and widespread awareness that enables maintenance. It will not be the force that brings weeds under manageable proportions.
>
> The bold step of making compliance possible is fundamental. The means by which action can take place, economically and physically, needs to be provided. (Stockard 2003)

Dr John Stockard's above statement is an accurate perception of "The culture underlying weed control". We need supportive and enforceable legislation with real teeth to recognise this and reflect standards at least equal to current EPA and Fishing offences.

Direction, what is happening?

Understandably and justifiably, as a government to LCA conduit, our Department of Primary Industries is keen for Local Control Authorities to achieve high levels of noxious weed inspections and compliance, insisting we measure, document and "report on all aspects of our performance, (including environmental and social outcomes)." (McDonald, *DPI Noxious Weed Handbook*)

They offer and help provide high-quality, well-delivered information through staff education and training. All this to prepare us, as well-meaning, inspired noxious weed inspectors, to uphold and enforce the act. To deliver effective outcomes, we need more than this.

Local Control Authorities need a consistent support ethic and culture from across the state in all local councils at both the executive and elected levels, but this is not always found. This is clearly an area of shared responsibility and should receive more focus. More support is needed to enable weed officers and Local Control Authorities to effectively complete actions involved to achieve compliance. Support is needed by expert witnesses of high standing to easily refute and contest what seems to be very thin evidence of compliance. If our Department has a policy and a position on this, there could be no better opportunity than now, at conference, to hear an explanation.

In the recent court case Merriwa vs.Castlebar Holdings 2003, clearly the evidence offered and accepted in court has no basis in science. It is not found in written material endorsed or provided by our provider of independent scientific information, our Department. One element of an integrated control program (i.e. Just fertilizer) used in isolation within a strategy does not constitute, "fully and continuously." In fact if the solution offered to and accepted by the court as compliance for the control of St John's Wort (*Hypericum perforatum L*) was so simple, why did St John's Wort ever become a problem at all or remain so today?

A technical difference or is a new approach needed?

Speculate on the outcome if an alleged offence was heard and proven in the Land and Environment Court under the environmental protection laws. The distinction between a septic tank discharge/overflow to that of an uncontrolled noxious weed infestation impacting on a neighbouring property is separated in law. Clearly both situations are an assault on the environment.

There are numerous court actions and precedents to quote regarding pollution prosecutions. I am not playing down pollution as the EPA views it. An uncontrolled noxious weed incursion into the environment at large does not dilute with time nor can it be measured in "half life" terms. To the contrary, scientifically this has long lasting and far-reaching implications on the environment. These offences should be viewed and dealt with more equitably.

Analogy: Grasshoppers and rabbit plague - Noxious weeds.

During the recent grasshopper plague, the contribution by our Department officers and Rural Lands Protection Board staff involved, is and was without question of significant value in combating the outbreak. Fortunately the same psyche and strategy from our Department in relation to noxious weeds, was not applied to this situation; that is, it's too big and widespread a problem (let 'em go). Take it off the list and let's not confront the situation, it will go away - Too Harsh? I think not.

How about the "Old Days" with the rabbit plague - was it too big a problem to solve? Just as well that line of thinking didn't get the sway and that both pests remained listed, officially recognising them as problems, for scientific work to continue and ultimately to find a remedy. The enormity and success of the tuberculosis and brucellosis eradication programs are also not to be overlooked.

Where are we going with this?

What happens if say 50% (or any number) of noxious weeds are relegated to wherever, or just taken off the list? They just don't go away and disappear.

In the real world of, "off the noxious weed list"**,** who would notice them, oversee, advise on or indeed undertake meaningful control? This can only lead to "compound" environmental degradation. I seriously challenge, "just let it find its natural range" (extent). What possible positive impact or advantage could this have, and where does this strategy fit in the overall picture of conservation in the environment?

Is it a Prediction? - Beyond all reasonable doubt.

Caution should be exercised during any review or dismantling of the noxious weed list. The action may well be likened to our predecessors allowing the likes of: lippia (*Phyla nodiflora* L, Greene), galenia (*pubescens*), Coolatai grass (*hirta* L), willows (*Salix spp*) camphor laurel trees (*Cinnamomum camphora*(L) Nees), oleander (*Nerium oleander*), privet (*Ligustrum lucidum Ation* & *Ligustrum sinense lour*) and cane toads, to mention a few of the more common ones. This is not a legacy I care to be credited with, as emanating from "on my watch". With an introduced species can we be absolutely sure? We list some now sight unseen. Where do they stop? They just don't extinguish themselves. The question by the CRC remains," What kind of Australia do you want to leave to your children?"

The time delay to list a noxious weed, re-list or indeed upgrade a list is a compelling disincentive not to participate in or contemplate any of these activities or ideals. In cases of seeking change to or for a listing and no new science is introduced into the debate, why delay? Meeting the criteria can be a hindrance and/or a contradiction, eg lippia, Espartillo (*Achnatherum caudatum*) and Olive (*Olea europaea, Leucaena L. leucocephala*)

- Upper Hunter Green Cestrum (*Cestrum parqui L`Her*.) W3 to W2 took 13 months.
- New England Weed Authority to have Privet listed took 12 months.

Mechanisms within the new proposed Noxious Weed Act should take care of these delays.

Blackmore (2004) "It is agreed the free market doesn't and won't work through common law for the control of weeds. Nor does the ideal of a level playing field even exist."

The corner stone, or in fact the only conceivable starting point, for weed control is through strong enforceable legislation. Having a weed on a list is only a means to an end. Declaration on its own has never killed a weed, but taking a weed "Off" is opening the gate, a beginning to not achieving or maintaining satisfactory control and ultimately ensuring our inability to manage them.

Weighing Up the Actions.

> "If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason [I say "excuse"] for postponing measures to prevent environmental degradation." (Stockard, 2003)

This has been recognized in the proposed new legislation and should apply in less urgent situations too. JUST DO IT. Assess the situation and progress from a controlled position. A small but calculated amount of collateral damage may be a very realistic small price to pay for a long term greater benefit to the environment and wider community. Let's not fiddle while Rome burns. The historical option of doing "nothing" is not an acceptable activity and one that has never been costed or measured, but alarming images emerge.

With hindsight.

Hindsight is a most exacting science, so let's continue to use it with foresight as happens now when justifiably listing sight unseen species on scientific and historic premiss, that is, plants that don't have an Australian passport.

> As reported in the CRC Newsletter *Weedwatch*, "Dr Rachel McFayden, CEO, has congratulated the Australian Government and Biodiversity Australia for a recent decision to ban 3335 species of plants that are known weeds from entering Australia … The second stage, which has been promised by the federal government, will be to remove all genera (groups of species) from the permitted list, which currently allows the un-assessed entry of 125,000 species of plants."
>
> Instead of waiting to see if new invaders cause harm, which may lead to a declaration being made too late to be effective, such as Nodding Thistle in New South Wales (Carter, 2000), it may be of value to apply the precautionary principle to potentially invasive species. A modification of this principle, as expressed in the National Weed Strategy (anon., 1999) might be [and most of us agree with the following] "It is better to erroneously declare noxious, a weed that might confer a net benefit than to erroneously fail to declare a weed that might confer a net burden to agriculture, the environment or to human health". Intervention to control new infestations at the earliest possible stage is more likely to produce a successful outcome than waiting to see if the weed species does in reality cause problems. (Moore 1975; Hobbs & Humphries, 1995 in Blackmore, 2004)

The proposed new legislation is designed to address this situation.

The question of funding won't go away.

Yes the systems are different but consider State funding and expenditure for 2001-2002: Our smaller sister state Victoria $14.5 million dollars, QLD $26.8 million dollars and New South Wales $19.8 million dollars. (Sinden et al 2004)

Conclusion: Currently expenditure is somewhere between nothing and what could be easily justified, but nowhere near what should be spent. We need to focus on the real cost.

> The cost of controlling weeds for our agricultural industries alone is in excess of $4 billion each year nation wide not including the impact on biodiversity, landscapes, tourism, water resources and other industries. This cost is equivalent to building 1000 new primary schools, more than 400 district hospitals or 1500 new nursing homes each year. ('Killing Us Softly-Australia's Green Stalkers' 2004. *CRC for Australian Weed Management.)*

This opportunity cost analysis is alarming to the extreme, presenting compelling argument and justification for the mobilisation of a great deal more capital to give the issue more focus, priority and the prominence it deserves.

Why is this not happening? Preaching to the converted is not progressing this cause. We need to find an effective spin-doctor and to utilise an alternative vehicle to get the message outside the square, possibly within an environmental parameter.

Historically, local government has had an undeniable and a legally binding responsibility for noxious weeds. It is blatantly obvious some have not always shouldered this obligation, with obvious detriment to their community and the environment. However, in recent years we have seen our Department accused of supporting the major National Sport: cost shifting and the sharing of responsibilities. This has been acknowledged and highlighted by several elected members of the New South Wales Legislative Assembly. (Hansard 19/11/2004 page 13251.)

The claim that, “funding arrangements haven’t changed” would not stand audit. There is a history of funds previously being available, within guideline material supplied to obtain them. It is hard to explain the outcome of the last round of funding disbursement results as nothing but goal shifting or more accurately goal dismantling. Local Control Authorities and Local Governments are justifiably disappointed and disillusioned by the continued division of the available funds.

It is time to radically review the rationale behind the current model for funding. However, this model would NOT serve all purposes, nor be more workable or equitable.

- For example, zero dollars from the New South Wales Government.

- Should we let Local Government or RLPBs find all the necessary dollars?

- The NSW Government could insist local government embrace rate rises or environmental levies outside of the pegged rates as now, for example the Hastings Environmental and Community Infrastructure levy.

- What would be gained?

- New South Wales government could shift total responsibility (saving dollars) to local government or RLPBs along with any political flack and do away with the necessity of compliance.

- With a completely uncoordinated and fragmented strategy in place state wide, there would be no need for centralised input.

- If we were to dismantle this section of the Department of Primary Industries? Look at the dollars to be saved there!

- Some of these elements may have appeal, for a variety of reasons, but NO, realistically, “weeds are a major environmental problem”, as both Minister McDonald and Dr McFayden endorse. It is time for all of the community to embrace this.

Reality Check

Without question I acknowledge the years of leadership our Department of Primary Industries specialists have provided. I for one look to an independent but publicly accessible Department of Primary Industries to acknowledge the enormity of the weed problem, not to just concur. The weed control industry is seriously looking for and in need of forthright cohesive high profiled voice and leadership. It is in much need of a major realignment, within environmental parameters, not just allowed to be downgraded, slip away or swept under the carpet. Our Department is best placed and equipped scientifically to help develop cases, and the lobby material necessary for research funds to be raised for “problem weeds”. In particular those identified that can’t be readily controlled.

> “Weed control and weed management should not be confused with each other. Weed control is the killing of a population of weeds, while management includes strategies for prevention of reproduction, reducing re-establishment and minimising competition (Zimdahl, 1991). Integrated weed or pest management is generally a term for a wider pest management not focusing on a single species. They all contain two key elements.
> 1. The use of multiple control tactics.
> 2. The integration of knowledge of pest biology into the management system. (Buhler et al 2000)
> Weeds are highly responsive to changes in the environment. (Storrie 2001.)

The Problem and a Solution should not be distorted or confused one with the other.

The problem has been clearly quantified and mapped (Sinden et al 2004). Let's not deny the enormity of this or downgrade it to fit the dollar funds allocated by removing weeds from lists or by reviewing the criteria potency.

Consider the team we already have in place and the opposition we face.
I am confident an effective strategy can be developed and a workable solution offered to address the problem within the existing framework, possibly as follows:

1. List- scientifically all weeds. DPI – independent and scientific expert staff to say "Weed" or not. (Justification – its 5 o'clock somewhere.) AWC may have the answer.

