HOLTKAMP

Greater Taree CITY COUNCIL

NSW Agriculture

MID NORTH COAST WEEDS Advisory Committee

12th NSW Biennial Noxious Weeds Conference & Expo

1st - 3rd July 2003

Hosted by Greater Taree City Council and NSW Agriculture

~OFFICIAL CONFERENCE PROGRAM & PAPERS~

Crowdy Head

VENUE :

CONFERENCE
Manning Entertainment Centre
Manning River Drive
Taree

EXPO
Endeavour Place
River Street
Taree

CONFERENCE DINNER
Winning Post Function Centre
Taree/Wingham Race Course

MAJOR SPONSORS

Dow AgroSciences
Harrington Holiday Park
Macspred
Du Pont Australia
North Coast Town & Country
Noxious Weeds Officers Association
Civic View
Vee Dri (Australia) Pty Ltd
Greater Taree City Council
NSW Agriculture

CONFERENCE PROGRAM/PAPERS

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CONFERENCE PAPERS (Colour Coded)

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~ Wednesday	Green
~ Thursday	Blue
~ Unpresented Papers	White
~ Competition Sketches	White

THIS CONFERENCE IS PROUDLY HOSTED BY

GREATER TAREE CITY COUNCIL

NSW AGRICULTURE

Greater Taree
CITY COUNCIL

FROM THE OFFICE

OF THE MAYOR

WELCOME FROM GREATER TAREE CITY MAYOR

It is my great pleasure to extend a very warm welcome to delegates and partners attending the 12th NSW Biennial Noxious Weeds Conference and Expo here in Turee.

Greater Taree City Council is delighted and proud to host this important conference and we hope that all delegates gain from the experience and have a pleasant stay in this beautiful part of New South Wales.

Our Council's area covers some 3,753 square kilometres, has a population of approximately 45,000 and includes mountain rainforests, rich agricultural flood plains, the magnificent Manning River and a 50 kilornetre coastal strip.

I am sure you will be pleased with the venues for the various components of the program and will take advantage of the opportunity to venture into the surrounding areas an the half day field trip:;.

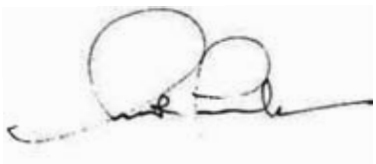
The Manning Entertainment Centre, the conference venue, is a 500 tiered seat theatre with excellent amenities. The conference dinner venue is the very popular Winning Post Function Centre at Taree/Wingham Race Course.

An innovative feature of the conference is the aquatic and land-based displays on the banks of our magic Manning River.

I know the organising committee has been working tirelessly to develop the program that promises to both stimulate and challenge. I am confident that the combination of conference program, field trips and expo will deliver both objectives in an unparalleled setting.

The 12th NSW Biennial Noxious Weeds Conference is an opportunity for environmental and noxious weed professionals involved in land management, rural and urban environments, to come together and learn in the spirit of fellowship and good will.

Welcome again. I hope you all enjoy the conference and expo and take home with you many fond memories of our Manning Valley.



CR MICK TUCK
MAYOR
CITY OF GREATER TAREE

Administration Centre · 2 Pulteney Street . PO Box 482 . Taree NSW 2430

Phone 02 6592 5301 · Fax 02 6592 5311

Minister for Agriculture

Foreword - 12th Biennial Noxious Weeds Conference Proceedings

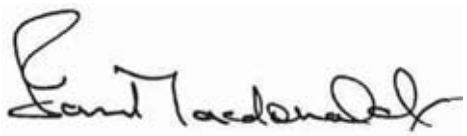
Weeds are a major and costly issue when it comes to protecting our natural resources.

In order to control these unwanted plants we need to constantly update our knowledge and seek improved management techniques. Successful weed management requires more than simply controlling the plants on the ground. It also requires planning, education, training, cooperation and knowledge.

Conferences such as this one are a vital part of sharing information, experiences and views from a cross-section of those involved in weed management. The fact that this is the 12th such symposium demonstrates its relevance and importance as a weed management forum.

The program includes topics and demonstrations that cover weed control in many systems and environments and includes presentations from researchers, weed control officers and those managing the processes behind the on-ground activities. These people have a wealth of knowledge and experience that will provide a valuable resource for future reference.

I urge you to make the most of this opportunity to gain information, forge networks and share your experiences so that the whole community can benefit.



IAN MACDONALD MLC
NSW MINISTER FOR AGRICULTURE AND FISHERIES

A SHORT HISTORY OF BIENNIAL NOXIOUS WEED CONFERENCES

The "Biennial Noxious Weeds Conferences" were preceded by "Weed Schools" of which the first was held at Hawkesbury Agricultural College in 1971. The attendance was in the order of 50 weeds officers

As the popularity of the Weed Schools grew the organisers needed to find facilities capable of taking the larger numbers. At the Weed School at Orange in 1979 the organisers were forced to restrict attendance to 90 as this was the limit of the auditorium.

The growth in the numbers wishing to attend and the attraction for people involved in noxious weed control other than council inspectors lead to the decision to rename the functions as Biennial Noxious Plant Conferences. It was also considered that the new title would more accurately describe the increased standing of the function and provide an increased incentive for people to attend. With the introduction of the new Weeds Act 1993 the word "Plants" was changed to "Weeds"

The initial Noxious Plants Conference, which was organised by Hugh Milvain, was held at Wagga Agricultural College in 1981.

The Conferences are now recognised as the premier noxious weed forum in the state and are well recognised in other states. There has been a steadily increasing attendance from government agencies and commercial companies. Attendance of interstate delegates has become a regular practice and there have also been international delegates. The attendance at the Ballina Conference in 1999 was 325 delegates

Initially the forum were organised largely by NSW Agriculture officers but over time there has come a greater input from weed officers in the host council's region. This input by weed officers now ensures that the conferences are closely aligned to the requirements their profession.

The increased attendances have been recognised by many councils which now realise the benefits that a conference brings to their community.

Consequently, NSW Agriculture now invites councils to apply to hold the next conference in their town and to carry out the substantial part of the organisation. This partnership between the host council and NSW Agriculture worked very well at Moama in 2001 and will continue with success at Taree in 2003. Much of the work is now done by an organising committee made up of host council officers, weeds officers from other councils in the region and officers of NSW Agriculture

Many councils have developed the expertise for organising well planned conferences. In partnership with NSW Agriculture, the continual success of Biennial Noxious Weeds Conferences is assured.

Biennial Noxious Weeds Conferences

#	Year	Month	Location	Venue	Regional Coordinator
Weed Schools					
	1971		Richmond	Hawkesbury Agricultural College	
	1973		Paterson	C B Alexander College	
	1975		Paterson		
	1977		Orange	Orange Agricultural College	
	1979		Orange		Chris Evans
Biennial Conferences					
1st	1981	July	Wagga Wagga	Wagga Agricultural College	Hugh Milvain
2nd	1983	April	Armidale	University of New England	Derek Brown
3rd	1985	May	Canberra	Australian National University	Peter Gorham
4th	1987	June/July	Richmond	Hawkesbury Agricultural College	Peter Gray
5th	1989	July	Lismore	Southern Cross University	Robert Dyason
6th	1991	May	Leeton	Soldiers Club	Hugh Milvain
7th	1993	April	Foster	Forster Services Club	Geoff Keech
8th	1995	September	Goulburn	Police Academy	Peter Gorham
9th	1997	September	Dubbo	Dubbo RSL Club	Peter Gray
10th	1999	July	Ballina	Ballina RSL Club	Regional Organising Committee
11th	2001	September	Moama	Moama Services Club	Regional Organising Committee
12th	2003	July	Taree	Manning Entertainment Centre	Regional Organising Committee

Peter Gray
Noxious Plants Advisory Officer
NSW Agriculture
Dubbo

PRESIDENT'S REPORT 2002/2003

Fellow Weeds Officers, other Associates of our industry, it does not seem almost two years since our last Conference in Moama. Now we have gathered for the 12th Biannual Noxious Weeds Conference and Expo in Taree.

The past twelve months have been very harsh to New South Wales with drought and bushfires, but with our Aussie fighting spirit, we will come through these setbacks and rise to greater heights with favourable weather conditions. While some areas have turned the corner, others are still waiting and hoping their turn is not far away.

During this period, Weeds Officers have taken leave, been asked to take leave, or performed other duties within Council.

With the drought conditions widespread across the state for most of the year, not a great deal has been happening in weed control. But some of the highs have been:

- An open invitation was extended to the Association Officials to meet with Noxious Weeds Advisory Committee as issues arise.
- A further twenty five Weeds Officers graduated through Tocal College in April 2003.
- Six Officers graduated with a Diploma in Conservation Land Management/Weeds, believed to be the first under the National package.
- Membership numbers have had a slight increase, but we would be happier with further increases in these numbers.
- The Association is a major sponsor of the 12th Biennial Conference and Expo, believed to be a first for us and hoping to continue our support to the Biennial Conference to further promote our Association.
- (Not sure if this is a high or low, but..) as of 1st September 2003 the Occupational Health and Safety Act, 2000 and Occupational Health and Safety Regulations, 2001, will be in force in every workplace in NSW and if not complied with, heavy fines may be imposed on both the Corporation and Individuals. Be Aware!! Work Safe!!

In the future I look forward to hearing and receiving written ideas on the Associations future direction(s). I would appreciate if you can put it in writing, both the problem and your solution and/or thoughts. I believe it is time to look to the future and the challenges that may confront us, united we can prevail.

Treasurer:	Kevin Nelligan 98 Darling St COWRA 2794	President:	Bryson Rees 53 Twickenharn Drv DUBBO 2830	Secretary:	Roger Smith PO Box 35 ORANGE 2800
Phone :	0427 629 237 (02) 6340 2067	Phone :	0417 293 251 (02) 6884 0797	Phone:	0419 011 002 (02) 6362 1991

Also, over the past twelve months some have retired, moved to other career paths, which in turn brings in new Officers to our industry. We thank you for your input and welcome to those new Officers. Other Officers/Associates have lost loved ones, workmates or have not experienced the best of health. While these times are testing, I wish and extend to all of those for better times ahead.

To the Executive, thank you for your efforts and support during the past year and now declare all positions vacant a look forward to a show of strength at the AGM.

Bryson Rees
PRESIDENT

GRADUATION DAY, 4TH APRIL 2003, ALEXANDER COLLEGE TOCAL

Graduates with a Diploma of Conservation and Land Management (Weeds)
L to R: Brian Worboys, Bryson Rees, Roger Smith, Phil Hansen, Bob Thurling & David Karlsen.
They are believed to be the first to graduate in the new National package.

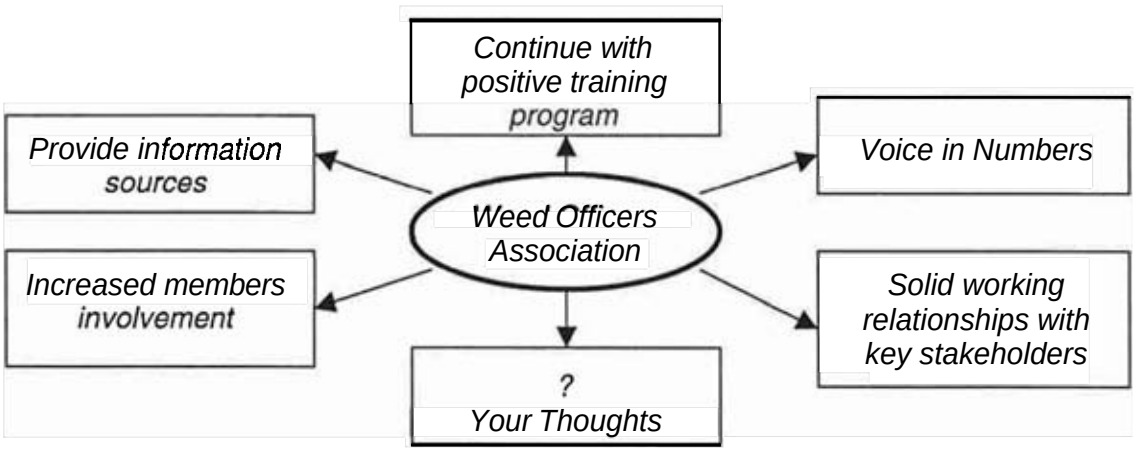
WHERE TO FROM HERE ?

TRAINEESHIPS

ADVANTAGES

- Possible Commonwealth Government Subsidies
- Help to start a person's career in weed management
- Person with few skills to obtain a full time position in a chosen area
- Structured training and Nationally recognised
- Developing skills through a combination of hands on experience and formal training
- To start in 2004 with sufficient numbers – 15 needed across the state

FUTURE DIRECTION



ACKNOWLEDGMENTS

The Association would like to acknowledge the fact that the dream is now a reality for Weeds Officers and training.

- Noxious Weeds Advisory Committee for financial grants.
- TOCAL College for the professional approach towards training
- Macquarie Valley Weeds Advisory Committee for their initiative in developing the training program
- Local control authorities for supporting the training program
- Weeds Officers for participating in the training program and looking forward to more and continued support

NOXIOUS WEEDS OFFICERS ASSOCIATION

OF NEW SOUTH WALES INCORPORATED

The Aim:

Protect the community and environment through professional weed control

The Objectives :

1. To provide a united approach for people associated with the weed control industry
2. To be proactive in the promotion of better weed control within the community
3. To keep members abreast of all relevant information on : Training – Funding – New Technology – etc.
4. To meet and set professional standards throughout the industry by : Facilitation – Extension – Coordination
5. To achieve a better environmental future through providing professional advice
6. To meet community expectations in good weed management
7. To accomplish a sustainable agricultural environment through training and high-quality weed management
8. To coordinate weed management with associated stakeholders
9. To produce a member's skill matrix
10. To develop and maintain a website
11. To develop networking opportunities and allow all members access to tap the knowledge pool
12. To maintain an employment register
13. To have a united voice when approaching Federal, State and Local Governments
14. To produce a quarterly Newsletter
15. To promote the Noxious Weeds Officers Association of NSW Inc.

WEED MANAGEMENT AND TRAINING FOR A STABLE ENVIRONMENT

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NOXIOUS WEEDS OFFICERS ASSOCIATION

OF NEW SOUTH WALES INCORPORATED

MEMBERSHIP APPLICATION FORM

Name . _____

Home Address : _____

_____

_____

Contact Numbers : _____

_____

Organisation . _____

Email Address . _____

Membership Fee : $25 per year
(Or pay $45 at the Conference and this will take you through to the next conference.)

* *I wish to join*

* *I wish to renew my membership of*

* ***Delete one***

the Weeds Officers' Association and enclose my cheque for $_____.

. . . ./.../20....

"Strength is in Membership Numbers !!"

G:\Weeds Conference 2003\Conference Papers\Bryson, R.doc

WEED MANAGEMENT AND TRAINING FOR A STABLE ENVIRONMENT

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12th NSW Biennial Noxious Weeds Conference
Expo & Field Trips

1ST - 3RD JULY 2003

CONFERENCE PROGRAM

MONDAY 30TH JUNE 2003 - For locations of venues, refer locality map.