2. Obvious national, state and local weeds to include regional weeds of significance and concern. Priority generated locally.

3. The overriding governance and scientific guidance (fact sheet material) would come from DPI officers, or material endorsed by them. We have a wealth of respected knowledge to call on, vested in our on ground professional staff.

4. Local Government LCAs to facilitate and develop partnerships to oversee, co-ordinate ALL roadside and VCL control. Including all works and weed efforts of volunteer working groups. (local ownership and responsibility.)

5. Local Government and LCA to work with local Regional Advisory Committees (as we do now). Possibly include Catchment Management Authority boundaries.

Question- Who better to execute the actions?

Answer- An expanded and adequately resourced Local Control Authority structure.

Expanded funding: Significantly greater than currently. Refer: CRC rationale and that of its CEO Dr McFadyen and that of Minister McDonald.

Invasive plants are unquestionably the most devastating and costly environmental problem we face. They add over $4 billion dollars to the price of our food and they are causing absolute havoc in our National parks, river systems and native bush. (McFayden in Rural Roundup, *Quirindi Advocate* 13.7.2005)

These costs emphatically impact on all Australians.

All tax and ratepayers will expect to bear some of the cost burden one way or another, as we are all net beneficiaries.

The debate can only be over who pays what proportion and who is accountable? The funding will also need to cover more on-ground qualified staff, their continued training plus the control costs of public lands and many specific project areas.

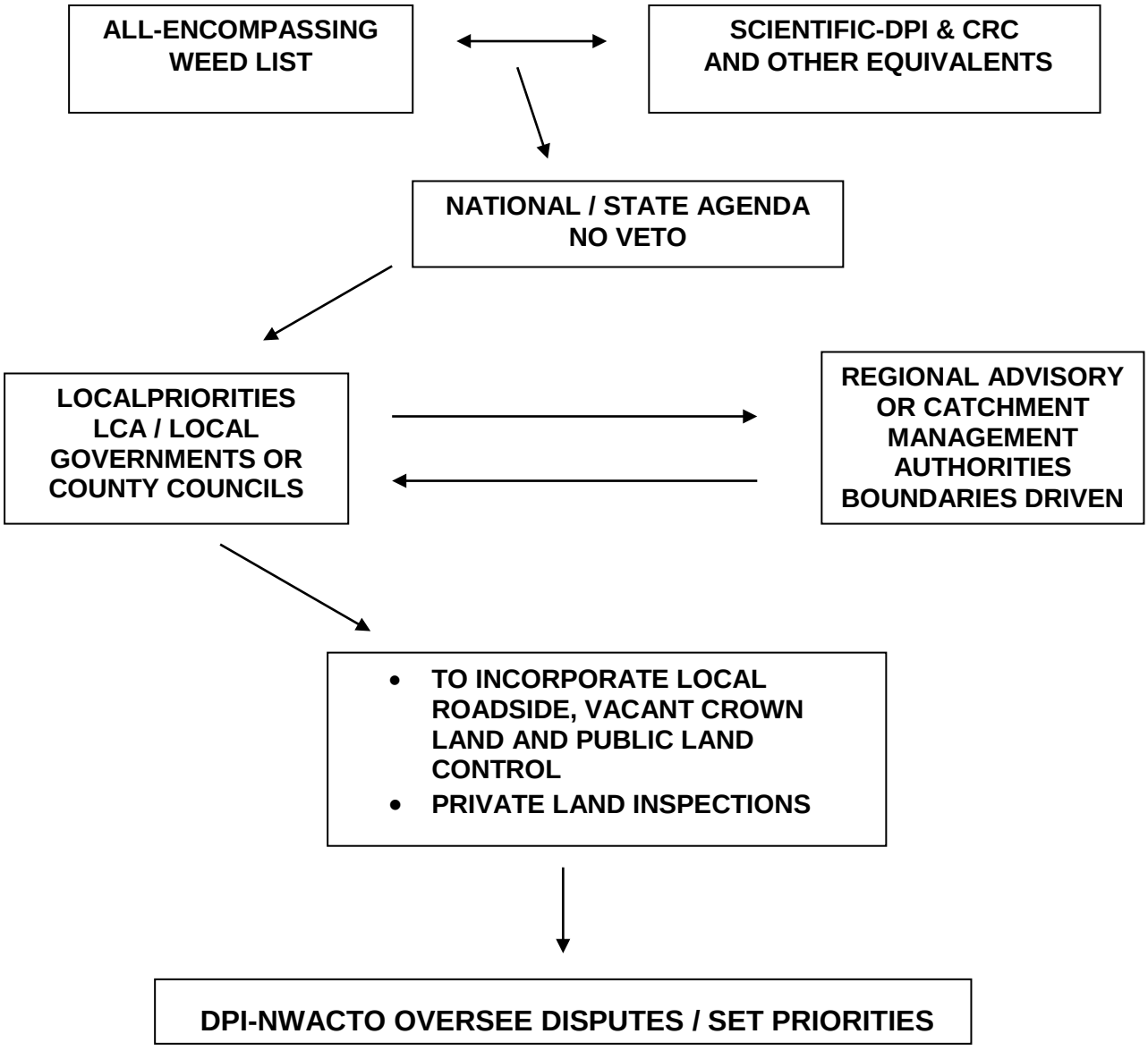
Two levels of funding,

1. Federal and State Governments, as deemed appropriate to reflect and acknowledge broader environmental impact.

2. Local Government / regionally, needs prioritized. This would give local ownership and responsibility to the community at large by allowing funds to be raised locally through environmental levies eg, Hastings Environmental and Community Infrastructure Levy. Driven by local response.
   If corporate dollars can be attracted for projects these must remain transparent at all times eg, Chemical Companies or Mining interests, Individual bequests

   - Compliance - Not an "option" similar to environmental laws that exist now. With a reasonable expectation and timetable.
   - This model should and could still be overseen by NWAC or equivalent, but would need to be more responsive.

Keep It Simple **A workable model for discussion.** **(P. Scott 2005)**



Conclusion

I have already admitted to being influenced and motivated by others, but certainly by both Dr John Stockard and recollections of Dick Honeyman's paper 2001; I suggest them as a good read again. I was, however, taken with the Bob Phelps' words of wisdom and passed on by Dick as his closing comment:

To control noxious weeds you need three things, and they are:

1. The Method or Means.
2. The Money.
3. The Intent to do the program.

And if you have the INTENT you don't need as much of the other two.

With a more positive attitude and support for the team in place now and a belief in oneself, there is a great deal more to be done and achieved in our specific area of Noxious Weeds control. Just shortening the list is not the answer. A lot more genuine INTENT needs to be generated and fostered throughout all levels of the community before we can really move forward.

DISCLAIMER.

The views expressed in the above paper are those of the writer and do not necessarily convey those of the organization represented by the writer.

References

Blackmore, PJ 2004, *Noxious Weeds in NSW – History, Relevance and the Test for Noxiousness*

Cummins, EJ and Mooney RB 2001,

Hansard 19.11.2004 page 13251.

Honeyman, D 2001, *Changes in Weed Management Over the Last 30 Years*

Sinden, J, Jones, R, Hester, S, Odom, D, Kalisch, C, James, R and Cacho, O 2004, 'The Economic impact of weeds in Australia', *CRC for Australian Weed Management Technical Series #8*

Stockard, J 2003, *The Culture Underlying Weed Control*

Storrie, A 2001, *Integrated Weed Management*

McDonald, I NWAC and NSW DPI, *Noxious Weed Handbook for Councils and Councillors* www.bpinsw.gov.au

'Killing Us Softly - Australia's Green Stalkers', 2004 *CRC for Australian Weed Management.*

'Open door slams shut for 3000+ species', 2005 *CRC Weedwatch Newsletter*

About Our Sector, DPI Handout (2005)

Rural Roundup, *The Quirindi Advocate* 13.7.2005

Acknowledgements
Possibly never has a non-Department paper received so much scrutiny. I extend my thanks for the attention to detail given by Syd Lisle and Peter Gray. I also extend heartfelt thanks to colleagues and fellow Weeds Officers for their help and encouragement, especially Mike Whitney.

Noxious Weeds Control in the 20th Century

The Changing Role of Weeds Officers

Peter Gray
Regional Coordinator (Weeds)
NSW Department of Primary Industries, Dubbo

There has been a dramatic change in attitudes and commitment to noxious weed control in the last 30 years. Consequently the role of council weeds officers in the 1970s (20th century) was considerably different to what it is now in 2005 (21st century).

This is not to say that there were not some weeds officers in committed councils who played a leading role in the community in the 1970s but this paper will discuss the general situation.

State Government grant funding only started in 1962 with a total grant of $40,000 (converted from pounds to today's dollars). Calculated on the rates of annual inflation this would equate to a grant of $407,092 in 2003/04 as compared to an actual grant of $7,232,000 (Alan Maguire *pers. com.).*

In the 1970s quite a few councils did not employ a weeds officer and the Weed Schools, which preceded Biennial Noxious Weed Conferences, were attended by about 60 to 70 weds officers with very few, if any other people in attendance.

The first Biennial Noxious Weeds Conference was held in Wagga Wagga in1981 and since then they have grown to be a major event in the weed control calendar. NSW has led the way in putting on an event for people involved in noxious weed control and other states have since followed.

In general, many weeds officers received very little or no recognition in councils and most had not received any formal training. Often they were seen as a small step above labourers and were paid as such. A common practice was to employ weeds officers with rural experience. Usually job applications did not request any formal qualifications. Hence the term "**burr cutter**"

A city council overseer once said to me "the problem of getting weed sprayers is that for $5 a week less they can rake leaves in the park".. In another city council noxious weed inspections were the responsibility of the ordinance inspectors and a contractor was employed full time to spray noxious weeds. The weeds officer in one shire was selected from the tar gang, obviously the only person who wanted the job!

When a spray operator from another organisation was asked what spray rate did he use replied "one of that jam tin to the tank". He would have been a very credible witness in court!

One of the important roles of the then Department of Agriculture Field Officer(Weeds) was to provide informal on-the-job training for new weeds officers as there was usually no other staff in the council with any knowledge of noxious weeds.

Today weeds officers receive much greater recognition both within the council and in the community.

Noxious Weed Control in the 20th Century

Author;

Peter Gray
NSW Department of Primary Industries
PO Box 865, Dubbo. NSW 2830
ph 6881 1238
fax. 6881 1295
peter.gray@dpi.nsw.gov.au

Biography
Employed by DPI and its predecessors since 1973.Originally a self employed farmer and grazier in the northern tablelands. Appointed to Dubbo in !978 to work with local government in regard to their noxious weeds programs. Originally responsible for Western and Hunter, Central Coast and Metropolitan Regions and now responsible for the Macquarie, Lachlan and Far-West Regions.
A graduate of Farrer Memorial Agricultural High School and the University of New England.

Key Word Description

As a consequent of changing noxious weed awareness in the last twenty years the roles and responsibilities of council weeds officers has also changed.

Abstract

The commitment to noxious weed control has changed dramatically in the last 30 years. Consequently there has also been a very significant change in the roles and responsibilities of council weeds officers. The paper will look at what things were like in the past and will identify those aspects that have undergone a significant change with the result that council weeds officers have achieved a much mopre responsible and recognised role.

THE CHANGING ROLE OF WEED OFFICERS INTO THE 21ST CENTURY

INTRODUCTION

Personal Background

I was employed as Orange City Council's Noxious Weeds Inspector in December 1995. Like many Weed Officers across NSW I felt strongly I was given the role because of my background in farming even though I had horticultural qualifications. The job was advertised internally and the person I replaced worked on Council's noxious weeds program for 9 months of the year although that changed to 12 months when I took over. The preferred qualifications for the job were a TAFE Certificate of Trade or equivalent with two years work experience. The position also required one to have a Class 1A and 3B Driving Licence and a First Aid Certificate. The interview was very casual only lasting for about 10 minutes. I was given 3 weeds to identify, (got 2 right), and was asked how I would handle a difficult landholder. I answered "very nicely" and got the job. The previous inspector informed me I would have plenty of spare time in the job but somehow I think I must have missed something. Enforcing the NSW Bushfires Act went hand in hand with my new role.

I was soon introduced to neighbouring Weed Officers and attended my first regional meeting at Mudgee in February 1996. The Macquarie Valley Noxious Weeds Advisory Committee, as it was known then, was a very proactive committee led by a very passionate chairman, George Hammond. I also managed to meet some interesting characters from the then Department of Agriculture. Before I knew it I was wearing around a pair of purple tights and a giant weed costume. Of course one had to be rather animated to wear the famous Woody the Weed suit. Balance was also important especially when you were surrounded by a group of rowdy school children standing on Woody's big feet trying to push him over. On several occasions, when I was in this precarious situation, I often thought to myself, "Was wearing a bloody weed suit in my job description?" I wore the suit during weed buster weeks, to schools, at weed conferences, field days and all those other awareness raising venues. The suit was very cumbersome, hot and smelly. The suit came with ice packs. I didn't quiet work out where the ice packs went but if you had a good imagination I'm sure you could work it out. A fan was also supplied. After a more mature lady grabbed me on the behind whilst I was wearing the weed suit in Orange's main street, I decided it was time to hang it up.

Reason for Change

With the role of our Noxious Plant Advisory Officers, (NPAO), ever changing and evolving, local weed officers began to take on their roles. These roles included organising and running education, training and awareness programs, establishing regional plans, mapping, organising conferences, field days, liasing with the media and so on. As the saying goes **"*for weed officers by weed officers".*** Weed

Officers became more accountable for their noxious weed programs. They had to spend available funds wisely and endeavour to source other funding. They became managers.

The following examples illustrate some of the roles of weed officers into the 21st century.

- In 1997, to raise the awareness of the parthenium threat in NSW a Study Tour to central Queensland was organised by weed officers for weed officers and landholders. Several Department of Agriculture staff also took part in the tour which was very successful and reinforced what NSW Agriculture had been doing for some time. Weed officers actually took the awareness campaign to the next level by taking landholders and weed officers to the problem and showing them first hand. One to Grafton to study Giant Parramatta Grass, another to southern NSW, followed this trip and then in 2002 a second tour to Central Queensland to look at a variety of new control measures to tackle Parthenium. All these tours were extremely successful and were seen as important educational activities. LCAs, RLPBs and NSW Agriculture staff being allowed to participate in the tours illustrated this.

- Education and skills recognition has always been high on the agenda for Weed Officers. In 1998 the Macquarie Valley Weeds Advisory Committee succeeded in securing funding of $120,000 to implement an education and training program for weeds officers in the Macquarie and Lachlan Valleys. A training subcommittee, comprising of several Weed Officers and other stakeholders was established to develop a competency based training program. The aim of the program was to collate and acknowledge training and skills already acquired by the weed officers and identify any training needs. Weed officers then matched their skills and qualifications against learning outcomes using Recognition of Prior Learning and if they were judged to have enough experience and skills they were given credits toward their qualifications. The Weed Officers on the subcommittee formed a pilot group to see where they stood with their experience and training thus far. Any training needs were addressed and in 2000 members of the pilot group were presented with either Certificate II in Weed Control Operations or Certificate IV in Weed Control Practice. The program proved extremely successful with dozens of weed officers across NSW undertaking the training and achieving qualifications for their skills and experience. In 2002 members of the committee were invited to the National Weeds conference in Perth to give a presentation on the success of the training program. Their presentation, which was given in front of a national and international audience, received tremendous accolades. Not bad for ***"burr cutters".***

- Raising public awareness has and will always play an integral part in noxious weed management. If you can ram home the message that *noxious weeds are a real threat and can have a major impact on agriculture* that

would be more beneficial then doing umpteen inspections and putting property owners under notice. Today Television Advertising campaigns reaching tens of thousands of landholders are organised by Weed Officers targeting noxious weeds throughout NSW. Campaigns, which can run for up to 3 months, focus on noxious weeds in general and inform landholders if they have any weed issues to contact their local noxious weed inspector. The campaigns have been so successful that several Government agencies have now come on board. Events such as weed buster week, field days and visits to local schools and resources such as landholder calendars, posters and web sites all assist local weed officers in raising awareness of noxious weeds.

- The advent of Regional Weed Management plans has put pressure on Weed Officers to become managers. With limited funding available the plans need to be accurate and relevant with clear aims and objectives. The plans need to be reviewed regularly to achieve maximum funding, which needs to be directed in the right areas.

- The NSW Noxious Weed Officers Association, (Incorporated) has played an important role in Noxious Weed Management across NSW. The Association Executive is comprised of Weed Officers with the association having some 160 members. The Association played an integral part in the Education and Training Program and has established important relationships with the Local Government and Shires Association, the Environmental and Protection Authority and Tocal College.

- The Weed Officers of the 21st century need to be competent in a wide range of activities. We need to be technologically literate in the use of computers, mapping systems, digital cameras and spray units. We need to be able to email, download, burn to a CD, scan, and photocopy and give a PowerPoint presentation. Not bad for burr-cutters

My New Roles

In 2001 my role with Orange City Council changed dramatically with my title changing to Vegetation Coordinator. I found myself involved more with revegetation work rather than noxious weeds. My primary responsibility was the coordination and management of environmental and community groups. These groups carried out environmental and nuisance weed control and revegetation on Council land. Some of these groups also installed walking tracks and boardwalks, erected fences and implemented tree planting programs. The groups I coordinate include Conservation Volunteers Australia, Green Reserves, Green Corps, Work for the Dole, private environmental restoration groups and special needs groups. I was also responsible for organising and coordinating environmental community events such as National Tree Day. This shift in responsibility from noxious weed control to environmental rehabilitation encompassed the whole conservation and land management concept. If something was controlled and removed it was replaced with endemic species. In 2003 I was presented with a Diploma in

Conservation and Land Management, which slotted in nicely with my new role. An important facet of my new role is sourcing funding from different programs including Envirofund, NHT, CMAs and many other funding bodies. The majority of funding sought was for projects including willow control, riparian restoration and regeneration programs. There is a huge pool of funding out there for allocation to various environmental projects, millions of dollars in fact. It's a shame a similar amount is not available for noxious weed management.

A role, which I never dreamed of, was assisting in the organisation of this conference. As you can image a huge amount of work goes into organising such an event. We have been working on the conference for two years but it has been enjoyable and stressful at the same time. In the past the conferences were always organised by the Noxious Plant Advisory Officers but recently the reins were handed over to the LCAs and their relevant weed officers.

In conclusion the roles of weed officers are changing and evolving constantly. Weed Officers, or whatever your title may be, are a unique breed. One day we are out in the field spraying weeds, the next we are in the office applying for funding and the next we are addressing a group of landholders. The roles are varied and diverse and that is probably the attraction of the job. If weed officers are inclined to go to the next level their roles vary even more. No matter how big, or how small your role is you are playing an integral role in weed management across NSW.

Biography
Roger is employed as Orange City Council's Vegetation Coordinator having recently achieved a Diploma in Conservation and Land Management. One of his roles includes implementing Council's Noxious Weeds Program.

Author details
Name: Roger Smith
Organisation: Orange City Council
Address: PO Box 35, Orange NSW 2800

Evaluating success of the Weeds Training Program

A progress report

Jodie Bartlett-Taylor and Rebecca Spinks
Education Officers
NSW Department of Primary Industries

ABSTRACT

In 1998 the Noxious Weeds Advisory Committee (NWAC) approved a project submitted by the Macquarie Valley Weeds Advisory Committee for the development of a Weeds Officers Training and Education Program. The basis of the submission was to have a quality training system that would be nationally recognised.

As the Weeds Training Program has now been in place for five years, it is time to carry out an evaluation to measure the effectiveness and impact of the Program. This evaluation will concentrate on four levels: participant reaction from the training, skills and knowledge learned, transfer of new skills and behaviour into the workplace, and the impact of the training on noxious weed management across the state.

Overall, this is a progress report. It will discuss responses from surveys completed by NSW local council Weeds Officers and their supervisors.

At the time of this report, feedback from training sessions implied that weed officers enjoyed participation. In addition to survey responses the level-of-learning attained through participation was also gauged through the use of competency-based training tools. Survey results indicated that in some cases application of new skills into the workplace was restricted. Consultation with stakeholders will complete the final level of evaluation, specifically, changes in weed management.

INTRODUCTION

Together with Macquarie Valley Weeds Advisory Committee, CB Alexander Agricultural College 'Tocal' initiated an education and training program for local council weed managers in 2000. The Weeds Training and Education Program (the Training Program) provides pathways for Weeds Officers to achieve nationally recognised qualifications under the Conservation and Land Management (CLM) Training Package.

Objectives recorded as a part of the NWAC training strategy;

Outcome:

In five years time (June 2007) Local Control Authorities (LCA) in NSW have a skilled workforce implementing efficient and coordinated weed control programs making effective use of available resources.

Objective:

By June 2007, the skills base of noxious weed managers in NSW is enhanced with a minimum of 20% of LCA's employing at least one Weeds Officer with a qualification in CLM, Weeds of AQF5 or equivalent and a further 65% of LCA's employing at least one Weeds Officer with a minimum of AQF4 or equivalent.

Data collected from short course enrolment forms of Weeds Officers (Table 1) provides an indication of the academic level of those participating in the Training Program. However this is not a thorough assessment of all LCA weeds staff in NSW.

Table 1 – Academic level of LCA weeds staff

*Source: data collected through Weeds Training and Education Program (**89 LCA's** have participated)*

Level of qualification	**%**
At least one staff with minimum qualification of AQF V	56
At least one staff with minimum qualification of AQF IV	25

To further assess the success of the Training Program the following evaluation plan was developed. Based on a four-level model described by Donald Kirkpatrick (American Society for Training and Development) the evaluation included:

1. Evaluating reaction
2. Evaluating learning
3. Evaluating behaviour
4. Evaluating results.

The main stakeholders of the Training Program include: i) the participants; ii) their employers; iii) CB Alexander Agricultural College 'Tocal' (CBAAC); and iv) NSW DPI. Ideal outcomes of the evaluation are listed in Table 2.

Table 2 – Ideal outcomes of evaluation

Ideal situation	**Level of evaluation**	**Who**
Participants enjoy participating in the training program.	Reaction	CBAAC via Weeds Training Program
Participants gain knowledge and skills that are needed.	Learning	Weeds Officers
Participants apply skills and knowledge in their workplace.	Behaviour	Weeds Officers, Supervisors
Participants with their employers implement effective and efficient coordinated weed control programs.	Results	Weeds Officers. Supervisors, Council and NSW DPI

THE SURVEY

Table 2 identifies target groups for obtaining information necessary to form the evaluation. Two surveys were mailed out. One survey was written for Weeds Officers of local council and the other for their supervisors. These surveys focus on two areas, a) The Participants – what skills, knowledge and attitude they have gained from the training program? and b) Skills Transfer – are these skills and knowledge and attitude being implemented in the workplace?

Surveys were posted out to 201 Weeds Officers and 114 were returned, (giving a response rate of 57%). Surveys were also sent out to 137 supervisors with 53 returns, (giving a response rate of 39%). Maps showing the council areas that returned completed surveys are shown in Appendix 1 and 2.

Demographic information gathered from the Weeds Officer survey provides us with a clearer picture of those who responded to the survey, (Table 3). Just over half (53%) of responding Weeds Officers carry out a mixed role at their council. They are performing various tasks which include spraying, inspecting and administration duties.