9.00 am	-	Early Registration at the Manning Entertainment Centre (all day)
11.00 am	-	Woody Weeds Tour - Taree Golf Club
1.00 pm	-	Evergreen Bowls - Taree Sports and Recreation Club
5.30 pm	-	CivicView Weed Mapping and Reporting Computer Presentation, Taree RSL Club
6.30 pm	-	Civic Welcome/Buffet - Taree RSL Club

CONFERENCE PROGRAM

TUESDAY 1ST JULY 2003

8 am **Registration**

OPENING SESSION - Chairperson: Mr Phil Pinyon, General Manager, Greater Taree City Council

8.30 am Welcome - Cr Wendy McKeough, Deputy Mayor, Greater Taree City Council
8.45 am Address - The Hon Mark Vaile, MP, Minister for Trade, Federal Member for Lyne
9.00 am Official Opening - The Hon Ian MacDonald, MLC, Minister for Agriculture & Fisheries
9.15 am Keynote Speaker - Mr Brian Scarsbrick, Landcare Australia - Solutions to Success

10 AM **MORNING TEA**

NATIONAL PERSPECTIVE - Chairperson: Mr Syd Lisle, NSW Agriculture

10.30 am Guest Speaker - Mr Tim Low - "More Weeds Please"
11.00 am National Issues in Weed Management: Successes and Challenges - Mr Tony Grice
11.30 am Extending the Search: Recent Weed Detections in Northern Australia - Ms Barbara Waterhouse

12 NOON **LUNCH**

CONCURRENT SESSIONS

	MANNING ENTERTAINMENT CENTRE AUDITORIUM	VISITOR INFORMATION CENTRE THEATRETTE	MANNING ENTERTAINMENT CENTRE - MEZZANINE ROOM
	Plan and Implement **Chairperson: Mr Graham Last**	**Defend and Contain** **Chairperson: Mr Rod Ensbey - NSW Agriculture**	**Councillors' Role in Noxious Weeds** **Chairperson: Cr Frank Harrison - Hastings Council, NWAC Delegate**
1.00 pm	Control of *Salvinia molesta* in the Waterways of Myall Lakes National Park - Ms Mel Schroder	Weeds - Solutions to Success or Solutions to Minimise Weeds Success - Ms Mirranie Barker	Roles/Responsibilities/Obligations - Cr Frank Harrison
1.30 pm	Towards Better Adoption of Regional Weed Management Plans - Mr Michael Michelmore	Solutions to Success - Defence Style - Ms Dee Murdoch	Co-ordinating and Prioritising Weed Management in the Riverina - Cr Doug Harris & Ms Paula Ash
2.00 pm	Early Detection and Eradication of Potentially Invasive Plants in Queensland - Mr Steve Csurhes	Willow Control in the Hawkesbury Lower Nepean Catchment - Ms Patricia Chadwick	Wither the Weeds County Council - Mr Phil Blackmore
2.30 pm	Regional Weed Management Issues in the Sydney Basin - Mr Paul Marynissen	Perennial Grass Weeds: An Overview of Management Options - Mr Tony Cook	Open Forum

CONFERENCE PROGRAM

TUESDAY 1ST JULY 2003 - CONTINUED

3 PM **AFTERNOON TEA**

CONCURRENT SESSIONS

	MANNING ENTERTAINMENT CENTRE AUDITORIUM	VISITOR INFORMATION CENTRE THEATRETTE
	Professional Development **Chairperson: Cr Anne Cross - Greater Taree City Council**	Aquatic Dilemmas Chairperson: Cr Jim Henderson - Gloucester Shire Council
3.30 pm	The Conservation and Land Management (CLM) Training Package - Dr Annabel Bowcher & Ms Birgitte Verbeek	Alligator Weed Management - Ms Rebecca Coventry
4.00 pm	Weed Mapping - Mr Robert Ferguson	Emerging Weed Threats to Irrigation in Victoria - Mr Roger Baker & Mr Jim Wilding
4.30 pm	Close	Close
4.30 pm	*Noxious Weed Officers Association - Annual General Meeting - Mezzanine Room, Manning Entertainment Centre	

EVENING PROGRAM

	Chairpersons: Mr Wayne Deer (Greater Taree City Council) & Mr Terry Schmitzer (Mid North Coast Weeds Advisory Committee)
5.30 pm	Chemical Companies Presentation - Taree RSL Club
6.30 pm	Evening Meal - Taree RSL Club
8.00 pm	Elected Members Meeting - Taree RSL Club - Meeting Room

CONFERENCE PROGRAM

WEDNESDAY 2ND JULY 2003

EXPO ENDEAVOUR PLACE, RIVER STREET, TAREE (refer map) Co-ordinator: Mr Dale Smith, **Hastings** Council

7.30 am	Breakfast on the Manning River - Rowing Club/Riverbank - Aquatic, Aerial and Landbased Display and Group Discussion
9.30 am	Bus to Manning Entertainment Centre

10 AM MORNING TEA

REGULATION AND INNOVATION - MANNING ENTERTAINMENT CENTRE AUDITORIUM - Chairperson: Mr Peter Gorham (NSW Agriculture)

10.30 am	Noxious Weed Control and the Native Vegetation Conservation Act, 1997 - Mr Stephen Gowlland
11.00 am	Pesticides Act 1999 - Mandatory Record Keeping - Mr Brian Curtin
11.30 am	The Real World and Red Tape - A Farmer's Perspective - Mr Ted Laurie
12 noon	Catchment Management Blueprints and Plans - Mr Michael Holton
12.30 pm	Innovations in Weed Science and Management - Mr Richard Carter

1 PM LUNCH

NORTH COAST TOWN & COUNTRY FIELD TRIPS

1.30 pm Depart Manning Entertainment Centre

a) Coastal Tour - Harrington/Crowdy Head (Red dot on name badge)
b) Brush and Beach Tour - Wingham Brush/Saltwater Beach (Yellow dot on name badge)
c) River and Rainforest tour - Coocumbac Island (Blue dot on name badge)

4.00 pm Return to Manning Entertainment Centre

CONFERENCE **DINNER/ENTERTAINMENT** - Master of Ceremonies: Mr Mike Collins
(Free bus transport available to and from Winning Post Function Centre - refer map for bus route and pick up)
6 pm Pre Dinner drinks - Winning Post Function Centre
7 pm Conference Dinner - Dress: Semi Formal

CONFERENCE PROGRAM

THURSDAY 3 JULY 2003

CONCURRENT SESSIONS

	MANNING ENTERTAINMENT CENTRE AUDITORIUM	VISITOR INFORMATION CENTRE **THEATRETTE**
	Community Weed Capers Chairperson: Cr Wendy McKeough - Greater Taree City Council	State of **Origin** Chairperson: Cr John **Weate** - Great Lakes Council
8.30 am	Engaging the Community in Weed Control - Gippsland Story - Ms Erlina Compton	Breaking Down the Barriers - A Cross-Border Approach to Managing Parthenium Weed - Ms Janet Barker
9.00 am	Community Groups as the Nucleus for Co-operative Land Management - Mr Chris Dewhurst	Parthenium Weed Training Kit - Ms Rebecca Hutchinson
9.30 am	The Culture Underlying Weed Control - Dr John Stockard	Current Status of Weed Biological Control in New South Wales - Mr Royce Holtkamp

10 AM MORNING TEA

CONCURRENT SESSIONS

	MANNING ENTERTAINMENT CENTRE AUDITORIUM	VISITOR INFORMATION CENTRE
	Floral Friends and Foes Chairperson: Mr **Ian Turnbull** - Bellingen Shire Council	Agencies in Action Chairperson: Mr Lee Amity - Gunnedah Shire Council
10.30 am	Leucaena: A New Conflict Tree - Mr Craig Walton	Plants Toxic to Livestock on the Mid North Coast of NSW - Mr Allan Glassop
11.00am	The Bushland Friendly Nursery Scheme - Mr Reece Luxton	Giant Parramatta Grass: An Emerging Weed on the South Coast - Mr Ian Borrowdale
11.30 am	Nursery and Garden Industry NSW and ACT (NGINA) - Mr Don Ainsworth	An Integrated Approach to Weeds Management on Travelling Stock Reserves: Kempsey Rural Lands Protection Board - Mr Peter James
12 noon	Discovering Alternatives to Garden Escapes - Miss Elwyn Swane	Threat Abatement Plans: Weeds and Plant Conservation - Dr Paul Downey

12.30 PM LUNCH

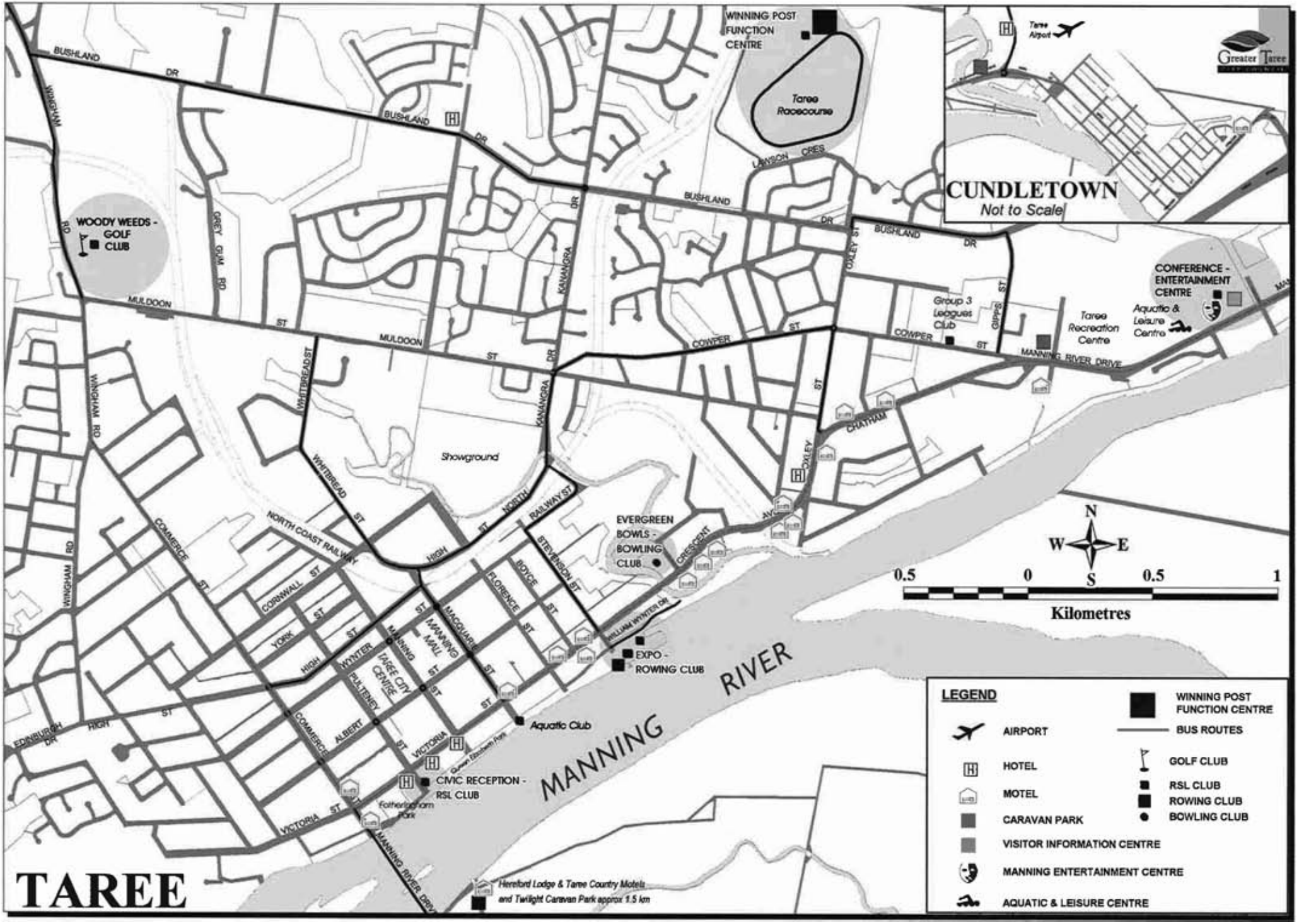
SUCCESS AND SURVIVAL - MANNING ENTERTAINMENT CENTRE AUDITORIUM - Chairperson: Mr Peter Gray, NSW Agriculture

1.30 pm Conflict Resolution/Body Language - Dr Warwick Hain
2.00 pm Hastings Environmental and Community Infrastructure Levy - Mr Geoff Freeman
2.30 pm Collection and Identification of Recent Plan Naturalisations in New South Wales and Assessment of Their Relative Importance - Mr John Hosking
3.00 pm Conference Review (Synopsis) - Mr Bryson Rees
Evaluation

MAJOR PRIZE DRAW - Mr Gary and Mrs Sue Brown, Harrington Beach Holiday Park

Concluding Remarks - Cr Wendy McKeough, Deputy Mayor, Greater Taree City Council

3.30 PM AFTERNOON TEA AND CLOSE


WINNING POST FUNCTION CENTRE
Taree Racecourse
BUSHLAND DR
LAWSON CRES
WOODY WEEDS - GOLF CLUB
GREY GUM RD
WINGHAM RD
MULDOON ST
WHITBREAD ST
KANANGRA DR
Showground
OXLEY ST
COWPER ST
Group 3 Leagues Club
GIPPS ST
Taree Recreation Centre
CONFERENCE - ENTERTAINMENT CENTRE
Aquatic & Leisure Centre
MANNING RIVER DRIVE
CHATHAM AV
CRESCENT
EVERGREEN BOWLS - BOWLING CLUB
NORTH RAILWAY ST
STEVENSON ST
NORTH COAST RAILWAY
COMMERCE ST
CORNWALL ST
YORK ST
HIGH ST
WYNTER ST
MANNING MALL
TAREE CITY CENTRE
MACQUARIE ST
FLORENCE ST
BOYCE ST
WILLIAM WYNTER DR
EXPO - ROWING CLUB
Aquatic Club
ALBERT ST
PULTENEY ST
VICTORIA ST
CIVIC RECEPTION - RSL CLUB
Queen Elizabeth Park
Fatherson Farm Park
EDINBURGH DR
MANNING RIVER DRIVE
MANNING RIVER
Hereford Lodge & Taree Country Motels and Twilight Caravan Park approx 1.5 km
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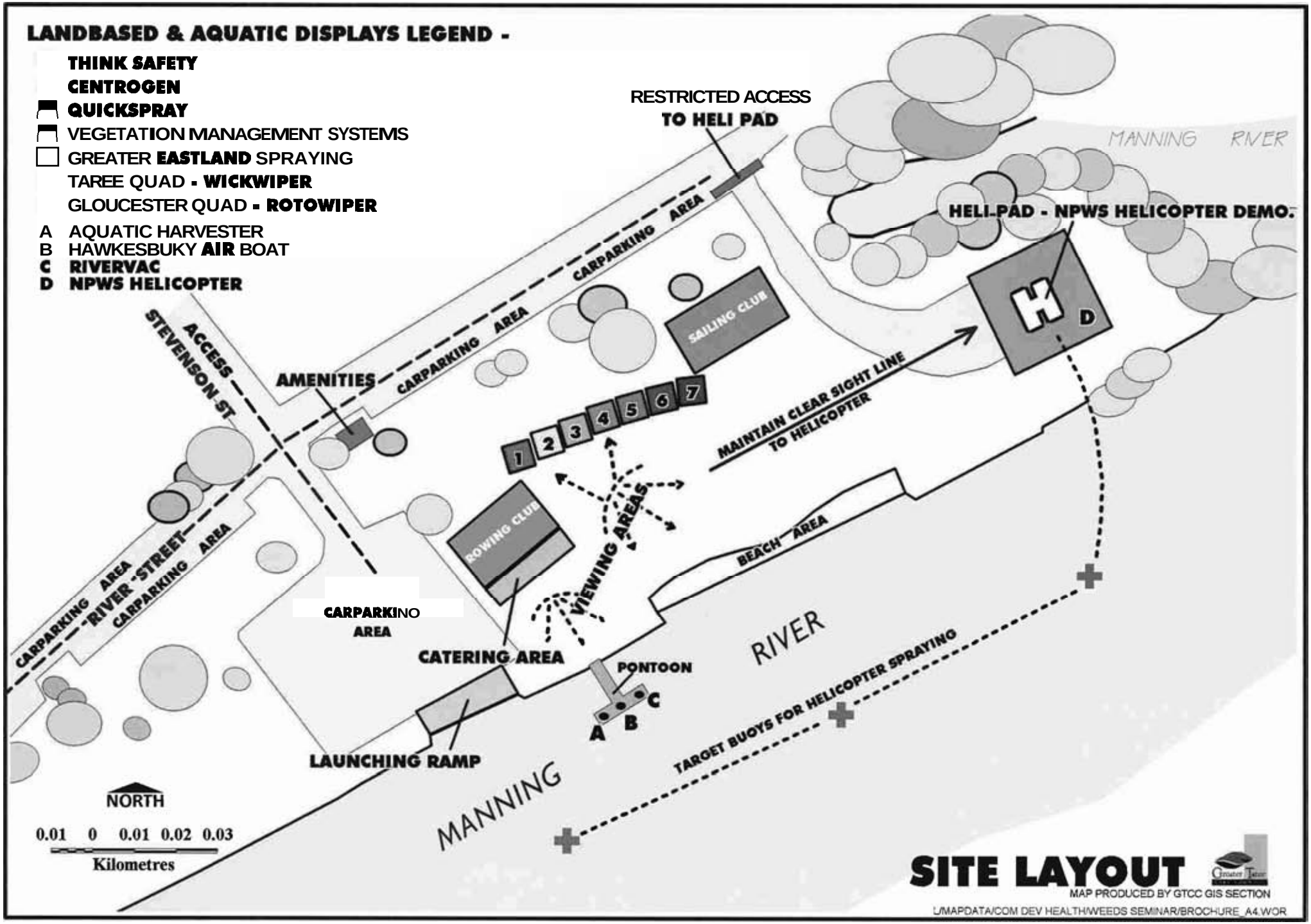
LEGEND
AIRPORT
HOTEL
MOTEL
CARAVAN PARK
VISITOR INFORMATION CENTRE
MANNING ENTERTAINMENT CENTRE
AQUATIC & LEISURE CENTRE
WINNING POST FUNCTION CENTRE
BUS ROUTES
GOLF CLUB
RSL CLUB
ROWING CLUB
BOWLING CLUB
TAREE