Length of employment showed that there is almost an equal proportion of Weeds Officers in each group (Table 3). A slight majority of respondents have been employed as Weeds Officers for five years or less. There is also a large portion who have been employed as a Weeds Officer for 11 years or more.

Question 3 of the Weeds Officer survey asked officers *"What is the highest level of education you have achieved?"* this showed some pleasing results. Almost half of

respondents (47%) have achieved a qualification of Diploma or higher. This could be attributed to the initiation of the Training Program which encourages officers to achieve formal qualifications. It also could be a result of the program encouraging the employment of higher qualified officers.

The demographic results of this survey enable a generalised picture of a "typical" NSW council Weeds Officer to be generated. That person would have been employed in that position for five years or less, hold a Diploma level qualification or higher and perform a mixed role within their job.

Table 3 – Weeds Officer demographic results

	Grouped Responses	**Percentage**
Q1. Describe your job role	Operational	7%
	Mixed (operational, inspectorial and managerial)	53%
	Managerial	40%
Q2. Length employed	5years or less	39%
	6 – 10 years	25%
	11 years or more	37%
Q3. Highest level of education	School, TAFE, Trade	25%
	Certificate level	28%
	Diploma or higher	47%

LEVEL 1: REACTION

Reaction concentrates on customer satisfaction. It is evaluated after delivery of training workshops. Participants complete a reaction questionnaire at the end of all workshops delivered in the Training Program. Most questions on the reaction forms use a four-point scale multiple choice system. Although the design of these forms has varied over the years, they address four areas: i) course content; ii) instruction; iii) course materials; and iv) an overall assessment of the course. A snap-shot summary of three courses that have been delivered are summarised in Table 4a and 4b.

Table 4a – Responses from participant reaction sheets (a four-point scale response) for Legal training stage 2 and Biological control of weeds

	Legal training stage 2	Biological control of weeds
Content	3.7	3.8
Instruction	3.9	3.7
Materials	3.7	3.6
Overall	3.6	3.7
'rate the course'	72% 'excellent' 28% 'good'	53% 'excellent' 28% 'good'

Table 4b – Responses from participant reaction sheets (a four-point scale response) for Weed management and planning

	Weed management and planning (first two workshops delivered)	Weed management and planning (remaining workshops)
Content	3.4	3.6
Instruction	3.1	3.8
Materials	2.9	3.2
Overall	3.1	3.5

Course reaction sheets confirm that participants were satisfied with the training. Table 4b shows how participant reaction scores for the Weed management and planning workshop improved as result of a change in delivery style of the course.

LEVEL 2: LEARNING

Evaluation of learning focuses on skills and knowledge acquired as well as any change in attitude by the participant from attending training. Unfortunately it is not possible to gather data by testing the participants before and after training. Instead the evaluation uses 'soft' data, collected from Training Program records and response from the surveys. The survey addresses the following: how the training is delivered, assessing whether suitable preparations to promote learning have been made and, if the training is accredited (Table 5).

Table 5 – Response from Question 11b in Weeds Officer survey and Question 7b in supervisor survey ("*The information provided at the course/s has improved my/staff knowledge in weed management*"); and

Response from Question 11c in Weeds Officer survey and Question 7c in supervisor survey *("I/staff have developed new skills in weed management from attending course/s*")

Response	**Count of responses**			
	Weeds Officer Q 11b	**Supervisor Q 7b**	**Weeds Officer Q 11c**	**Supervisor Q 7c**
strongly disagree	1	1	1	2
disagree	0	1	2	1
agree	47	15	44	22
strongly agree	54	25	52	17

Delivery style of training

In order to create an environment that is conducive to learning it is essential to deliver the training to suit the learners. Adults are likely to learn more quickly and effectively if they are actively participating in the learning process (ANTA 2003).

Participant reactions from Four Wheel Drive training are compared with reactions from Legal training stage 2 training in Table 6. One of these training workshops concentrates on performing hands-on activities outside in a familiar environment. The other, Legal training stage 2 is delivered in a classroom with what may seem to by 'dry' subject matter. Principles of adult learning are applied to both of these courses. The interaction between participant and trainer generates interest in the topic which consequently promotes learning. Course delivery style rather than topic alone can achieve a high level of satisfaction amongst participants (Table 6).

Table 6 – Participant course evaluation after training workshop (a four-point scale response)

Question	4WD	Legal training stage 2
the presenter related well to my needs	3.9	3.9
how would you rate the course	3.8	3.7

Question 9 from the Weeds Officers survey focuses on the preferred style of course delivery. Figure 1 compares responses with courses that have been delivered in the Training Program. One-day workshops were the most popular choice amongst Weeds Officers surveyed. This is disproportional to actual training delivered, where only 25% of training is delivered as one-day sessions. It should be noted that the most common delivery style in the training program are two-day training sessions. Legal training stages two and three, make up 50% of these two-day sessions.

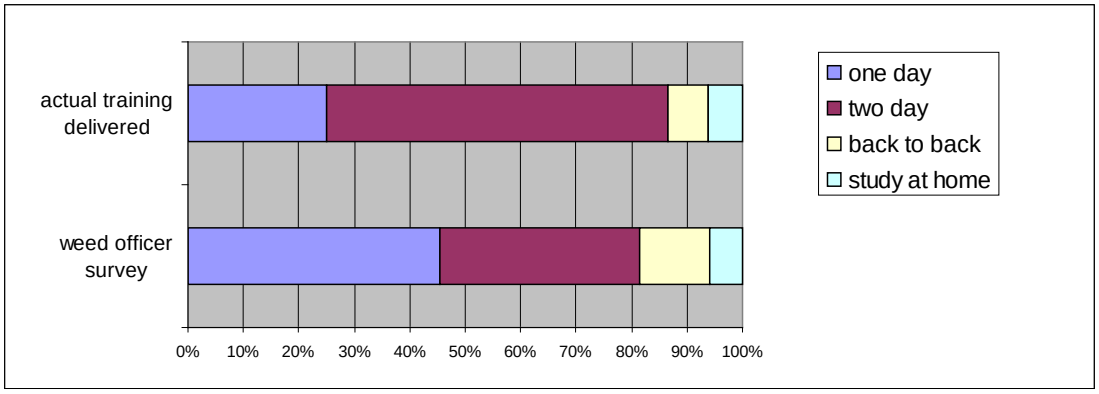


Figure 1 – Preferred training delivery style compared to actual courses delivered

Accredited training workshops

Competency based training provides an opportunity to evaluate learning more readily. With the exception of Legal Training, 94% of training offered through the Weeds Training Program is nationally accredited training. Accredited training workshops measure the skill and knowledge of participants against industry established competencies for a particular subject area. Table 7 lists training workshops according to AQF level that have been delivered since 2000.

Table 7 – Number of training courses delivered according to accreditation level since 2000

Not assessed	Legal Training	AQF II	AQF III	AQF IV	AQF V
4	*39*	*32*	*14*	*5*	*15*

Table 7 provides a summary of participants who: i) attended an accredited training session; and ii) who performed the assessment task competently. Assessment of AQF II workshops in the past have been completed on the same day as workshop delivery. Assessments for the AQF III and higher have required submission of an assessment task after the workshop. Although it was indicated in the survey that Weeds Officers prefer to be assessed on the day of a training workshop rather than have to submit an assignment, further assessment is required to fulfil competency requirements, particularly in higher AQF levels (Figure 2).

Table 8 – Number of participants who completed assessments after attending training

AQF level of training	Attendance	Assessed competent	% Completed assessments
V	134	58	43%
IV	55	25	45%
III	157	126	80%
II	330	330	100%
TOTAL	**674**	**519**	**77%**

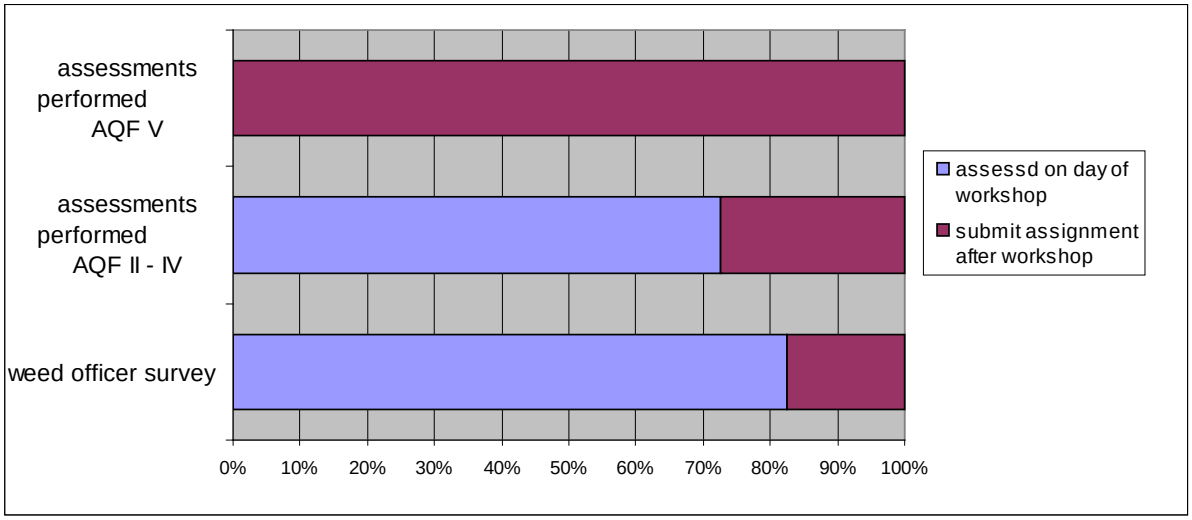


Figure 2 – Assessment method preferred by Weeds Officers compared to actual assessments performed

The Training Program also provides opportunity for Weeds Officers to have their skills recognised as a national qualification. All levels of the Conservation and Land Management Training Package can also be awarded through a Skills Recognition process. Data collected through the survey found that:

i) 71% of Weeds Officers surveyed said they have participated in the Skills Recognition program.

ii) 48% of Weeds Officers surveyed said they used skills gained from short courses together with existing skills to earn a qualification.

Level 2 of the evaluation involves participants performing assessments aligned with competency standards. Participants are required to demonstrate learned skills and knowledge in every accredited course. Although tests before and after training have not been done, the knowledge and skills gained from training has assisted nearly half of surveyed Weeds Officers surveyed to achieve industry qualifications.

LEVEL 3: Behaviour

The transfer of skills and knowledge is crucial to the success of the Training Program. Change in job behaviour is very difficult to predict when delivering training and also complicated to evaluate. Some participants may choose not to use information and skills provided at training, whereas others may not be given the opportunity to do so. Evaluating training in terms of on-the-job behaviour can be measured subjectively. Survey responses from trained individuals, and where available, responses from their supervisors can be used to gauge application of new skills in the workplace (Table 9).

Table 9a – Responses to Question 11d in Weeds Officer survey *("Since participating in the Weeds Training Program, I am a better weed manager"*)

Response	Count of respondents
strongly disagree	1
disagree	2
agree	57
strongly agree	40

Table 9a – Responses to Question 11e in Weeds Officer survey and Question 7d in supervisor survey (*"Participating in the Weed Training Program has improved my/staff confidence as a weed manager in my community"*); and
Responses to Question 11f in Weeds Officer survey and Question 7e in supervisor survey *("Participating in the Weed Training Program has improved my/staff confidence as a weed manager in my own workplace")*

Response	Count of respondents			
	Weeds Officer Q 11e	**Supervisor Q 7d**	**Weeds Officer Q 11f**	**Supervisor Q 7f**
strongly disagree	2	0	3	0
disagree	2	3	4	2
agree	51	22	52	19
strongly agree	44	16	39	18

Change in the workplace

Those surveyed were asked to provide opinion about changes in their role as weed manager since participating in the weeds training program. They were asked to indicate their level of participation in certain activities before and after training (Table 10a and 10b). Figure 3 illustrates responses from the Weeds Officers who attended a particular workshop. In total, 57% of Weeds Officers felt they have increased their activity level since attending training. A similar proportion of supervisor (53%) respondents believed that their staff have increased participation in these activities in Figure 3.

Table 10a – Understanding of the legal requirements of the Noxious Weeds Act (Weeds Officer response)

Legal training stage 3 Attendance number 70

		After		
		N	S	O
Before	N	0	2	16
	S	0	4	36
	O	0	0	12

(N = never, S = sometimes, O = often)

Change No change

Table 10b – Starting or expanding a biological control program (Weeds Officer response)

Biological control of weeds Attendance number 57

		After		
		N	S	O
Before	N	1	7	8
	S	0	19	15
	O	0	0	7

(N = never, S = sometimes, O = often)

Change No change

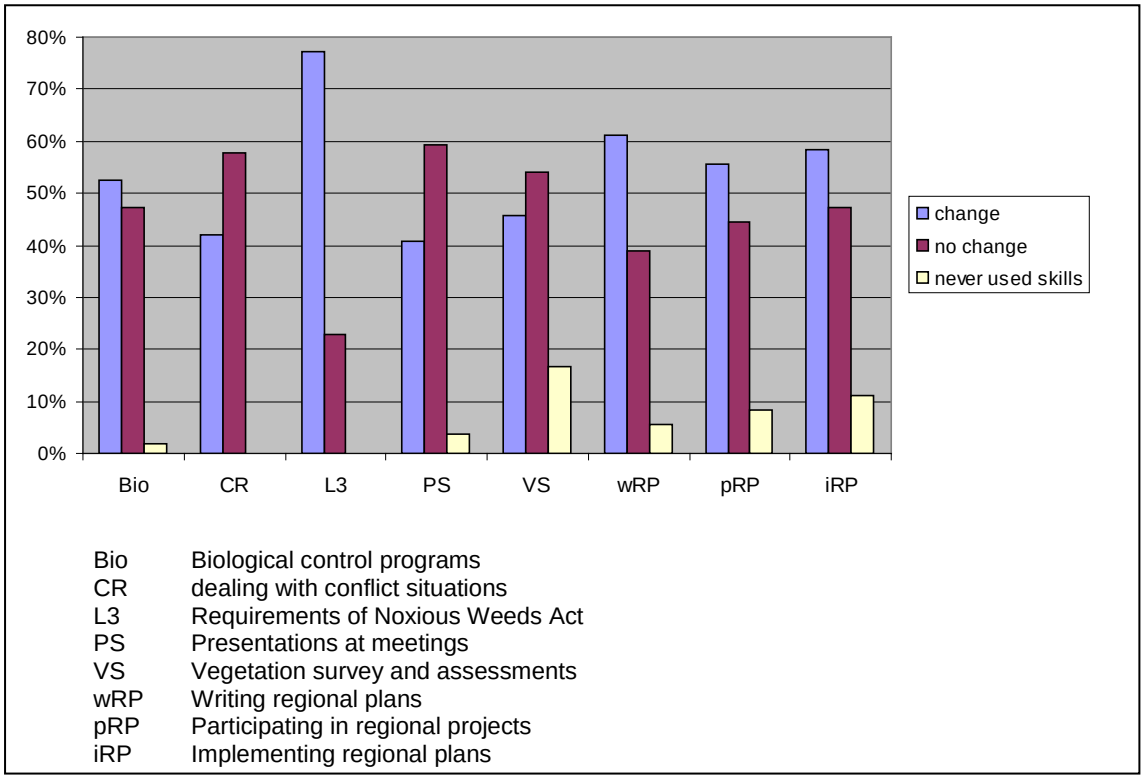


Figure 3 – Change in participation level in the workplace since training (Weeds Officers)

Barriers to change

For various reasons 47% of Weeds Officers are not increasing their level of participation in the activities listed. Their level of involvement in these activities may have not changed but the level of expertise may have increased, allowing them to perform the task better, this is not measured. There may also be barriers that are preventing the Weeds Officer from using new skills and knowledge in their job. A list of possible barriers are listed in Question 13 (Weeds Officer survey), responses are shown in Table 11.

Table 11 – Count of responses from Question 13 of Weeds Officer survey

Response	Count of responses
Not encounted any barriers	44
not had the opportunity to use skills	7
not had enough time to apply skills	13
Position restricts my ability to use skills	17
Supervisor does not support the Training Program	3
Supervisor does not encourage change	16
Training not useful	0

Supervisors were questioned about the level of support they provide their Weeds Officers relating to training. Responses relating to the transfer of knowledge and skills from the weeds training program to their staff's work are shown in Table 12.

Table 12 – Count of responses from supervisor survey Question 9

Response	9a	9b	9d	9e	9g
disagree	0	38	0	4	2
agree	36	1	38	35	36

9a I have noticed my staff using the information and skills gained from the training to implement changes in their work practices.
9b My staff have not used or rarely use the information and skills gained from the training.
9d I encourage my staff to implement what they have learned during training.
9e After my staff have attended training I discuss with them what they have learned.
9g My council supports improving skills through training and increasing the scope of my staff's positions.

All supervisors who completed the survey 'agreed' that they encouraged their staff to implement skills learned from training. Weeds officers were asked about support they received from their supervisors. A total of 35 (29%) Weeds Officer surveyed did not select option 14b or 14c, whereas only 7 Weeds Officers claimed they have not received sufficient support. A total of 112 Weeds Officer responded to this question (Table 13).

Table 13 – Response from Question 14 of Weeds Officer survey

Question from survey	Number of Weeds Officer responses
14a ***My supervisor encourages me to attend training.***	75
14b ***My supervisor encourages me to use information and skills gained from the training program to identify opportunities for implementing changes in my work practices.***	55
14c ***My council supports improving skills from training and increasing the scope of my position.***	73

LEVEL 4: RESULTS

This part of the evaluation concentrates on how the training is impacting on weed management. It aims to determine whether participation in the training program has or will result in implementation of effective and efficient coordinated weed management. This is quite difficult to measure and clear proof can not be found in the Training Program. Evidence that can be used to assess this includes:

i) Weeds Officers using an integrated approach to weed management rather than just weed control;

ii) An improvement in the quality of reports on expenditure of grant funds and outcomes achieved; and,

iii) More Weeds Officers approaching weed management on a regional level rather than localised control.

CONCLUSION

A complete evaluation of the Training Program will be completed in the following months. Further data will be gathered and further analysis of information already received will be completed. This will form the fourth level, results evaluation. Once finalised, this project will provide insight for reviewing, adjusting and revising the approach to weeds training. It can also assess if the training elements of the NSW Weeds Strategy are being addressed.

REFERENCES

Dawe, S. 2002, *Evaluating training and learning practices in large Australian firms*. Paper presented the 2002 Australasian Evaluation Society International Conference, Wollongong.

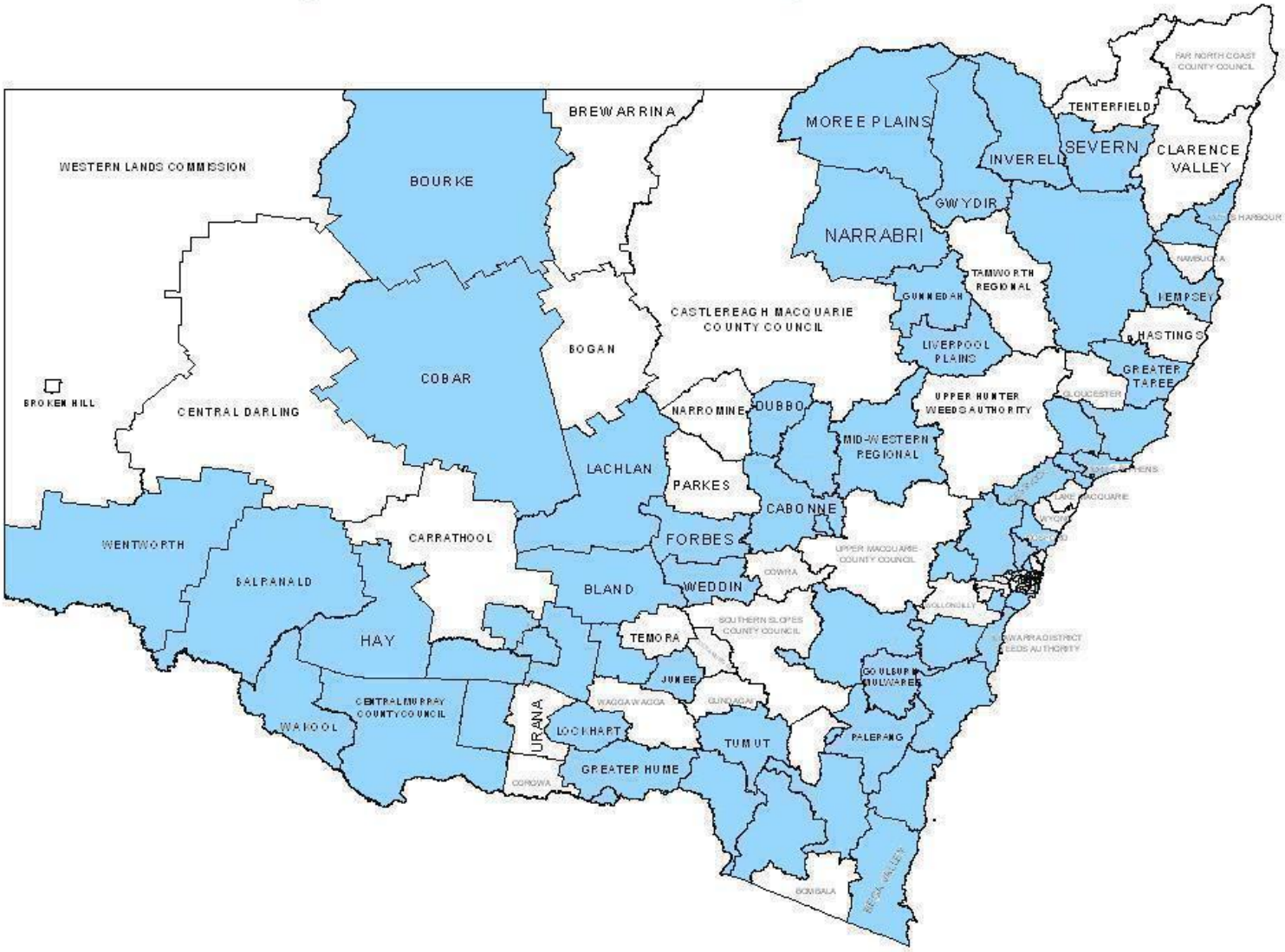
Kirkpatrick, D. 1994, *Evaluating training programs: the four levels*. Publishers Group West, San Francisco.

Maglen, L, Hopkins, S and Burke, G. 2001, *Training for productivity*, NCVER, Adelaide.

Australian National Training Authority. 2003 (date printed), Generic Information, BSZ40198 Certificate IV in Assessment and Workplace Training.