LANDBASED & AQUATIC DISPLAYS LEGEND -
THINK SAFETY
CENTROGEN
QUICKSPRAY
VEGETATION MANAGEMENT SYSTEMS
GREATER EASTLAND SPRAYING
TAREE QUAD - WICKWIPER
GLOUCESTER QUAD - ROTOWIPER
A AQUATIC HARVESTER
B HAWKESBUKY AIR BOAT
C RIVERVAC
D NPWS HELICOPTER
RESTRICTED ACCESS
TO HELI PAD
MANNING RIVER
HELI-PAD - NPWS HELICOPTER DEMO.
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CARPARKING AREA
SAILING CLUB
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STEVENSON ST
AMENITIES
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MAINTAIN CLEAR SIGHT LINE
TO HELICOPTER
ROWING CLUB
VIEWING AREAS
BEACH AREA
CARPARKING AREA
RIVER STREET
CARPARKING AREA
CARPARKINO
AREA
CATERING AREA
PONTOON
RIVER
A B C
TARGET BUOYS FOR HELICOPTER SPRAYING
LAUNCHING RAMP
MANNING
NORTH
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Kilometres
SITE LAYOUT
MAP PRODUCED BY GTCC GIS SECTION
L/MAPDATA/COM DEV HEALTH/WEEDS SEMINAR/BROCHURE_A4.WOR

12th Biennial Noxious Weeds Conference

Conference Papers

Tuesday 1 July 2003

SOLUTIONS TO SUCCESS

"SALINISING" THE WEED PROBLEM

Brian Scarsbrick
Landcare Australia Limited

"SALINISING" THE WEED PROBLEM

To significantly increase the funding available to tackle the weed problem, awareness of the threat weeds pose to the economy, human health and the landscape must be dramatically increased.

The awareness levels that salinity reached in both the rural and urban population must be reached nationally for the "weed threat", to significantly increase funding levels.

Natural Resource Management (NRM) is the funding focus for federal and state funding.

Weeds pose a threat to –

- Agricultural production\
- Human health (urban audiences)
- Export earnings
- The landscape
- Biodiversity
- The economy

Weeds are a major land degradation issue that needs to be brought to the attention of the Australian public.

Urban awareness must be increased and the voting population needs to be targeted to raise the profile of the weed threat.

COST OF INVASIVE WEEDS

Weeds have major economic, environmental and social costs. The direct financial costs of weeds to the agriculture industry alone is generally considered to be $3.3 billion a year – covering both loss of production and control costs. The costs to grain cropping alone are estimated to be about $1.2 billion a year, and at least twice that for the rest of agriculture. The cost of weeds to the environment and biodiversity is incalculable.
(A Glanznig 2003)

HEALTH IMPACTS OF WEEDS

Many weeds have health impacts. Parthenium Weed (Parthenium hysterophorus) for example, infests thousands of hectares in Queensland and is also found in New South Wales and the Northern Territory. The weed causes respiratory problems, dermatitis and asthma in people. Allergic reactions may be so severe that affected people have to leave the area of infestation.

Weeds can also affect water quality. Measurements of water infested by the water weed, cabomba, showed that it exceeded National Health and Medical Research Council water quality guidelines for most of the year. To comply with these guidelines by removing the colour in potable water supplies would result in significant ongoing costs.
(A Glanznig 2003)

TOMORROWS WEEDS ARE ALREADY HERE!

Some of the world's worst weeds have recently invaded Australia. Early detection is the key to timely and cost effective intervention and provides the best opportunity for eradication of new pests. If these weeds had not been detected until they were widespread, the Australian environment and primary industries would have incurred costs of hundreds of millions of dollars. Serious weeds recently detected include :

- **Siam Weed**
  Detected Bingil Bay and Tully area, Qld, 1994. One of the world's worst weeds. Invasive scrambling shrub. Smothers crops, trees and pastures. Produces thousands of wind borne seeds, also dispersed by water, livestock and vehicles. Threatens much of northern Australia. Potential to become a $100+ million weed problem in Queensland alone if not controlled.

- **Mile-a-minute**
  Detected at Mission Beach and Bingil Bay, Qld, in 1998. Each infestation less than 0.5 hectares in extent. Further infestations detected at Speewah and Ingham in 2001. Potential to smother rainforest, commercial forests, sugar cane, tropical fruit, vegetable plantations. Aggressive climber. Also known as mikania vine, produces tens of thousands of fine fluffy seeds dispersed by wind, water, machinery, and animals.

- **Kosters Curse**
  Detected Julatten, Qld, in 2001. Serious pest. In Hawaii 40,000ha is infested. Highly invasive shrub that forms dense thickets. Smothers plantations, pasture and native vegetation. Also known as Clidemis hirta, produces thousands of bird dispersed berries, which make control difficult and expensive. Potential to cause millions of dollars damage to agriculture and irreversible damage to the Wet Tropics.

- **Yellow Burrhead**
  Detected Centenary Lakes and Kuranda (near Cairns) Qld, in 2001. Potential to become a major aquatic weed in dams, slow moving streams and wetlands. Also known as Limnocharis *flava,* each plant able to produce one million seeds per year. Threatening US wetlands, including Florida Everglades. Rice paddies abandoned in Asia. Introduced in the US as an ornamental plant in water gardens.

- **Fringed Spider Flower** (Cleome rutidosperma)
  Detected in Darwin in 2000. Serious tropical weed of agriculture. Seeds dispersed by ants and as contaminants of produce, vehicles, footwear etc.

- **Canary Island's St Johns Wort and Swordgrass**
  Since 1999, 40 new plant species have been detected in Western Australia. These include Canary Island's St Johns Wort (Hypericum canariense), a serious weed in California and Hawaii, which has the potential to devastate coastal ecosystems, and as well as swordgrass (Miscanthus *floridulus*), which is a controlled species under Commonwealth quarantine and WA laws but was found in a nursery in late 2002.

- **White Tussock Grass** (*Nassella* tenuissima)
  Detected for sale in a Victorian nursery in 1998. Otherwise known as Mexican Feather Grass, this weed is a close relative of serrated tussock grass, a major pasture weed. The stock had been grown from imported seeds ordered through the mail.

- **Mouse-ear Hawkweed**
  Detected in Tasmania in 2001. Entry thought to be a nursery or garden.

How many serious weed infestations remain undetected throughout Australia?
Numerous weeds introduced before border controls were strengthened in 1997 are now naturalising somewhere in the environment. A coordinated national system will ensure the detection and eradication of many new serious weeds before they take hold.
(A Glanznig 2003)

SOURCES OF LAND AND INLAND WATER WEEDS

By far the majority of environmental weeds (65%) were intentionally introduced into Australia as ornamental species, 7% for agricultural use and only 2% through seed contamination. The remaining 26% are of unknown origin or other sources. They may have been legally imported, smuggled, or arrived through 'natural' avenues such as windblown seeds or dispersed by birds in northern Australia.
(R H Groves 1997)

- Garden escapes
  The greatest number of environmental weeds were originally introduced as ornamental plants. 65% of the 295 plant species and sub-species known to have become naturalised between 1971 and 1995 were intentionally introduced as ornamental species. In a list of 277 environmental weeds considered to be in their early stages of naturalisation in Australia, 73% of the plants were identified as garden ornamentals. Many weedy species are still being traded by the nursery industry. While over 860 species were recently identified as being an invasive risk, moves were made to only voluntarily withdraw 52 invasive exotic species from nurseries.

- Introduced pasture species
  Of the 463 exotic grass and legume species introduced into Northern Australia between 1947 and 1985, 60 (13%) became listed as weeds, while a mere 4 (less than 1%) were found to be useful without causing weed problems.
  (A Glanznig 2003)

RECENT AND POTENTIAL WEED SOURCES

- **Ornamental Plants**
  The African lily, *Wachendorfia thyrsiflora*, recently introduced as an ornamental plant, has been found spreading 'abundantly' along a drainage line in Victoria. In 2001, Ruella (a native of tropical South America with beautiful flowers) as found thriving in a gully at the end of an illegal tip in central Queensland.

- **Aquarium Plants**
  Coarse oxygen weed (*Lagarosiphon* major) is a serious aquatic weed in New Zealand and South Africa. Here it is currently restricted to home aquaria. It naturalised in a dam near Melbourne in 1977 but was eradicated. It is on the Alert List of weeds. Dense waterweed (Egeria) is an emerging waterweed also found I Melbourne, probably introduced by someone dumping the contents of an aquarium into a waterway.

- **Botanic Gardens and other scientific institutions**
  Serious weeds recently discovered in botanic gardens include (Miconia calvescens) a Latin American garden plant that has overrun Tahiti and infested Hawaii. Miconia plants have been found growing in the Flecker Botanical Gardens in Cairns, and botanic gardens I Brisbane, Sydney and Melbourne.
  (A Glanznig 2003)

SOLUTIONS TO SUCCESS

1. INCREASED FUNDING

The cost of weeds to primary industry is estimated at $3.3 billion.
The cost of land degradation (excluding weeds) = $2.5 billion.

Weeds should be one of the highest priority land degradation issues

Weeds control is high priority for land managers but funding program priorities are ambiguous and are sending mixed messages about the importance of weeds.

All ecologically sound weed control projects should be eligible for public funding where substantial public interest can be shown.

Raising Awareness – "Salinising Weeds"

The threat posed by weed invasion into productive farm land areas of high conservation value and the urban landscape must be promoted as a high priority land degradation issue to both the rural and urban audiences.

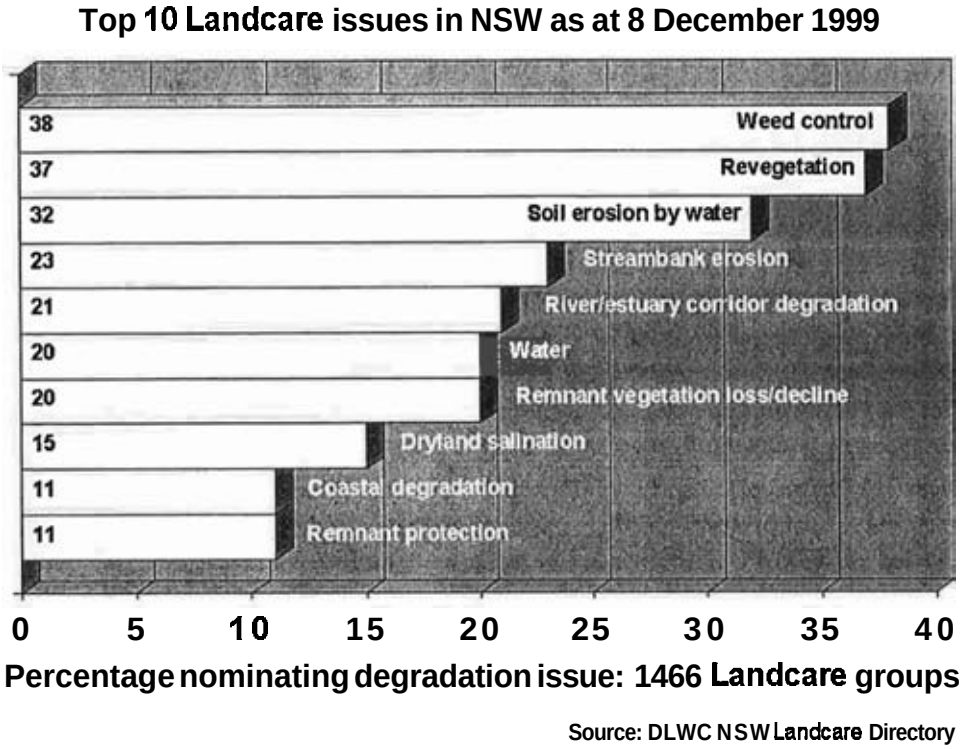
The weed threat should have a similar profile to salinity given the costs to the community. The so called "salination of weeds" is a very real issue and can only be achieved by a well planned awareness raising program.

Increased funding will only be achieved if the weed issue becomes a national urgency issue. The tried and proven promotion technique (CSAs using credible celebrities, national TV program promotions, regular press releases on newsworthy issues etc) need to be used in a national communication campaign.

ROLE OF THE LAND MANAGER

Surveys of farmers in landcare groups show that weed invasion is their top priority.
The following table shows the results of a survey of landcare groups in New South Wales :

FIG 1
Survey of Priority Issues in the Landcare Movement



Source: DLWC NSW Landcare Directory

The following are quotes by landholders on their attitudes to weeds :

- Weeds invade my crops, contaminate the wool and are a constant drain on my resources
- Weed control is the highest priority problem on my property
- Weeds are a constant battle and I spend a lot of money and time on the problem
- You talk about land degradation! – weeds render country useless when they take over and are a real threat to my property

Land Managers have a number of options that they may choose to manage their weed problem :

- They may control weeds to maximise production capacity
- They may also manage weeds to reduce biodiversity loss by minimising incursions into areas of high conservation value
- Established noxious and sleeper weeds may be their prime target
- It is most likely that they will manage the weeds that are a priority for their property and catchment/region if these are defined

Are Landholders Supported in their Weed Control Efforts?
Some national mechanisms are in place, but significant gaps still exist, for instance :

- In the past general weed control projects have not been eligible for NHT funding without being "dressed up" as a vegetation management project which sends the wrong messages about the importance of weed control
  This issue has been addressed in NHT (II) where weed control projects are now eligible for funding.
- Distinctions between production and environmental weeds despite moves to 'whole of landscape' management through regional plans
- Duty of care for noxious weeds picked up at a State level, but this is an incomplete approach

Linking Land Manager Role to Regional/National Priorities
The management of weeds needs to be in line with regional plans and drawing on a national framework of priority weed issues and regions. National systemic approach must support this regional/catchment model.

Awareness raising and education on weed identification and control are important drivers in achieving better weed control but regulation is also needed to ensure compliance of those who choose to turn blind eye to their weed problem.

With a strong systemic approach in place, local implementation may draw community action as an effective way to ensure collective action to control weeds. Peer pressure within, for example, a landcare group area is important in encouraging landscape wide weed control.

The landcare community group provides an ideal mechanism to carry out weed containment and control projects using coordinated community action.

3. INFORMATION FLOW AND COMMUNITY LANDCARE

The landcare network is an ideal vehicle to increase information flow and encourage community action because it increases awareness, knowledge and enhances skills. Landcare plays an important role in encouraging adoption of more sustainable agricultural practices.

70% of landcare group members said that the landcare network provides them with knowledge of farm practices to treat/avoid degradation. A surprising 35% of land managers who are not members of a landcare group receive their land degradation information through the landcare network.

Increasing Adoption of Weed Control
Landcare groups are ideally positioned for regional delivery of onground outcomes. Landcare groups have formed networks Groups of Groups (GoGs) of a number of groups in a discreet locality and are scaling up for regional (landscape) delivery. By 1998 71% of landcare groups were a member of a network in New South Wales and there are now over 100 GoGs in that state alone.

Most land managers and landcare groups are aware of their responsibilities to manage weeds but also know that weeds are not contained by fences – landscape approaches are needed for effective weed control.

The surveys in FIG II indicate that 40% of landholders across Australia are a member of a landcare group.

FIG II

Percentage of Landholders in a Landcare Group

- Reeve (2201) 43% (unadjusted)
- ABARE (2000) 38%
- Curtis (1994) – VIC 50% (properties had a member)

On average at least 40% of land managers are currently in a landcare group across Australia which provides a powerful network to achieve significant change

Adoption of conservation practices is much higher if the landholder is a member of a landcare group. Research has shown that a landcare group member (compared to a non-member is :

- 88% more likely to exclude stock from agricultural areas affected by land degradation
- 77% more likely to undertake formal monitoring of pasture/vegetation conditions
- 30% more likely to protect or enhance areas of conservation value
- 20% more likely to maintain vegetation cover along drainage lines
- 46% more likely to undertake other preventative/control practices

(ABARE 2000)

Similarly, the adoption of more sustainable best bet practices was shown to be much higher if the landholder was a landcare group member in research by Curtis.

A landcare group member (compared to a non-member) was :

- 67% more likely to plant trees
- 51% more likely to soil test
- 52% more likely to erect fencing for landcare
- 13% more likely to apply lime
- 7% more likely to plant perennial pasture

in the previous two years
(Curtis 1994 Victoria)

4. DEVELOP A NATIONAL INVASIVE SPECIES INFORMATION SYSTEM

A national information system is a vital foundation in providing an integrated and comprehensive online one-stop shop information resource to support early warning, rapid response and control efforts. It would also support implementation of the NRM framework (which includes 'ecologically significant invasive species' as a target for regional plans). The information system should also be designed to meet the functional requirements of the proposed EPBC Act invasive species regulations.

The system would enable the integration of a range of information and data sets currently being developed, including the –

- collation of data produced to measure regional NRM invasive target indicators by the National Land and Water Resources Audit
- development of the national exotic species database through the CRC for Australian Weed Management
- development of best practice management guides for all 20 Weeds of National Significance and 28 Alert List species

The system would also integrate available information that is currently fragmented and dispersed on the web sites of the CRC for Australian Weed Management, the Australian Weeds Committee and various Commonwealth and State agencies.

An important aim of the System would be to provide readily accessible information and resources to enable the rapid identification of, and geographically based information to assist development and implementation of NRM regional plans. It could include beset practice communication methods used by the States, such as the Weed Alert internet early warning tool established by the Royal Botanic Gardens (NSW).

A key part of the proposed Information System (and EPBC invasive species regulations) is a national list of *all* introduced species classified into broadbased threat and management response categories.

The proposed list should build on the national exotic species database being compiled by the CRC for Australian Weed Management and the categorised list of naturalised non-native species being developed to meet target 4.1.3 of the *National Objectives and Targets for Biodiversity Conservation, 2001-2005.*

Such a comprehensive list is a cornerstone of other national approaches to manage threats to the environment, for example, the *Australian Inventory of Chemical Substances* (containing over 38,000 chemicals used in Australia) maintained under the National Industrial Chemicals Notification and Assessment Scheme.

5. DEVELOP A NATIONAL SYSTEM FOR THE PREVENTION AND MANAGEMENT OF INTRODUCED LAND AND INLAND WATER WEEDS

One of the biggest gaps in the current response to invasive species is the lack of a nationally coordinated early warning and rapid response system for introduced land and inland water weeds. A major opportunity exists to develop the System so that it becomes an integral part of the national Natural Resource Management framework. Development of a National System enables effective implementation of *National Weeds Strategy* Objective 1.2 and National *Objectives and Targets for Biodiversity Conservation,* 2001-2005. Objective *4*.

Principal elements of the System should include :

Early Warning System

- A nationally coordinated community-based Weed Alert Network delivered regionally through the NRM framework. At the regional level, the Network could be coordinated through the National NRM facilitator network. The Network should build on successful and emerging State models such as the Victorian Weed Spotters Network

- A national set of **Sentinel Sites** in and around sites of probable introduction, including ports, roadsides, rubbish dumps, and other sites sensitive to weed incursion
- An alert list of harm potential, newly emerging, and sleeper weeds
- A **list of all introduced plant species** classified into broad-based threat categories
- A **standard set of reference material** to assist Weed Alert Network 'wed spotters' easily and rapidly identify possible harmful introduced land and inland water weeds, combined with a rapid identification service
- **National Land and Inland Weeds Information System** (part of the National Invasive Species Information System

Rapid Response System

- National Action Plan to prevent and eradicate new and emerging weeds
- Agreed cost sharing arrangements between the Commonwealth and the States/ Territories.

The National Action Plan should aim to locate and eradicate at least 50 high priority new or emerging weeds, and provide for nationally coordinated State/Territory pest plant distribution prevention strategies and rapid response action plans. It should also include an audit and/or retrospective weed risk assessment of all species located in botanic gardens, research centres, and especially old agricultural research farms, to identify and eradicate any potentially invasive species.
(A Glanznig 2003)

Conclusion

- Weed control is one of the highest priority land degradation issues facing land managers

- The profile of the "weed threat" needs to be raised to a level that will ensure increased allocations of funding are available to tackle the problem.

- Land managers need better access to funding from Commonwealth and States to carry out their weed management responsibilities

- Community action using the landcare model is an effective way to ensure collective action to manage weeds. Information flow and peer pressure within the landcare group area is important in encouraging landscape wide weed control.

- **A** national information scheme and system for the prevention and management of introduced weed species should be established.

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National issues in weed management: successes and challenges

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Introduction

Canute was a Viking who became king of England, Denmark and parts of Norway and Sweden between 1016 and 1035. He is probably best known because he is purported to have sat on his throne on the seashore and commanded the tide to advance no further. Of course, the tide ignored him and behaved in its usual way. Weed management often seems somewhat like trying to hold back the tide. In this paper we consider how successful we are being at holding back the tide of weeds in Australia and the challenges that face us if we are to improve our record.

There are some 25,000 native plant species in Australia (George 1981). To these have been added about 22,000 exotic plant species. The long list of exotic plants includes all our crop species, pasture grasses and legumes, forestry trees, and many garden plants, but it also includes a large number of weeds. Of the exotic species, about 2,500-3,000 have naturalised. Moreover, the number of naturalised plant species in Australian is increasing by about 10% per year. Now among these naturalised species are some that are perceived to be of benefit, at least to some sectors. However, for most of them, the costs out-weigh the benefits. This is certain to be the case in terms of the environmental impacts of weeds, although there are few cases where environmental impacts of weeds have been quantified. Weed management in Australia, then, is confronted by a lengthening list of problematic species. But wait, there's more.

Weed management must also contend with mixtures of weed species (''weed complexes'') because the various species do not exert their impacts in isolation from one another. For example, the perennial pastures of southern Australia are invaded by several important annual grass weeds (Vulpia spp., *Lolium* rigidum, Bromus spp., Hordeum spp.) and numerous broadleaf weeds (Dellow et ***al.*** 2002). Likewise, a large number of exotic species co-occur along riparian zones of the Burdekin River in northeast Queensland and often dominate the plant community (Figure 1; Grice and Lawes, unpublished data). Furthermore, many of Australia's well-established weed species are still increasing in abundance within their current ranges and expanding their ranges. In summary, weed management in Australia is confronted by a growing number of weed species, individual species are becoming more widespread and abundant and they are interacting with one another. Countering problems of this scale and complexity presents formidable challenges.

Are there any reasons for optimism?

1. Development of National Weeds Strategy

Australia has developed a National Weeds Strategy. This is significant for several reasons. First, it is recognition that weeds are a major problem for Australian people, industries and ecosystems. Second, it is recognition that there are many aspects of dealing with weed problems that require a national approach. For example, significant benefits in preventative weed management should accrue if the risks and benefits of further plant introductions are considered at a national scale. Similarly there are advantages in having policies that relate to weed management that are consistent across state and territory boundaries. Moreover, the mere existence of a National Weeds Strategy helps to focus attention on weed issues.

2. Co-operative Research Centre for Australian Weed Management

The CRC for Weed Management Systems and its successor the CRC for Australian Weed Management (Weeds CRC) have also fostered a national approach to weed problems and solutions. As far as research is concerned the Weeds CRC is addressing some of the big questions in weed ecology and management. The CRC is also dealing with issues of communication and education for improved weed management.

(i) The program, Weed Incursion and ***Risk*** Management is designed to develop a predictive capacity as a basis for avoiding ''new'' weed problems. First, it is attempting to devise ways of determining a priori which plant species have weed potential in Australia, that is, weed risk assessment. Second, it is developing protocols for detecting ''new'' incursions. An improved ability to detect new incursions will increase the likelihood that the weed can be contained or even eradicated. Third, this program is developing a basis for deciding what are realistic objectives for a ''new'' weed by providing a basis for assessing whether it can be eradicated or if containment is the more realistic option.

(ii) Sustainable Cropping Systems is seeking innovative management systems for crop weeds, through biocontrol, engineering and biotechnology, and integrating these to form best practice. It is also improving systems to manage the risks associated with cropping weeds.

(iii) The *Landscape Management* program is developing generic approaches to weed problems of extensive land units, either by considering weed issues for target habitats (e.g. riparian zones, rangelands and rainforests) or by developing solutions for weed species that are representative of broader groups of important weeds. This program is also looking for ways of streamlining biological control programs by re-examining how we select potential biocontrol agents, test them for host-specificity, release and establish agents in the field, and evaluate the impacts of releases.

(iv) A *Community Empowerment* program is working to increase community awareness of weeds, influence community attitudes toward them and increase the adoption of research findings.

(v) An *Education* program is training the next generation of weed researchers and managers at post-graduate and honours levels, as well as providing more general material for both primary and secondary schools.

Each of the three research programs of the Weeds CRC is attempting to do more than take a "next cab off the rank" approach to weeds. The concept of weed functional groups is being explored as a means of developing understanding and solutions that can be applied to more than one species. This is important in relation to both the policy and practice of weed management. Moreover, the networks that the CRC has established should facilitate the transfer and adaptation of experiences and developments between regions and situations.

3. Increased awareness of weed issues

There is evidence of an increased awareness of the threats posed by weeds to Australian industries and environments. For example, a National Weeds Awareness Workshop held in Brisbane in April 2003 was attended by representatives of Commonwealth and State government agencies concerned with the policy and practice of weed management, Environment Australia, non-government organizations and educators. The general impression of this meeting was that there is now an improved awareness of the threats posed by weeds and of the issues involved. Workshop participants indicated a need and willingness to co-operate on weed issues and to further improve the awareness of seven target audiences that they had identified. The high level of weed awareness is most apparent in rural communities, where weeds are identified as one of the major threats to sustainable production. This is also reflected in the fact that, in April 2002, Meat and Livestock Australia commissioned a workshop to identify important weed issues relevant to Australian grazing industries. Non-government organizations such as World Wildlife Fund are proactive in relation to weeds, having prepared a position paper on the topic earlier in 2003. At a general community level also, there is an increased awareness of the impacts of environmental weeds on natural ecosystems and of the need for action. Overall, weeds are now more clearly recognised as a key factor in natural resource management.

4. Communities mobilised against weeds

In recent years there has been increased involvement of community groups in implementing solutions to weed problems. This includes groups with interests in the maintenance and restoration of remnant urban bushland and rural communities that are taking catchment or regional approaches to specific weed problems. The first round of the Natural Heritage Trust (NHT) program focussed on community involvement in local natural resource issues but did not give due consideration to weeds. In its second manifestation (NHT2), there is scope to more overtly address weed issues. On-going community involvement in weed management will be very important if awareness is to be translated into action.

5. Developing more effective weed quarantine

A primary goal of Australia's National Weeds Strategy is "to prevent the development of new weed problems" by prohibiting "the introduction of new plant species with weed potential". The Australian Quarantine Inspection Service has moved to a "white list" approach to plant quarantine, which permits the introduction of nominated species, rather than a "black list" system that prohibits introduction of nominated species. The prohibited list approach assumes a species is innocent unless proven guilty and can be circumvented by confusion of plant names or simply because a particular plant species has not been identified as a weed. While the alternative approach is not infallible, it does have obvious advantages in helping to control plant introductions. A species is guilty until declared innocent.

6. Improved management of new incursions

The management of new weed incursions is a major focus of both the National Weeds Strategy and Weeds CRC. This recognises that the key principal of weed management that the earlier action is taken, the more effective and efficient that action is likely to be (Grice 2000). The CRC is undertaking research that will provide decision-making frameworks for eradication versus containment strategies. A two-day workshop in Sydney early in 2003 drafted a best practice guide for dealing with new incursions. This guide covers reporting requirements, surveillance and identification methods, relevant legislation for State and Territory jurisdictions and hygiene and disposal protocols.

7. Significant successes in weed management

Historically, Australia has had some very significant successes in weed management. Perhaps the most well known example is of the successful biological control of prickly pear (Opuntia spp.) by the moth Cactoblastus *cactorum*. Most attempts at weed control since then have perhaps not been quite so dramatically successful or widely publicised but there have, nevertheless, been some notable achievements. Some examples are:

(i) The 25-year biological program against Mimosa pigra involving release of twelve agents has greatly reduced the plant's seed output and established plants are dying under sustained attack (Julien 2002).

(ii) The impacts of the rust fungus introduced for the control of bridal creeper (Asparagus asparagoides) are "severe and destructive" and the agent is spreading slowly but steadily in southern Australia (Morin et *al.* 2002).

(iii) The rust *Maravalia cryptostegiae* has greatly reduced the seed output and recruitment of rubber vine *(Cryptostegia grandiflora*) and, in some areas, it has killed up to 40% of plants (Vogler and Lindsay 2002).

(iv) *Helenium amarum* and *Eupatorium serotinium* have been eradicated from Queensland (Tomley and Panetta 2002), *Bassia scoparia* from Western Australia (Dodd and Randall 2002) and, apparently, *Hieracium pilosella* from Tasmania (Rudman and Goninon 2002). Other eradications are being attempted (e.g. *Cleome rutidosperma* in the Northern Territory; Mitchell and Schrnid 2002). Perhaps of greatest significance is that eradication of some potentially important weeds is being resourced and attempted, and we are gaining a clearer indication of what genuine eradication requires in terms of time and money.