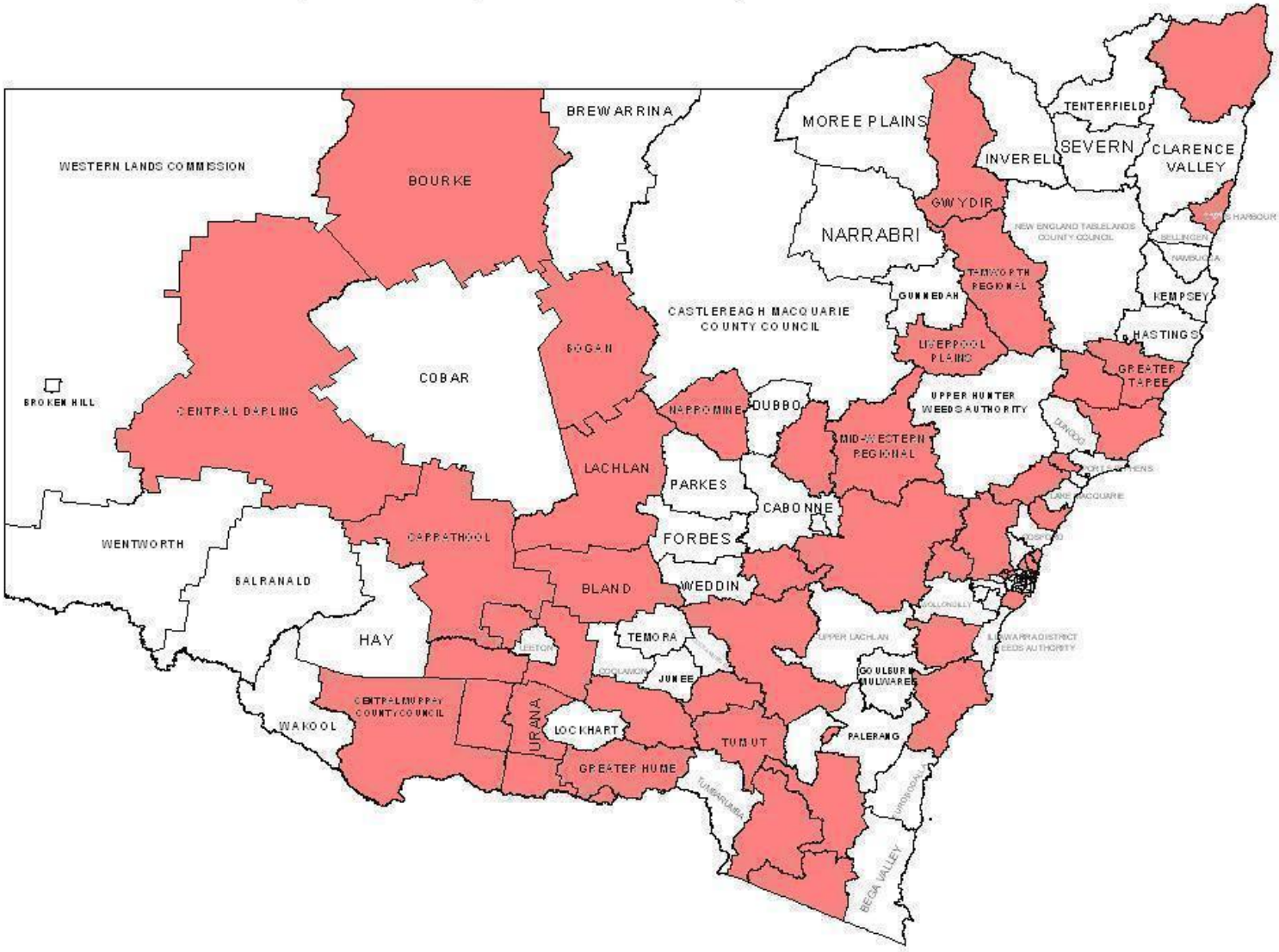
Appendix 1

Completed Weeds Officer Surveys



Appendix 2

Completed Supervisor Surveys



Managing bitou bush in NSW: the value of concerted efforts.

Hillary Cherry[1] and Paul O. Downey[2]

[1]National Bitou Bush and Boneseed Coordinator
Pest Management Unit, Parks and Wildlife Division
NSW Department of Environment and Conservation
PO Box 1967 (43 Bridge Street), Hurstville NSW 2220
Tel: 02 9585 6587; Email: hillary.cherry@environment.nsw.gov.au

[2]Pest Management Unit, Parks and Wildlife Division
NSW Department of Environment and Conservation
PO Box 1967 (43 Bridge Street), Hurstville NSW 2220
Email: paul.downey@environment.nsw.gov.au

Paper submitted to:
13th NSW Biennial Noxious Weeds Conference – 20-22 September 2005, Orange

Status: 2nd of paper August 14 2005

Managing bitou bush in NSW: the value of concerted efforts.

Hillary Cherry[1] and Paul O. Downey[2]

[1]National Bitou Bush and Boneseed Coordinator
Pest Management Unit, Parks and Wildlife Division
NSW Department of Environment and Conservation
PO Box 1967 (43 Bridge Street), Hurstville NSW 2220
Tel: 02 9585 6587; Email: hillary.cherry@environment.nsw.gov.au

[2]Pest Management Unit, Parks and Wildlife Division
NSW Department of Environment and Conservation
PO Box 1967 (43 Bridge Street), Hurstville NSW 2220
Email: paul.downey@environment.nsw.gov.au

Key words Bitou bush, boneseed, weed of national significance, WONS, national coordination, strategy, key threatening process, threat abatement plan.

Abstract

Bitou bush, a South African coastal shrub, has invaded over 80% of the NSW coastline since its introduction less than 100 years ago, causing significant environmental impacts. The severity of these impacts on biodiversity has led to a variety of government initiatives dealing with bitou bush, including its listing as a Weed of National Significance (WONS), a Key Threatening Process [under the NSW *Threatened Species Conservation Act 1995*] and a Noxious Weed in all coastal regions of NSW. These listings have prompted the development of numerous regional strategies, a State and National Strategy and a draft Threat Abatement Plan (TAP). In addition, there is a national biological control program and, under the WONS initiative, a national coordinator and management group were appointed to oversee implementation of the National Strategy. These concerted efforts have positively influenced the management of bitou bush. The majority of these initiatives have occurred only within the last 10 years. However in this relatively short time there have been major advances, including: i) detailed mapping of the entire NSW coastline in 2001, allowing a better understanding of the problem, ii) increased understanding of bitou bush impacts through the draft Bitou TAP, with <150 species and nine ecological communities identified as threatened, iii) identification of state-wide priority control sites, iv) field establishment of several biological control agents, v) successful localised eradication and containment programs, vi) improved control techniques (i.e. aerial spot-spraying), vii) new research in bitou bush biology and ecology, and viii) an increased awareness of bitou bush in the wider community. These advances highlight the value of concerted efforts across a wide range of stakeholders over several years. The end result is better and more informed management of bitou bush. Concerted efforts such as these would benefit a wide range of other weeds.

Bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata* (L.) T. Norl.)

The South African coastal shrub, bitou bush (Asteraceae), was first observed in Australia around 1908 near Newcastle, NSW (Weiss et al. 1998). In less than 100 years, bitou bush has invaded over 900 km of the NSW coastline, aided by a series of deliberate plantings in the 1950s and 1960s. Today, bitou bush occurs along approximately 80% of the NSW coastline (Thomas and Leys 2002). The scale and impact of the invasions are such that

bitou bush has been listed as a Key Threatening Process under the NSW *Threatened Species Conservation Act 1995* (TSC Act), as a Noxious weed in all coastal regions of NSW (under the NSW *Noxious Weeds Act 1993*), and as one of the 20 Weeds of National Significance (WONS: see Thorp and Lynch 2000). Such recognition has resulted in numerous regional strategies (eg. North Coast Bitou Bush Management Plan: Scanlon 2001), a State Strategy (NPWS 2001), a National Strategy (ARMCANZ et al. 2000) and a draft NSW Threat Abatement Plan (Bitou TAP: DEC 2004) to combat the problem. While there is some overlap in these strategies, each has a different aim and delivers a range of different outcomes. For example, the Bitou TAP aims to reduce, abate or ameliorate the threat posed to native biodiversity, while the WONS national strategy aims to coordinate efforts across three broad areas: i) prevention of spread, ii) minimising adverse impacts, and iii) harnessing national commitment.

The WONS Program for bitou bush

One of the key goals of the National Weeds Strategy is to reduce the impact of existing weed problems of national significance (see ARMCANZ et al. 1997). To further this goal, 20 Weeds of National Significance (or WONS) were identified (see Thorp and Lynch 2000). The WONS program has fostered the development of a national strategy and the appointment of a national coordinator for each of the 20 WONS. In addition, each of the 20 national WONS programs has a national management group or taskforce responsible for overseeing implementation, monitoring and evaluation of the respective WONS National Strategies. This concerted effort and support at a national level has influenced the management of bitou bush, however the true value of such efforts is only seen when they are viewed in light of state, regional and local efforts. Below are several major milestones that have occurred in the management of bitou bush over the past few years. While some of these began prior to the initiation of the WONS program, they are relevant to the National Strategy and benefit from being encompassed under the national bitou bush and boneseed WONS program. This discussion is only focused on bitou bush management within NSW, thus the boneseed component of the WONS program is not presented here.

i) the distribution of the bitou bush mapped

In 2000/1, an intensive program was implemented to map the distribution of bitou bush along the entire NSW coastline (see Thomas 2002). The only other attempt to map the distribution of bitou bush in NSW occurred, almost 20 years earlier (see Love 1984). While these two studies used different techniques, comparisons can still be made on the expansion of bitou bush over the intervening period. The latest survey showed that bitou bush was present along approximately 900 kms (80%) of the NSW coastline, an increase of 240kms (36%) since the previous survey (Thomas and Leys 2002). In addition, the 2002 survey indicated that bitou bush was the dominant species along over 400 kms of coastline and occurred up to 10 km inland. Data from these two surveys will be an integral part of upcoming efforts to monitor the success of current national bitou bush control and containment programs.

ii) the draft NSW Bitou TAP – identifying biodiversity threatened by bitou bush

Following the listing of bitou bush as a Key Threatening Process under the NSW *Threatened Species Conservation Act 1995*, a draft Threat Abatement Plan (TAP) was prepared (see DEC 2004). The objective of the TAP is to reduce, abate or ameliorate the threat of bitou bush. To achieve this objective, the draft Bitou TAP incorporates two main processes: i) identification of the biodiversity at risk from bitou bush and, ii) identification of priority sites for control based on the biodiversity at risk. The first process involves the identification of species, populations and ecological communities at risk from invasion by bitou bush (see DEC 2004; Downey 2004). After extensive research and stakeholder consultation, approximately 150 species, two populations and nine ecological communities were identified as threatened by bitou bush invasion in NSW. A series of models was then used rank these entities and determine biodiversity priorities for bitou bush control efforts. This process

significantly increased our understanding of the impacts of bitou bush to biodiversity (Downey 2004)

iii) the draft NSW Bitou TAP – identifying priority sites for bitou bush control

Biodiversity priorities developed in the TAP (see above) were used to prioritise sites where control would have the greatest benefit to the biodiversity at risk (see DEC 2004). Sites containing threatened biodiversity were identified and entered into a site model to produce a series of priority sites for control. These sites are independent of land tenure and occur along the entire NSW coastline. The TAP process has greatly increased recognition of the impacts of bitou bush and improved the ability to manage weeds for conservation outcomes (Downey 2004; Downey and Leys 2004). The WONS national network and concerted efforts under the WONS bitou bush program have played a key role in the development of the Bitou TAP and will be crucial for its successful implementation.

iv) biological control program

A national biological control program for *Chrysanthemoides monilifera* subsp. *monilifera* and subsp. *rotundata* (bitou bush and boneseed, respectively) has been running for almost 20 years. This program has led to the release of six agents for bitou bush, however only four have successfully established to date (see Downey et. al. *in prep*.). The established agents are the bitou tip moth (*Comostolopsis germana* Prout), bitou tortoise beetle (*Cassida* sp.), bitou seed fly (*Mesoclanis polana* Munro) and bitou leaf roller moth (*Tortrix* sp.). The bitou seed fly has spread throughout the distribution of bitou bush, and the bitou tip moth is also widely established across large areas. The bitou tortoise beetle, however, has not moved great distances from the original release sites. The latest agent to become established, the bitou leaf roller moth, is only established at a few sites due in part to predation by native insects, which are more active in dunes than headlands. Thus future release will be targeted to headland sites (see Downey et. al. *in prep.).* No agents have successfully established in the field for boneseed, however investigations are ongoing.

v) successful eradication and containment programs

There are many examples of successful bitou bush eradication programs on a localised scale (e.g. Iluka bluff, and the Queensland eradication program). These programs are collaborative efforts between a range of stakeholders, including state and local agencies, regional taskforces, NGO's and community groups. In addition, the national northern and southern bitou bush containment lines are being maintained in NSW. The northern containment line efforts work in conjunction with the QLD eradication program to prevent re-invasion of bitou bush into QLD. The South Coast Bitou Bush Task Force (SCBBTF), in conjunction with regional stakeholders, has progressed the southern containment line at least 100km northward, and continues eradication of bitou bush in areas south of the containment line. The SCBBTF is also working in conjunction with Victorian partners to eradicate boneseed from NSW, establish a boneseed national containment line in eastern Victoria and continue eradication of bitou bush in Victoria. These projects highlight the value of concerted and sustained control programs.

vi) improved control techniques (i.e. aerial spot-spraying)

Over the past few years, there have been a number of new initiatives to help improve bitou bush control. One of these initiatives involves the use of aerial spot-spraying. At present, the NSW DEC (Department of Environment and Conservation) has a permit to aerially spot-spray bitou bush in NSW using a helicopter. This process involves a ground spray rig mounted in a helicopter with a modified nozzle for remote use outside of the helicopter. Aerial spot-spraying is extremely beneficial for control of bitou bush in remote locations or in hard to access areas (e.g. plants growing on cliff-faces). Another related initiative is the production of best practice guidelines for aerial boom spraying of bitou bush in NSW (see Broese van Groenou and Downey *in prep*.). In addition, the draft Bitou TAP outlines a series of factors to be considered when developing a control program (see DEC 2004).

vii) new research in bitou bush biology and ecology

A number of research projects are underway or recently completed aimed at better understanding the ecology and biology of bitou bush. Researchers at the University of Wollongong are investigating the impacts of bitou bush on coastal environments and native species. One study is looking at the differences in species composition between managed sites, native sites, and sites that are infested with bitou bush by examining fore and hind dune vegetation (above ground vegetation and seed banks) to determine the extent of bitou bush impacts (Tanya Mason, unpublished data). Another project examines how competition between bitou bush and native species is manifested. This involves investigating the role of bitou bush infestation in affecting physiological and ecological parameters of native species, as well as investigating the role of phytotoxic chemicals in controlling germination of native plants in bitou infested sites (Emilie Ens, unpublished data). A third project delves into understanding bitou bush competition and endangered plants. It strives to strengthen our understanding of how bitou impacts on specific species and will include surveying the health of endangered species affected by bitou invasion (Kris French, unpublished data). In addition, work recently was completed on the interactions of bitou bush and birds (see Gosper 2004a, 2004b), the alteration of decomposition rates in bitou bush invaded area (see Lindsay and French 2004a), and the interactions of bitou bush and litter invertebrates (Lindsay and French 2004b) was also undertaken through the University of Wollongong.

Studies such as these increase our ability to better manage bitou bush. Further research is a priority in the National Bitou Bush Priority Action Framework and encouraged by the bitou bush and boneseed WONS program.

viii) increased awareness of bitou bush in the wider community

Over 600 community groups volunteer their time and energy caring for the NSW coastline, and a majority of these dedicate a large proportion of their time to bitou bush control. These community control efforts, as well as community participation in local and regional weed management planning, are critical factors in the success of bitou bush programs across NSW. The importance of the community effort to the bitou bush and boneseed WONS program is highlighted by the fact that “providing support for volunteers and expanding the volunteer effort” is awarded the highest priority in the national priority actions for bitou bush and boneseed. These community groups, in conjunction with councils and regional weed groups, also raise awareness in the general community about the threat of bitou bush.

Students are being engaged through educational incentives involving bitou bush. These include bitou bush “environmental challenge” modules and “webquest” learning aids that have been developed by environmental educators in conjunction with the South Coast Bitou Bush Task Force (SCBBTF). In conjunction with the WONS program, these resources are being further developed for potential use in schools across NSW and can be incorporated with a bitou bush Weed Warriors program - Weed Warriors is a national education and awareness program supported by the Weeds Cooperative Research Centre (Weeds CRC) that empowers students through participate in the rearing, release and monitoring of biocontrol control agents (see http://www.weeds.crc.org.au/for_schools/weed_warriors.html). It has been very successful in other States and it is hoped that a program for bitou bush can be developed in the near future.

There are many other education and awareness initiatives being developed for bitou bush and boneseed as part of large cross-regional, multi-state projects for possible funding under the Australian Government’s “Defeating the Weeds Menace” program. These projects, proposals aimed at preventing the spread and reducing the impacts of bitou bush and boneseed, have been instrumental in bringing together agency and community stakeholders from 5 states, 22 Natural Resource Management (NRM) regions and over 100 local government areas around Australia. These types of concerted efforts complement the efforts

achieved thus far in NSW and will link those to a national approach facilitated by the bitou bush and boneseed WONS program.

The cost of achieving these initiatives for bitou bush in NSW

Costs associated with these major initiatives in NSW over the last three years (ie 2001/02-2004/05) are in excess of $1.5 million. This value excludes the funding for local and regional control efforts, and in-kind contributions and commitments for these initiatives, which are difficult to calculation, but are significant. This represents a significant investment from a wide range of stakeholders. One assessment of the value of this investment can be determined by the predicted cost of allowing bitou bush invasions to cause the loss of native species. The potential 'environmental' cost of losing one species is estimated at $68,700 per species per year (see Sinden et. al. 2004). Using the 133 species identified as threatened by bitou bush in NSW (see the draft Bitou TAP: see DEC 2004), the predicted cost of 'doing nothing' to save these species would be over $ 9 million per year in NSW alone (ie 133 x $68,700). If we assume that there are at least 100 species at risk from boneseed in the three other states with significant infestations (TAS, VIC, and SA), the total cost of not controlling bitou bush and boneseed to prevent species losses is estimated at $ 30 million per year. This highlights, once again, the importance of concerted efforts in national management of bitou bush and boneseed.

Summary

These major milestones and advances in the management of bitou bush within NSW highlight the value of concerted efforts across a wide range of stakeholders over several years combined more recently with national guidance (ie the WONS strategy). This has resulted in more informed and enhanced management of bitou bush. One of the main reasons for the success of this program is the ability of the WONS program to bring together relevant stakeholders and to facilitate implementation of the national strategic framework in the WONS strategy. In addition, the enhanced focus on a specific weed through legislation (i.e. bitou bush listed as a Key Threatening Process, a WONS and a Noxious Weed) can significantly affect the management of such weeds (see Downey 2003). The concerted approach outlined here highlights the value of such efforts in tackling widespread weeds. Therefore this approach could be adopted for a wide range of other weeds.

Acknowledgments

Information contained here was sources from a wide range of stakeholders for which we are grateful.

References

ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand), ANZECC (Australian and New Zealand Environmental and Conservation Council) and Forestry Ministers (1997). *The National Weeds Strategy: A strategic approach to weed problems of national significance.* Commonwealth of Australia, Canberra.

ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand), ANZECC (Australian and New Zealand Environmental and Conservation Council) and Forestry Ministers (2000). *Weeds of National Significance Bitou Bush and Boneseed* (Chrysanthemoides monilifera *ssp.* rotundata *and* monilifera) *Strategic Plan*. National Weeds Strategy Executive Committee, Launceston.

Broese van Groenou, E.A. and Downey, P.O. (*in prep*.) Best practice guidelines for the aerial boom spraying of bitou bush in NSW. Department of Environment and Conservation (NSW), Hurstville.

Department of Environment and Conservation (NSW) (2004). *Draft Threat Abatement Plan: Invasion of Native Plant Communities by Bitou Bush/Boneseed (*Chrysanthemoides monilifera*).* Prepared by P.O. Downey, Department of Environment and Conservation (NSW), Hurstville.

Downey, P.O. (2003). Invasive Species and Plant Conservation: woody weeds. In: Brown, C.L., Hall, F. and Mill, J. (eds) *Plant Conservation: approaches and techniques from an Australian perspective*. Module 4 (pages unnumbered). Australian Network for Plant Conservation, Environment Australia, Canberra.

Downey, P.O. (2004). Bitou bush management and plant conservation: establishing priorities for control. **In**: B.M. Sindel & S.B. Johnson (eds) *The Proceedings of the 14th Australian Weeds Conference, Wagga Wagga, September 2004*. pp. 697-700, Weeds Society of New South Wales, R.G. & F.J. Richardson, Melbourne.

Downey, P.O. and Leys, A.R. (2004). Weeds as key threatening processes: implications for managing environmental weeds. **In**: B.M. Sindel & S.B. Johnson (eds) *The Proceedings of the 14th Australian Weeds Conference, Wagga Wagga, September 2004*. pp. 454-457, Weeds Society of New South Wales, R.G. & F.J. Richardson, Melbourne.

Downey, P.O., Holtcamp, R. Ireson, J.E., Kwong, R., and Swirepik, A. (in prep.). A review of the *Chrysanthemoides monilifera* biological control program in Australia: 1987-2005. *Plant Protection Quarterly*.

Gosper, C.R, (2004a). *Consequences of Weed Invasion and Control on Plant-bird Interactions and Bird Communities*. PhD Dissertation, University of Wollongong, Wollongong.

Gosper, C.R, (2004a). Fruit characteristics of invasive bitou bush, Chrysanthemoides monilifera (asteraceae), and a comparison with con-occurring native plant species. *Aust.J.Bot*. **52,** 223-230.

Love, A. (1984). Distribution of bitou bush along the New South Wales coast. In: Love, A. and Dyason, R. (eds) *Proceedings of a Conference on* Chrysanthemoides monilifera, *Port Macquarie*, pp. 53–64. NSW National Parks and Wildlife Service and NSW Department of Agriculture, Sydney.

Lindsay, E.A. and French, K. (2004a). *Chrysanthemoides monilifera* ssp. *rotundata* invasion alters decomposition rates in coastal areas of south-eastern Australia. *Forest Ecology and Management* **198**, 387–399

Lindsay, E.A. and French, K. (2004b). The impact of the herbicide glyphosate on leaf litter invertebrates within Bitou bush, *Chrysanthemoides monilifera* ssp *rotundata*, infestations. *Pest Manag Sci* **60**, 1205–1212

NPWS (National Parks and Wildlife Service) (2001). *NSW Bitou Bush Strategy*. NSW National Parks and Wildlife Service, Hurstville.

Scanlon, T. (2001). *NSW North Coast Bitou Bush Management Strategies*. North Coast Weeds Advisory Committee. Location unknown.

Sinden, J., Jones, R., Hester, S., Odom, D., Kalisch, C., James, R., and Cacho, O. (2004). *The economic impact of weeds in Australia.* CRC for Australian Weed Management, Technical Series No. 8, CRC for Australian Weed Management, Adelaide.

Thomas, J. (2002). *Bitou Bush 2001 Mapping Report*. Unpublished internal report, NSW National Parks and Wildlife Service, Grafton.

Thomas, J. and Leys, A. (2002). Strategic management of bitou bush (*Chrysanthemoides monilifera* ssp. *rotundata* (L.) T. Norl.). In: Spafford Jacob, H., Dodd, J. and Moore, J.H. (eds) *13th Australian Weeds Conference: papers and proceedings*, 8–13th September 2002, Perth. Shannon Books, Melbourne.