(v) Improved management of crop weeds has been achieved by development and acceptance of a number of technologies. These include the use of higher seeding rates of wheat and **incorporation** of a forage crop phase to **suppress weeds such** as herbicide-resistant ryegrass. More **effective management** of herbicide resistance in **weeds** has also been achieved through the rotational use of herbicide groups that have different **modes** of action.

What are the challenges?

The following are some of the major challenges that must be met if we are to improve our performance in weed management.

1. Further improve weed awareness

While there has been major progress in terms of general awareness of weed issues there is a need for further improvement. It is critical that urban populations as a whole, and not just a committed few, become aware of and concerned about the threat posed by weeds. This interest will be critical to the status of weed issues on political agendas. Salinity has for some time had the status of "the environmental issue". The threat posed by weeds is economically and environmentally greater and yet it does not yet have the profile, and so the resources, of salinity. This was exemplified at the November 2002 *Science Meets Parliament* meeting at which politicians rated weeds, pests and quarantine last in a list of twenty environmental issues that they wanted to hear about.

2. Improve weed R&D capacity

In recent years there have been some significant changes in Australia's capacity to undertake weed research and development activities. Overall R&D capacity has probably declined though the extent of the decline has not been uniform across jurisdictions or sectors. In the main, it is unlikely that solutions to weed problems in Australia can be imported. Research and development capacity within Australia should be maintained or increased. This capacity should include both the expertise and the resources to apply it.

3. Improve capacity to circumvent and respond to new incursions

Over the next 10-20 years, most 'new' weeds are likely to be species that are already in the country, that is, by naturalisation of plants that have already been introduced. The challenge here will be to ''manage'' the naturalisation process. This will require appropriate education, regulations and weed management practices. Key stakeholders in this process are State and Commonwealth regulatory agencies, the Australian Quarantine Inspection Service, gardeners, the nursery industry, forestry and other rural industries. Expertise and protocols are required to detect new incursions as early as possible.

A somewhat more specific challenge in relation to managing new incursions will be to provide adequate resources for realistic eradication campaigns. Even when new incursions are located and identified very early in the invasion process, eradication can take years. This can be the case even when the incursion is restricted to a few infestations covering a very limited area. Moderate funding over an extended period is more likely to facilitate eradication than is a high level of funding over a short period. There is a need for flexibility in eradication campaigns to account for different biological characteristics of weeds and the circumstances under which they are growing.

4. Move beyond the species-by-species approach

There will always be a demand for research, development and management action against individual weed species, but there is a need to augment these species-by-species approaches. Obviously, many aspects of policy and regulation must be developed and applied above the level of the species. Perhaps the greatest challenge, however, is to deal with invasions by ''species complexes''. This is especially relevant for environmental weeds because many ecosystems are invaded by a large number of interacting species of a wide variety of growth forms (Figure 1). If attention to an individual species leads to a decrease in its abundance, there may be a pay off because the system, and so the problem, has been slightly simplified. However, there may be no gain in terms of a reduced impact of weeds on the ecosystem because of the high probability that one of the other weed species that is already present will fill the gaps that arise. Management of these ''weed complexes'' in natural ecosystems requires integrated management of the whole as it does in cropping systems.

5. Continue to build community capacity

The big challenges in relation to community capacity for weed management are to maintain and build momentum for community action against weeds. Appropriate action will depend upon three interrelated elements: motivation, education and resources. We need to find a balance between private and public resources and between education, incentive and regulation. The balance required between these factors may not be the same for all scenarios. However, regardless of the balance in a particular situation, the role of community groups in weed management is likely to be critical, as is the support and understanding of the issues by the general public. If the general pubic is not engaged (and this is largely an education problem) then they will not create the political pressure necessary to ensure that community groups get the resources and support networks they need. Individual land managers and community groups that are involved in land management should develop and implement weed management strategies in the context of integrated resource management. This context should promote the mind-set that weed management is an on-going requirement of sustainable land management rather than a short-term or one-off exercise.

6. Tackling the intractable

A number of weed species or groups of species have proven very difficult to manage, some in spite of considerable research and development. Lantana (Lantana camara) has, for decades, been a focus of research but it remains a major environmental and pastoral weed. Unpalatable grasses (e.g. serrated tussock Nassella trichotoma, Chilean needle grass Nassella neesiana, gamba grass Andropogon *gayanus*, mission grass Pennisetum polystachion) also present a major and growing threat and there are as yet few economic solutions, especially for extensive situations. While biological control is worth exploring for some of these grasses, worldwide there are few precedents for this approach with grasses. Finding solutions to the problems of these intractable species is a major challenge.

Conclusions

One version of the story of King Canute says that his real purpose in commanding the tide to advance no further was to demonstrate to his courtiers that he was a mere mortal and that there were limits to what he could achieve. He is supposed to have said, "Let all men know how empty and worthless is the power of kings. For there is none worthy of the name but God, whom heaven, earth and sea obey". In other words, his purpose was not to hold back the tide but to show that he could not. The lesson for weed management here is that we (scientists, educators, extension specialists, land managers, the general public) must have realistic expectations and objectives. Many of our successes will be 'low profile'. Perhaps some of weed management's greatest achievements will be in the prevention category rather than the cure category. It may not be easy for many stakeholders is recognize them as great achievements. For example, a weed species eradicated is not a problem. Eradication, though, is rarely an option, so in most cases we have to concentrate our efforts on containing and managing weeds to minimize the areas that are affected and the severity of the impacts where they do occur. The containment and management objectives that we set and the means whereby be plan to meet them must be realistic. Certainly, we cannot make the tide recede but we can influence its rate and direction of flow and the impacts that it has upon the Australian landscape.

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Figure 1. The riparian zone of the Burdekin River has, in many places, been invaded by a complex of weed species. This site is dominated by chinee apple (Ziziphus mauritiana), parkinsonia (Parkinsonia aculeata), rubber vine (Cryptostegia grandiflora), bellyache bush (Jatropha *gossypifolia*), castor oil plant (Ricinus communis), snakeweed (Stachytarpheta jamaicensis) and other species. Native species are a minor component.

Extending the search: recent weed detections in northern Australia

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Abstract

Early recognition and prompt intervention before 'new' weeds become widely established are essential to reducing the future environmental and economic impacts of weeds in Australia. Many weed species have broad ecological tolerances and can potentially occupy a wide geographic range. In the past decade in northern Australia (particularly north Queensland), naturalised populations of several species with reputations as serious weeds overseas have been recorded for the first time in Australia. These include *Chronzolaena odorata* (chromolaena), *Mikania inicrantha* (mile-a- minute weed), *Cleome rutidosperma* (fringed spiderflower), *Lirnnocharis flava* (yellow burrhead), *Miconia calvescens* (velvet leaf) and *Clidemia hirta* (Koster's curse). However, not all potentially serious weeds arrive on our shores with a history of weediness. Species like *Praxelis clematidea* (praxelis), *Brillantaisia lamium* (brillantaisia), *Miconia racemosa* (camasey felpa) and *Phytolacca rivinoides* (Venezuelan pokeweed) were not widely known before they were recognised as being invasive in north Queensland. Irrespective of their weed history, at least some of these species could also establish and become invasive in other parts of Australia, including the humid coastal regions of northern New South Wales. The principal objective of this paper is to draw attention to these recently recorded 'new' weeds in case single plants or infestations are lurking unrecognised in unexpected localities.

Introduction

The rate of naturalisation of introduced plant species in Australia has apparently increased in recent decades (Groves 1998). Despite the implementation of a more effective weed risk assessment process for new plant introductions in 1997 by the Australian Quarantine & Inspection Service (Steinke 1999) this trend is likely to continue in the foreseeable future, largely due to the wide diversity of species that had previously been introduced for horticultural and agricultural purposes (Pheloung 2002).

Only a small proportion of all introduced species becomes naturalised, and a small proportion of naturalised species will become invasive weeds. Considerable time may elapse between the introduction and naturalisation of a potential weed species; or between naturalisation and when a species' population begins to increase exponentially. Groves (1999) refers to the latter as "sleeper weeds". History of weediness overseas is often a useful indicator of potential weediness in Australia (Csurhes & Edwards 1998), but not all 'new' weeds have a 'track record'.

New incursions by potentially serious weeds and the gradual expansion of populations of sleeper weeds have often remained unnoticed or untreated until they are already widely established and invasive. Early recognition and response a e essential to reduce the environmental and economic consequences of new weeds (Csurhes & Edwards 1998; Groves 1999; Pheloung 2002; Groves & Panetta 2002). Recently in Australia and internationally, there has been a shift of emphasis towards early detection and timely intervention before new weeds become significantly invasive. A primary goal of the Cooperative Centre for Australian Weed Management (Weeds CRC) is to enhance capacity for early detection and response to new weed incursions at national, state and regional levels. Surveillance under AQIS's Northern Australia Quarantine Strategy has led to the detection of a number of potentially serious new weeds in northern Australia, particularly far north Queensland. Additional new weeds have been discovered and reported by state and local government personnel and concerned landowners. Eradication programs are in progress for some of these species.

This paper summarises activities of the Northern Australia Quarantine Strategy and provides brief descriptions of ten new weeds found in northern Australia in the last decade. Some of these species could potentially occupy a much broader geographic range than the current known extent of infestations and there may already be other small, unrecognised populations. In drawing them to the attention of a wider audience I hope to increase the likelihood that other occurrences will be recognised and reported promptly, thus facilitating low cost remedial action, where appropriate.

Surveillance methods under the Northern Australia Quarantine Strategy

The Northern Australia Quarantine Strategy (NAQS) is a sub-program of the Australian Quarantine and Inspection Service with scientific, operational and public awareness components. It was established in 1989 after a review of quarantine in northern Australia highlighted the special quarantine risks faced by that region (geographic proximity to neighbouring countries, relatively free movement of traditional inhabitants, prevailing winds from north-west from December to March; and the sparsely inhabited northern coastline of Australia).

The scientific component of NAQS involves strategic surveillance and monitoring to facilitate early detection of new pests, diseases and weeds that may have arrived and established in the remote and sparsely populated regions of northern Australia. NAQS employs a small number of entomologists, plant pathologists, botanists, veterinarians and technical staff based in regional centres across northern Australia. Survey activities are primarily focussed on a narrow coastal zone from Broome to Cairns, including inhabited islands within Australian territory. Overseas surveys in Indonesia, East Timor and the border regions of Papua New Guinea (PNG) facilitate early warning of movement of new pests (including weeds) towards northern Australia.

'Target lists' are used to help focus survey efforts (for example Michael (1989) and Waterhouse & Mitchell (1998) have provided focus for weed surveillance). These are lists of pests known to occur in neighbouring countries but not yet Australia and with the potential to reach northern Australia via the NAQS region. Pests found to be present but of limited extent in Australia remain on the target lists if they are subject to eradication campaigns. In practical terms NAQS scientists are on the lookout for any new or unusual occurrences and all new detections (for example new naturalisation records for weeds) are reported, irrespective of whether they occur on a target list. Federal and state authorities are formally notified of significant findings through an agreed protocol. Significant detections often lead to response activities (such as eradication or containment programs) managed by the relevant state authority (in Queensland, the Department of Natural Resources and Mines [NR&M] for weeds).

NAQS botanists collect and submit voucher specimens of weeds to the appropriate state and/or national herbaria for verification and permanent record. State and local government pest officers, members of the public and landholders are also encouraged to submit specimens of unknown weeds for identification and are trained in collection of satisfactory herbarium specimens. Many of these specimens (including all significant records) are also forwarded to the state herbaria for permanent storage.

Some recent new weed detections in northern Australia

Table 1 summarises the names, origin and life forms of ten potentially serious weeds for which naturalised populations were recorded for the first time in Australia over the last decade, the majority being NAQS detections or identifications. With one exception, all were discovered in far north Queensland, but most could occupy a much broader geographic range in northern and eastern Australia. Further information on each species is provided in the notes below.

Table 1: Names, origin and life forms of ten recently naturalised weeds in northern Australia

Family	Scientific name	Common name	Origin	Life form
Acanthaceae	*Brillantaisia lamium* Benth.	brillantaisia	West Africa	perennial, erect or decumbent herb or sub-shrub
Asteraceae	*Chromolaena odorata* (L.) R.M. King & H. Robinson	Siam weed, chromolaena	Central and South America	perennial, erect or scrambling shrub
	Mikania micrantha Kunth	mile a minute weed, mikania	Central and South America	perennial, twining vine
	Praxelis clenzatidea (Griseb.) R.M. King & H. Robinson	praxelis	South America	annual or biennial, erect herb
Capparaceae	*Cleome rutidosperma* DC.	fringed spiderflower	tropical Africa	annual or biennial herb; sometimes epiphytic
Limnocharitaceae (Alismataceae)	*Limnocharis flava* (L.) Buchenau	yellow burrhead, limnocharis	Central and South America	annual or perennial aquatic herb
Melastomataceae	*Clidemia hirta* (L.) D.Don	Koster's curse, soap bush	Central and South America	perennial, shrub
	Miconia calvescens DC.	velvet leaf, rniconia	Central and South America	perennial, small tree
	Miconia racemosa (Aubl.) DC.	camasey felpa	Central and South America	perennial, shrub
Phytolaccaceae	*Phytolacca rivinoides* Kunth & Bouche	Venezuelan pokeweed	Central and South America	perennial, much-branched shrub

Brillantaisia lamium

Brillantaisia lamium is a shade tolerant herbaceous plant that is not yet widely known outside its native range, where it colonises disturbed sites (Csurhes & Edwards 1998). It grows to *c.* 2 metres tall and shows promise as an environmental weed, especially in riparian zones. It is also invasive in orchards, plantations and run-down pastures. *B. lanzium* flowers for much of the year, and has very attractive candelabra-like inflorescences of purple flowers. Typical of the Acanthaceae, it reproduces by prolific seed production and by vegetative propagation (stems root at nodes). Seeds are dispersed locally by explosive rupture of capsules and are carried further by waterborne spread and as contaminants of vehicles, machinery and nursery stock.

Naturalised populations of *Brillantaisia lamium* were first recorded for Australia near Japoonvale (Johnstone Shire) in far north Queensland in late 1996. Specimens were submitted for identification by a concerned landholder who had found it invading her orchard soon after she obtained some fruit trees from a property near Miallo (Douglas Shire) *c.* 180 km further north. Infestations were subsequently discovered in the vicinity of Miallo, where it is now a serious weed of stream banks and forest margins. Miallo is thought to be the site of original introduction. Other localised infestations have been found elsewhere in Douglas Shire (Cow Bay) and in Mareeba Shire (Julatten, Speewah) but it is certain to be more widespread. Response has varied from local control in Douglas Shire to attempted eradication of known populations in Mareeba Shire, but it seems likely that *B. lamium* will become significantly invasive in Queensland's wet tropical lowlands, at least (Waterhouse 2003).

Chromolaena odorata

Chromolaena odorata is a very serious environmental and pastoral weed that is widely naturalised and problematic in Africa, Asia, the Philippines, Indonesia, Papua New Guinea and Micronesia. It has a broad potential distribution in northern Australia, extending along the eastern seaboard to New South Wales. It rapidly colonises disturbed sites such as roadsides and riverbanks and forms dense smothering stands to *c*. 3m tall in open sites, but will climb to *c*. 8m along forest margins. C. *odorata* is fire tolerant and fire promoting, with a store of epicormic buds near the base of the stem enabling rapid resprouting after fires. *C. odorata* usually flowers between April and August in the southern hemisphere and produces huge numbers of wind-borne seeds that are readily spread as contaminants of vehicles, machinery, animals and floodwaters. Stems sometimes root at nodes when in contact with moist soil.

I discovered naturalised populations of *Chromolaena odorata* in the Bingil Bay and Tully River districts of north Queensland in July 1994 (Waterhouse in press). Accidental introduction as a contaminant of imported pasture seeds is postulated. A nationally funded eradication program managed by Queensland Natural Resources and Mines has achieved spectacular reduction of the population since then. Detection of isolated plants in rugged terrain and an unexpectedly persistent seed bank are problematic (Waterhouse & Zeimer 2002), but mopping up continues and there is no evidence of spread beyond the infested area circumscribed during the first three years of the eradication campaign. Maintaining public concern and enthusiasm for reporting isolated plants also requires more effort now that the large infestations have been removed and no longer impinge on farming activities (O. Zeimer pers. comm. 2001).

Mikania micrantha

Mikania micrantha is a rampant, twining vine that has become widely naturalised from India to China, and throughout Indonesia to PNG and the Pacific Islands. Although predominantly a weed of humid tropical regions, in Indonesia it is also invasive in localities with a distinctly monsoonal climate. M. *micrantha* is a serious environmental weed as well as a weed of degraded pastures, plantations and horticulture. Although shade tolerant, it usually flowers only in better-lit situations and rapidly climbs into the canopy reaching heights greater than 20 metres along forest margins. *M. micrantha* produces huge numbers of tiny wind-borne seeds that are carried long distances aloft in air currents and are readily dispersed as contaminants of vehicles, machinery and footwear. Vegetative propagation is its principal mode of reproduction in shaded sites and makes mechanical control of infestations difficult.

I discovered several tiny (each < 0.5 hectare) infestations of *Mikania micrantha* in the Bingil Bay, Mission Beach and Forrest Beach districts of north Queensland in June 1998, as the direct result of a member of the public submitting a tiny flowering fragment for identification. Each of these infestations is known to have a common source. However, in 2001, local government weed officers discovered several additional small infestations at a nursery near Speewah (Mareeba Shire) and at several sites near Ingham (Hinchinbrook Shire) in north Queensland. Morphological differences between plants in the different infestations and anecdotal evidence, suggests at least two separate introductions (Waterhouse in press). Genetic testing may help clarify the origins. All known infestations have been target of eradication efforts since their discovery, using a combination of chemical and mechanical control techniques. Flame has been used to destroy seeds where large numbers are present on the vines or on the ground. Excellent reduction of the infestations has been achieved to date, especially at the earliest found sites. However, because of suspected seed dormancy (Harry Evans pers. comm. 2003) and rapid regeneration from vegetative fragment to flowering plants, continued vigilance is essential at all sites.

Praxelis clematidea

Praxelis clematidea is an unpleasantly aromatic herb, 20 – 100 cm tall, with hairy stems and leaves. It has blue to lilac coloured flowers and produces large numbers of seeds adapted for wind-dispersal or spread as contaminants of vehicles, livestock, footwear and produce. It is a ruderal species that rapidly colonises disturbed sites, overgrazed paddocks and annual crops. In north Queensland it also forms large populations in the understorey of banana plantations and its tendency to invade relatively intact native pastures and the understorey of native woodlands is cause for concern. Although unpalatable to livestock, there is anecdotal evidence to suggest that it may be toxic if ingested.

Praxelis clematidea was almost simultaneously identified as invasive in north Queensland and Hong Kong in 1993-1994. It had not previously been recorded outside its native range (southern Brazil to Argentina) and did not have a history as a weed. In both regions, correct identification and recognition of its status as a new invader had been delayed because it was mistaken for the related but less invasive species *Ageratum conyzoides* L. (bluetop), and specimens were not collected for verification (Waterhouse & Corlett 1996). P. *clematidea* has spread rapidly in both regions. It is now present in southern China, Macau and Taiwan (J. Veldkamp pers. comm. 1999) and threatens much of Southeast Asia and the Pacific Islands.

Praxelis clenzatidea was found to be common in the Tully to Innisfail district of north Queensland in 1994 during the early searches for *Chromolaena odorata* infestations, and particularly abundant on the property where C. *odorata* is thought to have been introduced (Waterhouse & Corlett 1996). Since then it has spread rapidly to the north, south and west. Small infestations have been identified in remote parts of Cape York Peninsula and on two Torres Strait islands, where it has almost certainly spread as a contaminant of mulching straw, hay, and building and landscaping materials. It has become relatively common along roadsides as far south as Townsville, but collection of a specimen from the Gympie district in 2002 suggests its arrival in southeast Queensland is imminent. In north Queensland, *P. clematidea* has not been subject of any official control, although herbicide and management trials have been mooted in the light of increasing reports by concerned pastoralists. If outlying populations can be identified near Gympie it is likely that they will be target of control efforts.

Cleorne rutidosperma

Cleome rutidosperma is a much-branched herb to c. 100 cm tall, although often much smaller. It has small pale to reddish-pink flowers and the capsules contain numerous small, ribbed seeds, which have elaiosomes. Capsule dehiscence disperses seeds short distances from the parent plants, while longer distance dispersal occurs as contaminants of agricultural machinery, produce, vehicles and footwear. Ants feed on the elaiosomes but discard the seeds, resulting in dispersal to and germination in unexpected sites such as tree forks, roofs and guttering and rock walls or cliff faces. *C. rutidosperma* has a recent history of rapid spread outside its native range, particularly in southeast Asia and Indonesia where it is a weed of annual crops (eg. peanuts), abandoned cultivation, roadsides and amenity areas (Waterhouse in press).

NAQS botanist Andrew Mitchell discovered several small populations of *Cleome rutidosperma* in Darwin in August 2000, the first record for mainland Australia. In low numbers this species is relatively cryptic and difficult to locate amongst other herbaceous vegetation, so other infestations may remain undetected in the Darwin area. A further infestation was found just outside Darwin in February 2002. The largest infestation occupied *c.* 2 hectares, but most were less than 1 hectare and the total infested area is less than 10 hectares. Eradication efforts using a combination of hand-pulling and herbicide treatments commenced soon after the initial discovery. This has resulted in the apparent elimination of *C. rutidosperma* from one site but work continues at the others (Mitchell & Schmid 2002).

Lirnnocharis flava

Limnocharis Java is a clump-forming, aquatic herb with yellow flowers. It grows in shallow, slow-moving water with its roots attached to the muddy substrate. It has naturalised widely outside its native range and is regarded as a pest in the United States of America, India, Sri Lanka, Thailand and Indonesia. L. *Java* seeds and vegetative plantlets are dispersed by flowing water and it is a weed of padi rice, irrigation canals and wetlands. It has attractive foliage and flowers and was probably introduced outside its native range as an ornamental. It is also used as a green vegetable in parts of Southeast Asia, including Indonesia.

I discovered a naturalised population of *Limnocharis flava* in Cairns, north Queensland in June 2001. Subsequent follow-up led to the detection of further wild populations and individual plants in both the Cairns and Townsville districts (Waterhouse in press). Unfortunately L. *flava* has been cultivated as an ornamental pond plant in north Queensland, and may have been distributed more widely, particularly in gardens with 'Asian water features'. It is almost certain that other small populations and isolated backyard plants remain undiscovered. The known infestations occupied an area of less than 10 hectares and eradication efforts, where the plants are removed by hand and destroyed by deep burial, are under way. Regular and ongoing follow-up of infested sites is vital to locate and remove seedlings.

Clidemia Izirta

Clidemia hirta is a highly invasive weed of plantations and pastures and a serious environmental weed in humid tropical regions. It is naturalised and invasive in Southeast Asia and the Pacific region including Malaysia, Indonesia, Palau, Fiji and Hawaii. A much branched, shade tolerant shrub, C. *hirta* grows up to 5 m tall, but more usually 1-2 m. It has small white-flowers and purplish fruit containing dozens of tiny seeds. The seeds are ingested and dispersed by birds and mammals, and are dispersed externally as contaminants of agricultural equipment, vehicles, produce and footwear.

Clidemia hirta was discovered at Julatten north Queensland, in August 2001, by the Mareeba Shire weeds officer while following up the recent discovery of *Mikania micrantha* at Speewah. The infestation was small, comprising several hundred mature plants and seedlings scattered throughout a former palm nursery and along the banks and bed of an ephemeral stream running through the property (Waterhouse in press). The source and duration of the infestation are unknown. In some parts of the world C. *hirta* has been grown as an ornamental shrub, but it could also have reached this site as a contaminant of imported nursery stock. An eradication program was implemented soon after verification of its identity. Unfortunately dense rainforest and rugged terrain in the area adjacent to the infested property hamper the detection of isolated plants. Regular, follow-up to locate and destroy seedlings will be essential for successful eradication.

Miconia calvescens

Miconia calvescens is a shade-tolerant tree growing to *c.* 15 m tall. It is relatively uncommon throughout its native range, but has been cultivated elsewhere for its unusual and attractive foliage. It has escaped from cultivation and become naturalised and a serious environmental weed in Hawaii and French Polynesia (Csurhes & Edwards 1998), where it has invaded steep mountainsides, displacing native forest species. *M. calvescens* has a shallow root system and the dense shade created by infestations inhibits growth of understorey plants, leading to a serious soil erosion problem. *M. calvescens* flowers and fruit are small but prolific. Its tiny seeds are dispersed by birds, mammals, running water and as contaminants of footwear and tyres.

In Australia, Miconia calvescens has been grown in botanic gardens in the eastern states (Csurhes & Edwards 1998) and could occasionally be found in Queensland nurseries until it was prohibited in the 1990s. Plants were recently discovered in a nursery in northern New South Wales (P. Davis pers. comm. 2003). Since the mid 1990s, naturalised populations of M. calvescens have been identified and reported in several north Queensland districts (eg. Mareeba, Douglas and Johnstone Shires). It is hoped to eradicate M. calvescens from Queensland. All known infestations have been destroyed and the sites are revisited regularly to locate and destroy seedlings. Unfortunately, all the known sites are close to the rugged and densely vegetated Wet Tropics World Heritage Area, making detection of isolated plants almost impossible.

Miconia racemosa

Miconia racemosa is a straggling, shade-tolerant shrub that resembles Clidemia hirta in habit and leaf shape. Its flowers and fruit are similar to the closely related Miconia calvescens and seeds are dispersed in the same manner. Unlike M. calvescens, M. *racemosa* is reported to be weedy throughout its native range (F. Almeda pers. comm. 2002) and thus expected to be significantly weedy elsewhere.

Mareeba Shire weeds officer Sid Clayton discovered a naturalised population of Miconia racemosa near Kuranda, north Queensland in June 2002. While a close relationship with Clidemia hirta and Miconia calvescens was obvious from the plants' appearance, herbarium specimens had to be sent overseas for identification. M. racemosa had never been recorded outside its native range until this discovery. This species has not been used in commercial horticulture (F. Almeda pers. comm. 2002) and its mode of entry into Australia is unknown. Small infestations have been found along several kilometres of an ephemeral tributary of the Barron River, just upstream of Kuranda. The infestations are in rugged and densely forested country adjoining the Wet Tropics World Heritage Area, creating difficulties for detection of isolated plants. Because of its weed potential M. racemosa is now also the target of an eradication program (Waterhouse 2003).

Phytolacca rivinoides

Phytolacca rivinoides is a spreading shrub to 3 m tall. It is reported to be weedy in its native range and like other species in the genus, is probably toxic to livestock (Randall 2002). P. rivinoides flowers and fruits prolifically and has attractive pendulous white-flowered inflorescences. The inflorescence stalk and rachis, and individual flower/fruit stalks mature a deep pink colour. Its fruit are fleshy, purplish-black and contain numerous seeds. Birds (and possibly mammals) consume the fruit, potentially resulting in long-distance seed dispersal.

Phytolacca rivinoides was probably introduced to Australia for ornamental purposes. A concerned landholder first reported a small, naturalised population in the Miallo district north Queensland, in April 2002. Herbarium specimens had to be sent overseas for identification. A search of the area revealed several hundred mostly small plants along the banks of a perennial stream. Native silvereyes and honeyeaters have been observed feeding on fruit, but the pattern of plants suggests that localised waterborne seed dispersal is also a factor in its spread (Waterhouse 2003). In view of the site's proximity to the Wet Tropics World Heritage Area and the apparently weedy characteristics of P. *rivinoides*, the Douglas Shire weeds officer and Queensland Natural Resources and Mines personnel have sought out and destroyed all visible plants. Follow-up searches for seedlings are planned in conjunction with other weed eradication programs in the area (eg. for *Miconia* calvescens).

Conclusions

Some of today's isolated naturalised plants will become tomorrow's weed infestations. Early detection and identification of sleeper weeds and recent or new naturalisations will help determine where resources should be allocated for eradication or containment programs, thus reducing the cost and impacts of potential weeds in Australia. Each of the species listed above could occupy a much broader geographic range in Australia than at present. The fact that some have been recorded at nurseries or have been used for ornamental purposes increases the likelihood that they already occur more widely but remain undiscovered. Curiosity about the identity of unknown plants and willingness to collect herbarium specimens for identification are simple but effective tools in the struggle to reduce the future impacts of invasive plants.

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Control of *Salvinia molesta* in the waterways of Myall Lakes National Park

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Background

In 1996 a salvinia (Salvinia molesta) infestation was discovered on private land in the Myall Lakes Catchment, in the upper Boolambayte Creek, 4.5km upstream from the Myall Lakes National Park. Myall Lakes National Park(MLNP) is situated on the mid north coast 100km North of Newcastle. MLNP covers an area of 44 000 hectares and protects the largest natural coastal lake system (10 000ha) in New South Wales. Due to the limited tidal flushing much of the lakes waterways remain brackish, with salinity levels often low enough to be conducive to the growth of salvinia.

Salvinia is a small, hardy, free-floating aquatic fern, highly invasive and capable of explosive rates of growth which enable it to rapidly form dense floating mats. The plant is identified by its fronds (or leaves) which are found in whorls of threes, two of which are broad slightly folded, hairy and remain emergent the third being a modified root like frond remaining submerged. Salvinia is a sterile hybrid in which proliferation is wholly asexual by vegetative means following fragmentation, the plant can regrow from a single node(Parsons & Cuthbertson 1992).

Once established, salvinia rapidly forms dense floating mats due to its capacity for rapid growth rates, its hardiness, and its reported high level of acclimatisation to adverse conditions. Salvinia infestations adversely and severely reduce light penetration and nutrient availability to other native aquatic plants and animals, imperiling their survival with potentially serious disruption to the functioning of aquatic ecosystems.

Apart from its ecological impacts, salvinia degrades the aesthetic quality of waterways and can severely restrict navigation, fishing and recreation (Parsons & Cuthbertson, 1992).

The salvinia infestation in Myall Lakes NP had the potential to spread throughout a large proportion of the lake system. Whilst wind and wave action would protect the large expanse of water within the lakes. The RAMSAR protected wetlands covering the foreshores of the lake and numerous protected shallow embayments were at threat.
The ecological and recreational value of the range of aquatic habitats of the Myall Lakes has been widely acknowledged (NPWS 2002). The Myall Lakes system is the only Class P protected lake waterway system in NSW and contains unusual freshwater habitats. The lakes system is also listed in the Directory *of Important* Wetlands in Australia (Blackley et *al*, 1996).

Primary Control

In **1997** a control program was initiated on private land both within two farm dams and along a 1km stretch of the upper Boolambayte creek by Great Lakes Council. Containment and treatnient of the infestation was considered feasible. The infestation was contained using a floating boom and salvinia upstream from the boom treated using diquat herbicide. Access into the site was very difficult and the effectiveness of herbicides contacting salvinia plants was inhibited by natural vegetation occurring along the creek. Follow-up was difficult at this time as the creek line was covered in a large quantity of degrading vegetation from past heavy rainfall events, and due to the death of native species from herbicide use. No ground follow-up was undertaken thus allowing plants not effected by herbicide treatment to survive and reestablish. At this time the biological control, Cyrtobagous salviniae was released on an infested farm dam Within the catchment but failed to establish, probably due to the heavy forest canopy.