Thorp, J.R. and Lynch, R. (2000). *The Determination of Weeds of National Significance*. National Weeds Strategy Executive Committee, Launceston.

Weiss, P.W., Adair, R.J. and Edwards, P.B. (1998). *Chrysanthemoides monilifera* (L.) T. Norl. In: Panetta, F.D., Groves, R.H. and Shepherd, R.C.H. (eds) *The Biology of Australian Weeds*, Volume 2, pp. 49–61. R.G. and F.J Richardson, Melbourne.

Biography [presenter underlined]

[1] Hillary Cherry is the National Bitou Bush and Boneseed Coordinator. She has a Masters Degree in Botany and has worked as a weed researcher at the University of Florida Center for Aquatic and Invasive Plants, and as a Pest Management Ranger with NSW National Parks.

[2] Paul Downey coordinates state-wide weed issues for NSW National Parks, his expertise in weed management includes working on weeds in both the US and France and a PhD in plant invasions. He has published numerous papers on weed management and ecology.

Author details:

Hillary Cherry[1] and Paul O. Downey[2]

[1]National Bitou Bush and Boneseed Coordinator
Pest Management Unit, Parks and Wildlife Division
Department of Environment and Conservation (NSW)
PO Box 1967 (43 Bridge Street), Hurstville NSW 2220
Tel: 02 9585 6587; Mobile: 0427 104 448; Email: hillary.cherry@environment.nsw.gov.au

[2]Pest Management Unit, Parks and Wildlife Division
Department of Environment and Conservation (NSW)
PO Box 1967 (43 Bridge Street), Hurstville NSW 2220
Email: paul.downey@environment.nsw.gov.au

Lantana – Targeting the Hotspots

Andrew Clark[1], Michael Day[2]
Queensland Department of Natural Resources and Mines
[1]Landcentre Level 3, Corner Main and Vulture Sts, Woolloongabba
[2]Alan Fletcher Research Station, 27 Magazine St, Sherwood

ABSTRACT

Lantana is one of the 20 Weeds of National Significance (WoNS) in Australia. Landholders and communities feel its impacts across a range of land uses, topographies and climatic zones and it is recognised as costing Australia millions of dollars in lost agricultural production, invasion of forest understoreys, reduced access and risk from altered fire regimes. While eradication of lantana is unlikely, there is certainly much that can be achieved on a local basis to reduce its impacts. This paper explores some of the options for targeting the hot-spots, namely, where lantana causes the greatest threats and has the best opportunities for control.

Keywords: lantana, WONS.

INTRODUCTION

Lantana is a Weed of National Significance because of its extent of spread throughout Australia and its impacts to economic, environmental and social values. While some may believe that lantana has reached the limits of its distribution, we still need to be concerned about this weed increasing its density, infilling lantana-free areas and infesting new areas.

Some of the main issues with current control programs targeting lantana are:

- Australia does not have adequate mapping at a regional scale to show areas of local distribution
- the locations of high priority areas are not known within that distribution (that is, where land managers should be targeting lantana control)
- often control is done in an ad-hoc way even though there is some enthusiasm at the ground level for managing lantana
- incentives are either not present or not recognised by land managers and lantana's priority is deemed to be low
- there is minimal use of best management practices.

There are many examples where the costs of lantana control in agricultural systems has shown economic benefits, but there is limited knowledge about the costs of lantana to the environment. The neglect of the environmental costs will result in larger impacts to endangered species and ecosystems. Without an assessment of environmental areas in a methodical way, resources devoted to these areas may be targeting areas of limited value. Areas need to be designated with a high, medium or low priority dependent on desired outcomes in terms of eradication, containment or management of impacts.

The lantana WoNS project is looking at ways we can strategically improve our control of lantana and improve our knowledge of control options. The National Lantana Coordinator and the National Lantana Management Group (NLMG) are implementing the National Lantana Strategy. This paper discusses the activities of the lantana WoNS project and those aspects that are improving the way land managers and authorities manage lantana.

TARGETING THE RIGHT AREAS OF CONCERN

The national lantana strategy identifies work that is being undertaken at a national, regional and local scale and promotes the sharing of information, better strategic modelling and better methods of control in order to reduce the threat of lantana. A number of key strategies are being implemented to assist in achieving these goals:

- National coordination of actions
- Mapping lantana at a national and regional level
- Identifying high priority strategic areas
- Developing, trialling and promoting the adoption of best practice at the ground level
- Communicating for improved awareness and encouraging behaviour change

National Coordination

The NLMG has put effort into coordinating national priorities, improving national communication, proposing a consistent Australia-wide legislative framework and identifying new infestations. It has also helped define management areas where:
(a) lantana should be eradicated, (b) zones that should be used for containment and (c) areas where lantana's impacts should be mitigated.

For example, local authorities in both Victoria and northern WA have possibly eradicated lantana from several sites. In addition, outlying light infestation, such as those in Western Australia, Northern Territory, Central Queensland, Cape York, and Torres Strait could be easily target for eradication. Containment is being achieved in the southern part of NSW, where the South Coast Regional Weed Management Plan identifies containment and buffer zones as a way of reducing the extent of lantana over time in this region. This containment zoning could be extended to Cape York as a method to prevent infestations over this vast area. Lastly, the impacts of large dense infestations throughout coastal Queensland and New South Wales can be reduced by targeting high priority environmentally significant areas within these areas.

Some of the variables that could be considered to separate priorities include public or private benefit, values placed on the area, small outlying infestations, environmentally significant areas or likely success of control given the terrain and current site conditions.

Mapping lantana

Information has been collected from local government, herbarium records, local studies, the bio-control program (Day *et al*. 2003) and personal communications showing some areas of lantana distribution. However, much of this knowledge is confined to the coastal and sub-coastal regions of eastern Australia where most activity has occurred. Further information capture is necessary define local infestations and likely further spread or potential to infill. Therefore mapping needs to occur at two levels.

- Nationally - Mapping on a grid-based output to quickly and cost-effectively identify presence and distribution. Local knowledge is useful to strategically define areas for eradication, containment and buffer zones.
- Regionally – Mapping to identify the distribution of local infestations may identify lantana free zones and areas for high priority control that will be useful in planning and directing management programs. Viable methods of data capture include local knowledge and remote sensing technologies.

Identifying strategic areas

Usually there is a financial benefit to landholders removing lantana from relatively flat and accessible profitable pasture paddocks, with any costs being balanced by increased

production profits. However this cost-benefit ratio reduces as lands become marginal or accessibility reduces. This example serves to demonstrate a range of private benefits from high to low. In economic terms it becomes obvious as to which are the high priority areas to be targeted and which will become too difficult and expensive. A production land manager decides where lantana is worth controlling for their enterprise, as a private benefit is received for a privately funded control program. However, little has been done to similarly prioritise non-agricultural areas in terms of public benefit. It is fundamentally important that these lands are assessed so that public funds are used to achieve the maximum effectiveness for dollars spent.

A model developed by NSW Department of Environment and Conservation (DEC 2004) has been used to define high, medium and low priority sites for bitou bush (*Chrysanthemoides monilifera* (L.) T.Nord) from an environmental perspective. Using this model, a list of species and ecosystems threatened by lantana could be also compiled to determine the highest threat and then a number of sites prioritised using the following criteria:

- threat by lantana – determined by "endangered" or "vulnerable" status.
- actual impact – the condition of sites, that can be determined by degradation.
- effective control – suitable control options after considering the site's local topography and vegetation.

As with the economic example above, there is a continuum from high priority to low priority areas, with high priority areas corresponding to areas of endangered species and lower priority areas being defined by limited impact on biodiversity. This model does not consider other invasion of typical vegetation unless other criteria are considered.

Best Management Practices

One of the key aspects in the successful management of lantana is improving results of control efforts. The Lantana survey (2003) showed that the majority of landholders either do not control lantana or use only single control options (NR&M 2004). This is a major set-back in terms of best practice and successful management of lantana. Two aspects need to be achieved – encouraging action and secondly adopting best practice as ways to reduce apathy and failed control methods.

The WoNS project will trial several integrated control scenarios and demonstrate the outcomes using adaptive management principles. This project component aims to show the relative ease in controlling lantana with cost-effective integrated control options, good planning, and reinforcing land management principles.

Communication and Behaviour Change

Communication is also important to build awareness. The extension challenges faced include how to address information to the range of target sectors, each with varying attitudes, awareness and needs; and how to maximise the adoption of best practice. The WoNS project has continued to raise awareness and exchange information as an essential first step. Issues relating to lantana will continue to be communicated to target audiences and specific areas to improve knowledge and attitude.

While awareness helps generate interest, adoption of best practices is the ultimate goal. By building landholder commitments to voluntarily control lantana a benefit to the land manager and the community can be achieved and ultimately improve the management culture for lantana control. Traditionally communication programs have concentrated on media or information-based materials being distributed to audiences hoping they will uptake the positive actions. These programs have limited benefits in changing behaviour but are useful for peripheral audiences and education purposes. The development of specific behaviour change strategies through commitments and promoting model behaviours are likely to achieve a better result. Understanding what motivates people will also assist in better

understanding actions that assist or detract from on-ground action (Clark *et al*. 2004) and improve strategy development.

CONCLUSION

Through the implementation of the national strategy over the coming years, steps are being taken to create the environment in which land managers are likely to begin or continue to control lantana in a more cost-effective manner and with better results. National co-ordination, mapping and identification of high priority areas will assist policy development, on ground action and ability to assess funding opportunities for local and regional projects. The results will include a better use of available funds, protection of biodiversity and improved planning opportunities. Developing and trialling integrated control techniques will also provide useful results by providing land managers with best practice control options for lantana and together with information exchange and demonstration of results will influence landscape management practices. A concerted and integrated effort incorporating all these components should minimise the impact of lantana in many areas of Australia.

ACKNOWLEDGMENTS

Acknowledge the work of Paul Downey, NSW Department of Environment and Conservation who developed the model for the Bitou bush Threat Abatement Plan.

REFERENCES

Clark, A., van Oosterhout, E., Menzies, E., Haapakoski, H. and Day, M. (2004). Lantana – at WONS with the community? In Sindel, B.M. and Johnson, S.B. (eds). *Proceedings of the 14th Australian Weeds Conference*. Weed Society of New South Wales, Sydney.

Day, M.D., Broughton, S. and Hannan-Jones, M.A. (2003). Current distribution and status of *Lantana camara* and its biological control agents in Australia, with recommendations for further biocontrol introductions into other countries. *Biocontrol News and Information* 24, 63N-76N.

Department of Environment and Conservation (2004). *Draft Threat Abatement Plan for the Invasion of Native Plant Communities by Bitou bush/Boneseed* (Chrysanthemoides monilifera). DEC (NSW), Hurstville.

Department of Natural Resources, Mines and Energy (2004). *Lantana control manual: current management and control options for lantana (Lantana camara) in Australia*. NRM&E, Queensland.

Biography
Andrew Clark is the National Lantana Coordinator for the Weeds of National Significance Project. He has led the lantana WONS project since 2003 which has been implementing the national lantana strategy including the developing of key information such as the Lantana Control Manual. Andrew also facilitates the National Lantana Management Group to assist in the implementation of the national strategy for lantana.
Previously Andrew successfully worked with a number of weeds projects to promote awareness, education and community participation.

Author details
Name: Andrew Clark
Organisation: Natural Resources and Mines (Qld)
Address: Level 3 Landcentre, PO Box 1653, Woolloongabba Q 4102
Phone:07 3224 8383
Fax 07 3224 2933
Mobile: 0414 369 129
Email: andrew.clark@nrm.qld.gov.au