Between 1996 -1998 the area received little rainfall reducing the dispersal of remaining *salvinia.* However, following heavy rainfall in May 1998, the worst possible scenario occurred plants which evaded treatment were washed over the boom and on into the remainder of Boolambayte Creek and Lake and consequently into Myall Lakes NP. Following a mild Winter/ Spring and very low Salinity levels the entire 4.5km length of the Boolambayte creek (from the start of the infestation) became choked with *salvinia.* By mid spring 1998 the wetlands surrounding the Boolambayte Lake contained both heavy and scattered infestations. In total the infestation covered over 20km of creek and lake foreshore in various growth stages.

Developing a Co-ordinated Strategy

Prior to 1998 coordination amongst relevant land managers was minimal. The infestation covered a range of land tenures and follow-up management of the infestation had not been adequate. Following the increase in the distribution of the infestation a Coordinated Control Strategy steered by the NSW National Parks & Wildlife Service (NPWS) and including Great Lakes Council, Department of Land & Water Conservation and Waterways, was developed in 1998.

This strategy (NPWS 1999) was prepared and implemented in late 1998. The aim of the program was to identify and map all infestations, contain and reduce the distribution of *salvinia* whilst monitoring uninfected areas of the catchment. The strategy included the identification of suitable control techniques (considering the sensitive nature of the Myall Lakes aquatic system) and the division of the infestation into specific geographic management areas, thus establishing high, medium and low priorities. The later was to ensure resources were utilised where the weed provided the biggest threat for further dispersal. The strategy also incorporated a community education component, which promoted community awareness through a field day and the preparation of an identification brochure.

The initial physical removal of the larger infestations within the Boolambayte Creek was completed using, Conservation Volunteers Australia in December 1998. This work was then followed up by a combination of Great Lakes Council Staff, NPWS Staff and Bush Regeneration contractors undertaking physical removal using scoops by foot, canoe and small aluminium dinghy.

Four *Salvinia* containment fences were constructed on the Boolambayte Creek during this time. One trash fence and three mesh fences (constructed across the creek in a herringbone arrangement and anchored on the creek banks). A larger trash mesh fence (10cm x 10cm) was installed above the three containment fences to prevent the larger flood debris washing downstream in high flow events and damaging the *salvinia* fences.

In conjunction with the installation of these containment measures, the Waterways Authority installed a Marine Notice on the creek, closing it to all vessel movements.

In spring 1999 NPWS staff undertook monitoring, physical removal and some chemical application (using AF100) within the known infestations within the Boolambayte Lake. Continued monitoring and removal of the weed within the Creek and Lake has been undertaken since January 1999. By spring 2001, the salvinia infestations were found to be restricted to a few scattered plants within a private farm dam and a small infestation in Boolambayte Lake. These infestations were removed and fortnightly monitoring of the areas undertaken.

In 2002 the NPWS and Great Lakes Council received Natural Heritage Trust funding to undertake a *salvinia* survey of the entire Myall Lakes Catchment. This also incorporated other aquatic weed species. No *salvinia* was found during this survey.

By Summer 2003 no more plants have been recorded within the previous infested area, however random monitoring has continued on a monthly basis during the active growth phase. Due to the biology of the plant this will continue for at least two years. If one small plant remains it has the capacity alone to reinfest this entire area.
The programs success has been assisted by low rainfall which resulted in a decrease in water levels and an increase in salinity.

Conclusion

The program has been successful because of access to an appropriate level of resources, the coordination of control works with relevant landholders, integration of a number of control techniques and the consistent monitoring and follow-up of previously infested areas.

The program has highlighted that early detection, coordination across all land tenure and appropriate treatment is critical to the success of a program. The program has cost over 120k in the last six years but inexpensive compared with the cost of allowing the continued expansion of the weed within the Myall Lakes.

The success of the program to control *salvinia* in Myall Lakes provides a positive outcome in the treatment of a difficult aquatic weed and should inspire other land managers that the fight against weeds in some instances can be won.

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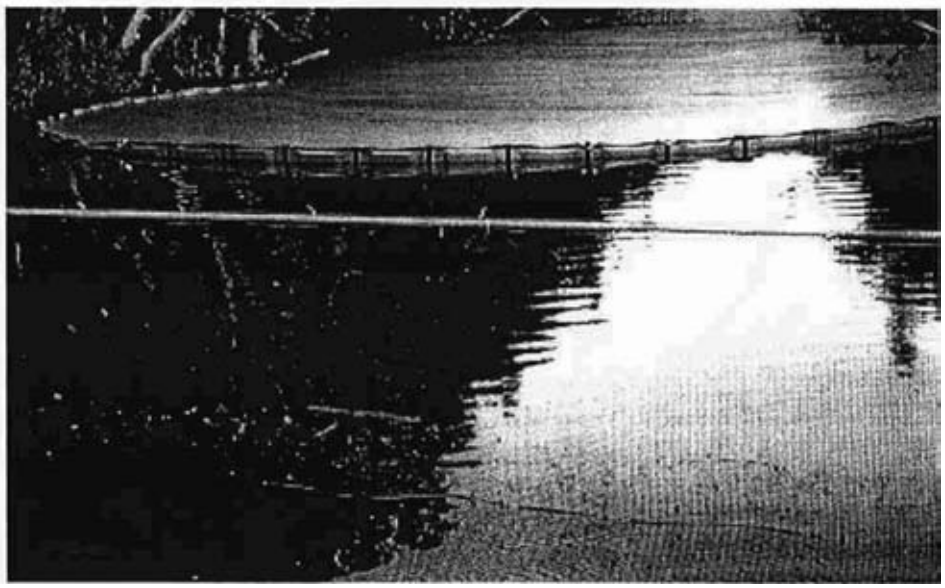
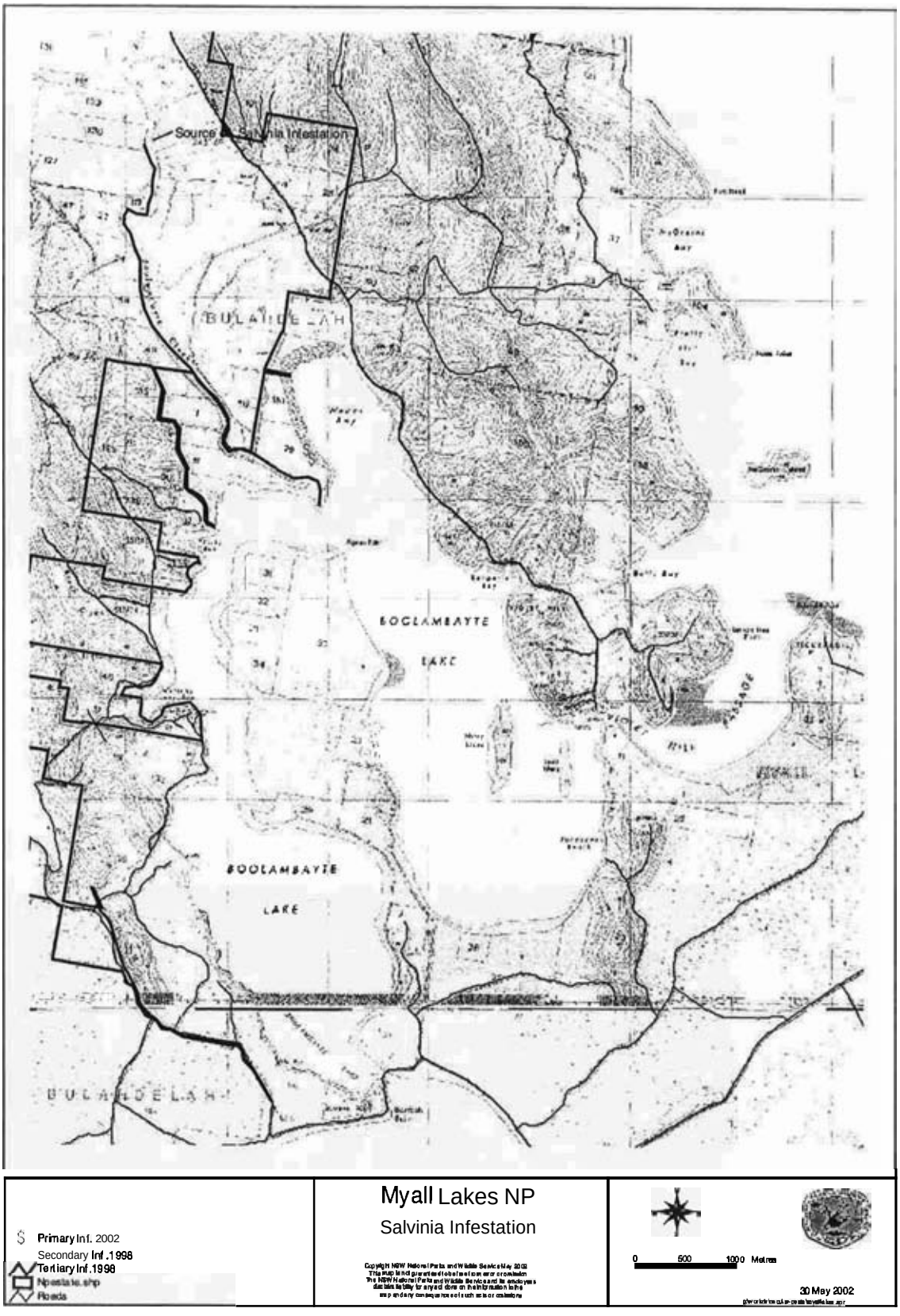
NSW National Parks & Wildlife Myall Lakes Staff (Geoff Mason, Terry Tooze ,Warren Delaney, Ben Dawson & Jim Patulo) who spent many days up to there elbows in mud and water.
Forest Regen (Terry Rolls & co) who have diligently undertaken the *salvinia* containment work in the Myall Lakes Catchment since 1999.
Jason Ramsay, Noxious Weeds Officer, Great Lakes Council

Picture 1 – Containment fencing – Floating Boom and Mesh Fence to catch larger debris. (Two other finer mesh fences were located downstream.)



Picture 2 – Physical Removal of plants amongst Wetlands in Boolambayte Lake - MLNP



Above: Map of the Myall Lakes Salvinia infestation.
The Blue and Green indicates Salvinia infestations at their peak in 1999. The purple identifies where the last infestations treated in 2002.


NOXIOUS WEED MONTHLY REPORT.

TOWARDS BETTER ADOPTION OF REGIONAL WEED MANAGEMENT PLANS

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For the past 19 years Mich has worked with weed control authorities, landholders, community groups and government in South Australia and New South Wales to coordinate weed control programs.

Introduction to the Regional Weed Management Planning process:
Although the concept of regional weed planning is not new in NSW, the planning process took off in mid 1998 with the introduction of the revised Noxious Weeds Grant funding process. Priority was placed on grants for weed control on council land where control is part of an approved regional plan.

The first workshop to develop Regional Weed Management Plans was held in Goulburn in October 1998. All regions subsequently held workshops to develop plans. Most regions have employed noxious weeds planning officers since mid 1998 to help develop plans.

Year	Plans approved
1999	21
2000	60
2001	28
2002	28
2003	43

To date, 161 Regional Weed Management Plans have been approved, see table.

Performance indicators or milestones of Regional Weed Management Plans have not always been met, This paper examines reasons for poor implementation of Regional Weed Management Plans.

Reasons for poor implementation of plans:
When reading through this list of reasons for poor implementation of plans, remember that causes for poor adoption of Regional Weed Management Plans are complex. Many groups, organisations, and sometimes, individuals, can take some blame. Please don't dwell on the blame; instead, find how you can help with the solution.

> **Solutions:** Can you help by leading, participating or supporting the implementation of solutions to these issues?

Planning for funding rather than for coordination. Planning in order to attract Noxious Weed Grant funding has lead to planning for the wrong reasons and, perhaps, excluded some stakeholders that could make a significant contribution.. There is a range of other opportunities to attract resources and your Regional Plan should be able to demonstrate to others that you know what needs to be achieved and how to achieve it. A plan that relies on Noxious Weed Grant funding to achieve its key objectives cannot be implemented if funding is not forthcoming.

> **Solution:** Regional stakeholders must examine how they can make a difference by working together. The plans should demonstrate to a wide range of stakeholders that the plan is worth investing time and other resources. Plans should not concentrate on seeking resources singly from the Noxious Weeds Grant, which has been over subscribed for a long time. The key objectives should be achievable within existing resources.

Changes within the system or instructions not followed. The system of approval of plans and application for grants has had one major change and several minor changes since conception. Participants did not always identify and commit to achieving certain actions with their own resources, and separate additional actions if a grant were received. NSW Agriculture is obliged to comply with a range of policy and statutory requirements. This may mean that processes and procedures, while appearing restrictive and cumbersome, are imposed from outside.

> **Solution:** Participants must carefully read the current instructions for applicants. The system need only change to meet critical concerns.

Term and size of grants. Grants have been paid for a short part of the plan and not for the life of the plan. Grants paid were not always the amount sought. The presumption of outright funding may have been implied.

> **Solution:** The Noxious Weeds Grant should be provided to the best value for money projects for the State. While better projects were continually being developed, the Noxious Weeds Advisory Committee had been cautious about locking into projects that do not fully meet expectations. This issue is likely to diminish as the quality of projects currently presented is good.

Genuine commitment. While weed planners knew what was necessary to ensure that a plan appeared comprehensive and included a broad range of stakeholders, they may not have sought or received full commitment to the plan by stakeholders. Often, the weed planning process has been divorced from the general council planning process. Local Weed Control Coordinators, employed by Local Control Authorities, have strong obligations to their local rate payers. They have tended to meet their local needs, maximised the grant received, and have not met the other requirements of regional plans. This issue in not confined to the Local Control Authorities, but to many of the stakeholders. Business as usual.

> **Solution:** When agreeing to a plan, stakeholders must identify what will be achieved with their normal recurring funds and what could be achieved with a budget enhancement – either from within their organisation or from any grants received. This must be considered and agreed to by all levels of management. Plan writers must recognise that if a group of stakeholders happen to locally be doing the same thing, it does not make a regional plan. A regional plan not only identifies local actions, but also identifies activities that are critical across the region. Local management must agree to commit to joint activities where they can make a difference by working together.

Reporting for grants but not on actions of the plan. While regions have established reporting systems to meet requirements for continuation of grants, they have not always established reporting systems to monitor progress to all parts of the plan. See Box 1. It is critical that all stakeholders can be informed of and see real gains from the plan implementation.

> **Solution:** A reporting and management structure must be incorporated into Regional Weed Management Plans. A person, such as a weeds officer, should be nominated to collect progress reports from all stakeholders and make a summary of progress. Progress reports would include reports for group projects, key points from Weed Control Coordination reports, and activity reports from other stakeholders. These progress reports need not be elaborate documents, but enough to guide the regional committee to make the best management decisions, show successes (and failures) and, perhaps, to shame some stakeholders into action.

Box 1. The collection of management information demonstrates implementation, highlights success, and allows the planning cycle to continue.

Planning, Co-ordination, Integration
Planning: *a scheme of arrangement (strategic plan); a projection (plans for the future); a scheme of action or procedure (plan of operations)*
We must plan our work to ensure that there will be cooperation.

Coordination: *to place or arrange in due order or proper relative position; to act in harmonious combination.*
Councils are not the only organisations in the community which plan and implement noxious weed control. Programs must be developed with Landcare, Catchment Management Boards, Rural Land Protection Boards, and other organisations.
Other activities on properties; such as production, control of soil erosion, conservation, or vermin control; must be considered and integrated into weed management programs.

Integration and Cooperation: *to work or act together or jointly; unite in producing an effect; collaboration.*
Liaison: *the contact maintained between units, in order to ensure concerted action; inform, acknowledge and recommend.*
Throughout the implementation of the program, the community must keep in touch.

Monitoring, Reporting and Management
Management information: *information that will demonstrate to managers how a program is progressing and will help in future planning.*
Coordination and future planning will be enhanced by the collection of and sharing of this **management** information.

Compromising positions of NSW Agriculture staff. Regional Weed Control Coordinators, employed by NSW Agriculture, have a considerable range of duties, including the assessment of plans, group project grant applications and project reports. They have not been fully effective in coordination of implementation of plans because of time constraints and the need to remain at arms length.

> **Solution:** Considerable effort has been required to guide regional committees and groups to develop initial plans, group projects, and funding reports. Now that the process has been established, Regional Weed Control Coordinators will have more time to concentrate on facilitating outcomes. NSW Agriculture now has a revised system to ensure that assessors remain at arms length.

It is difficult to coordinate large comprehensive programs, Regions are often large, diverse and difficult to coordinate. Several enthusiastic plans call for a large number of extra activities across a region, considerable strain may be placed on existing weed management staff. The preparation of plans and projects has exhausted many of the participants. It is easier to place the plan in the bottom drawer than to implement it.

> **Solution:** Group projects may now be prepared that includes activities that were previously funded under the Planning Assistance Program, and projects may include costs of coordinating and reporting on projects and plans. However, if funding cannot be guaranteed, qualifying statements should identify the core program and the extra activities if budget enhancements are received.

Need for direction and an overarching strategy. Some level of planning is needed from the national to the property level. State Weed Management Plans were initially drafted for several of the key weeds, but this process stalled during the development of National Strategies for Weeds of National Significance. The National Strategies provide reasonable direction for development of regional plans, and in many instances, adoption of these has removed the need to develop State Weed Plans for these key weeds. The NSW Weeds Strategy provides a guiding document that helps integrate activities on weed issues, and NWAC policy provides an indication of state priorities. Some regions have developed integrated weed strategies to agree on priority weed issues and weed activities. The Noxious Weeds Grant has a focus on rarer weeds; but this may not reflect the needs of the region. If, for some reason, control of a rare weed is not considered a priority by a region, then stakeholders might consider 'looking a gift horse in the mouth'.

> **Solution:** Research what guiding documents already exist. Regions should consider development of an overarching regional weed strategy. Group projects could be developed to address these regional strategies.

Towards better adoption of Regional Weed Management Plans:

All of the solutions presented can be implemented without changing the Regional Weed Management Planning or Noxious Weeds Grant systems. Some alteration to policy, forms and guidelines may be useful to give stakeholders more confidence in the solutions.

Take home messages:

We can all take better steps towards better adoption of Regional Weed Management Plans. We should:

- Plan for the right reasons
- Plan and commit to activities that can be completed within expected resources
- Plan for activities that can only be completed where extra resources are received
- Expect to report on your achievements.

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EARLY DETECTION AND ERADICATION OF POTENTIALLY INVASIVE PLANTS IN QUEENSLAND

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ABSTRACT

At least 700 non-indigenous plant species have the potential to become weeds in Queensland if they are introduced into suitable habitats. Due to the large number of species involved, it is important to prioritise potential weed species so that finite resources can be focussed on control of species that pose the greatest threat. In 1994, a priority list of 18 species and 7 genera were declared as 'category P1/P2' potential weeds, under the Queensland Rural Lands Protection Act. A substantial proportion of these species pose a threat to New South Wales, especially sub-tropical areas of northern New South Wales. Since 1994, 14 priority species have been detected in Queensland for the first time. Following detection, the Queensland Department of Natural Resources and Mines, working in cooperation with Local Governments, initiated measures for their eradication. Eradication efforts continue to this day with cleared sites now being monitored for seedlings. This action has no doubt saved the State millions of dollars in long-term control costs and prevented loss of biodiversity and agricultural production. The Department has made a firm commitment to preventative pest management by developing legislation and a system of direct action for the exclusion, early detection and eradication of foreign plant species with substantial pest potential in the State. It is important for neighbouring States to cooperate, where necessary, to ensure that eradication programs and coordinated.

INTRODUCTION

There are at least 700 non-indigenous plant species that have histories as significant pests overseas but are not yet recorded in Queensland. Since government and community resources are limited, it is not feasible to attempt exclusion, early detection and eradication for every potentially invasive species. As such, there is a need to prioritise species so that finite resources can be focussed on species that pose the greatest threat. Once a manageable list of top priority species has been selected, measures to prevent naturalisation of these species need to be implemented. Measures can include legislation (i.e., prohibition of introduction, possession and sale throughout the State) and a system of early detection and eradication. The latter involves community awareness of the identification of potential weeds, cooperation from the nursery and aquarium plant trade, cooperation from the proponents of new forage and timber species and commitment from Local and State governments to fund and maintain eradication efforts. This paper outlines the approach that has been taken to significantly reduce the impact of 'potential weeds' in Queensland.

METHODOLOGY

To reduce the impact of potential weeds in Queensland, the Department of Natural Resources and Mines (NR&M) has decided to focus preventative control resources on a prioritised selection of species considered to pose the greatest threat. A list of 18 species and seven genera were selected as 'top priority' targets for preventative action, following a review of more than 700 potential weed species not yet recorded in the State (species listed by Csurhes 1991). Species that have histories as major weeds either interstate or overseas, and are climatically suited to Queensland, were declared as 'category P1/P2' weeds under the Queensland ***Rural Lands Protection Act*** 1985. Climate match and a history as a major pest elsewhere were used as selection criteria to prioritise candidate species since experts generally agree that these are perhaps the only two reliable indicators of potential weediness. Declaration prohibited the introduction, possession and sale of these plants within the State and set priorities for Local Government and the Department's eradication initiative called "SWEEP" (Strategic Weed Eradication and Education Program).

Table 1. Potentially invasive plant species that represent a substantial threat to Queensland.

Scientific name	Common name
Acacia spp. (all non-native thorny species, except *A. nilotica*)	acacia
Alternanthera philoxeroides [a b]	alligator weed
Austroeupatorium inulaefolium	-
Baccharis coridifolia	toxic groundsel
Chromolaena odorata [a]	Siam weed
Clidemia hirta	Koster's curse
Eichhornia azurea	anchored water hyacinth
Equisetum spp. [b]	horsetails
Gymnocoronis spilanthoides [b]	Senegal tea plant
Kochia scoparia [b]	kochia (or burning bush)
Lagarosiphon major [a]	lagarosiphon
Limnocharis flava	-
Ludwigia peruviana [b]	-
Miconia spp.	miconia
Mikania spp.	mikania vine
Mimosa pigra [a b]	giant sensitive tree
Myriophyllum spicatum	Eurasian water-milfoil
Pithecellobium dulce	Madras thorn
Pontederia rotundifolia	tropical pickerel weed
Prosopis spp. [a]	mesquite
Rubus argutus	Florida blackberry
Salvinia spp. (except *S. molesta*)	salvinia
Sesbania punicea	red sesbania
Striga spp. (non-native species only)	parasitic witchweed
Trapa spp.	floating water chestnut
Zizyphus spina-christi	Christ thorn

[a] species/genera declared under the Queensland Rural ***Lands Protection Act*** prior to the review
[b] species/genera absent from Queensland but naturalised in other States

To support the legislative response, public awareness of these species has been improved, particularly within the nursery and aquarium plant trades. To date, the public has been very helpful and has reported species such as miconia, alligator weed and red sesbania, which have subsequently been eradicated and removed from sale. The Queensland herbarium currently advises NR&M whenever a non-indigenous plant species is recorded in Queensland for the first time.

The nursery trade plays a major role in the introduction and dispersal of invasive plant species. It is estimated that 72% of Australia's potential environmental weed species are available in nurseries (Csurhes and Edwards 1998). For this reason, restrictions on sale and possession of high-risk species are vital. Eight of the 14 top-priority potential weed species detected in Queensland since 1994 have been grown in Queensland gardens (Table 2).

The release of non-native grasses, legumes and shrubs to provide forage for cattle and sheep represents another significant source of invasive plants. Examples of forage plants that have become significant pests include prickly acacia (Acacia nilotica), honey locust tree (Gleditsia triacanthos) and hymenachne (Hymenachne amplexicaulis). To address this issue, the Department of Natural Resources and Mines has liaised with pasture scientists from the Northern Australian Pasture Plant Evaluation Committee (NAPPEC) to develop a draft code of practice applicable to all proposed pasture plant releases. The centre-piece of the code is a commitment to subject all proposed releases to a weed risk-assessment protocol.

RESULTS

Preventative measures implemented by NR&M, working in cooperation with Local Governments, have successfully detected 14 species of high-risk potential weeds over the past eight years (Table 2). In all cases, detection was timely and subsequent eradication efforts have substantially delayed, or prevented, naturalisation and spread of these species in Queensland. The benefits of preventative legislation, early detection and eradication are impossible to quantify but are likely to total many millions of dollars.

Table 2. Recent incursions that the subject of eradication programs.

Species	Detection date (location)	Response
Chromolaena odorata (siam weed)	1994 (near Tully).	5-year eradication program funded by States and Commonwealth (target of SWEEP).
Eichhornia azurea	1996 (advertised for sale by aquatic plant wholesalers).	Growers requested to stop sale.
Equisetum hyemale (horsetail)"	1996 (Mt Coot-tha botanic gardens, Brisbane); 1997 (reported as a medicinal herb near Maleny).	Plants removed and site monitored; Qld herb society advised of legal status of cultivation.
Gymnocoronis spilanthoides (Senegal tea plant)[a]	1995 (Redland Bay, near Brisbane).	On-going detection and eradication program in cooperation with Local Governments (subject of SWEEP operations).

Alternanthera philoxeroides (alligator weed)[a]	1995 (Brisbane).	As above.
Sesbania punicea (red sesbania)[a]	1994 (offered for sale in nurseries near Brisbane).	Plants withdrawn from sale and public requested to report specimens.
Miconia calvescens (miconia)[a]	1997 (Kuranda).	Eradication underway – more plants being detected but still within relatively small area of potential range + public requested to report plants.
Miconia racemosa	2002 (Kuranda)	Eradication underway
Mikania micrantha (mikania vine)	1998 (Mission Beach/ Bingil Bay).	As above + regrowth/seedlings monitored and removed (subject of SWEEP operations).
Mikania sp. (unidentified sp.)[a]	1996 (wholesale nursery near Brisbane).	Nursery requested to stop sale.
Clidemia hirta (Koster's curse)	2001 (near Julatten, north Qld).	Eradication underway
Limnocharis *flava* (limnocharis)[a]	2001 (near Cairns)	All known plants removed and area being monitored.
Mimosa pigra (giant sensitive plant)	2001 (near Proserpine)	Subject of eradication program.

[a] species recorded in Queensland gardens.

DISCUSSION

Preventative pest management is the most efficient and cost-effective form of pest management. Emphasis has been placed on preventing the establishment and spread of a prioritised list of species (Table 1). Results achieved to date (Table 2) are likely to have saved the State many millions of dollars in lost agricultural production and long-term control costs. In addition, early detection and eradication of species such as Miconia calvescens, a shrub that is poised to eliminate 35-45 endemic plant species in Tahiti (Csurhes 1997), has protected our unique native ecosystems. The results achieved for category P1/P2 potential weeds are in addition to successful eradication/containment programs currently underway for other declared potential weed species in the P2 category, including bitou bush, honey locust tree (Gleditsia triacanthos), blue thunbergia (Thunbergia *grandiflora*) and *Prosopis* spp. Provided preventative control programs can be maintained, the full impacts of these species can be avoided. It is suggested that other States should consider a similar strategic approach to the management of potential weeds, with priority given to species that are climatically suited to a particular State and which have well-documented impacts as major pests either interstate or overseas.

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- University of Queensland – Master of Agricultural Science (field of research: ecology – post-mining revegetation and erosion control)

RESEARCH AND POLICY POSITIONS HELD

- Scientist (woody weed ecology and management), Department of Natural Resources (1987-1992).
- Policy Officer (potential pests), Department of Natural Resources (1992 – present).
- A/Senior Environmental Scientist (Ecology), Department of Natural Resources (1998).
- Principal Project Officer (legislation review), Department of Natural Resources (2002-3)

EXPERIENCE

15 years experience in pest management, with an emphasis on the ecology of biological invasions and the development of measures to prevent invasions. Significant involvement in pest risk assessment, identification and prioritisation of potential pests, management of environmental weeds, pest management legislation and policy issues concerning preventative pest management.

PUBLICATIONS

Csurhes, S.M. (1991). Potential weeds of Australia (Review of Plant Quarantine Proclamation **86P),** Report prepared under contract to the Australian Quarantine and Inspection Service, Canberra.

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Groves, R. H.; Bishop, A.; Carr, G.W.; Carter, G. W.; Corey, S.; Csurhes, S.M.; Hosking, J.R.; Keighery, G.J.; Cowie, I.; Stajsic, V.; Waterhouse, B. (1998). Recent incursions of weeds in Australia, 1971-1995. CRC Weed Management Systems Technical Series. **3.**

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Regional Weed Management Issues in the Sydney Basin

~ A Sydney North Perspective ~

Mr Paul Marynissen
Noxious Weeds Officer
Hornsby Shire Council

Cheryl Bate
Project Officer
Sydney North Regional Weeds Committee, and
Sydney West / Blue Mountains Regional Weeds Committee

Regional Weeds Committees – Sydney North Case Study

The Sydney North region is characterised by corridor systems of fragmented bushland. These bushland remnant reserves are significantly impacted by invasive weeds associated with adjacent urban pressures, such as stormwater runoff and nutrient loads, ridgetop development, backyard dumping, etc.

The Regional Weeds Committee – Sydney North was formed in 1996, following encouragement from NSW Agriculture, Catchment Management Committees and land management officers responsible for weed management in the region.

The committee has a membership of approximately 27 officers from Local, State and Federal government. It is made up of officers from a noxious weed background to bushland management planning officers. Community representatives of the catchment management committees in the region were also members of the committee until the CMC's were disbanded.

The committee meets quarterly at host agencies and has a part-time project officer responsible to a steering sub-committee to coordinate regional projects.

AIMS:

The aims of the committee are to:

- Promote the coordination of regional weed management at both the regional and catchment levels.
- Provide a forum for information exchange between member organisations
- Increase awareness of noxious weeds in the broader community

ISSUES FOR WEED MANAGEMENT IN THE URBAN ENVIRONMENT

With urban development and natural areas existing in close proximity, many issues arise that impact on the management of weeds in the Sydney area.
These issues help guide the formation of our strategies but can also restrict their implementation.

Issues that face weed managers include:

Landholder apathy
Difficulty in attracting media support
Inadequate resourcing for bushland and riparian restoration and weed management for on-ground work as well as the community awareness raising programs
The need for stronger inter-agency communication
More consistency and coordination in best practice methods and approach
Need for more community incentives to encourage participation eg. extension of Privet Program in Wollondilly
Public education and awareness about bushland management and it's threats
The need for closer links related management areas eg. stormwater, landscaping, nursery industry and management of public amenity areas.
Identification of gaps in weed management and wider implementation of successful projects across the catchments of Greater Sydney

ACHIEVEMENTS OF THE SYDNEY NORTH REGIONAL WEEDS COMMITTEE

To address these issues work currently underway includes:

- Well established information sharing amongst committee members
- Development and active implementation of the Regional Weeds Strategy
- Development and widespread distribution of Stop the Spread noxious weeds brochure
- Part-time project officer funding to coordinate the committee
- Development, resourcing and implementation of 9 Regional Weed Action Plans:
  - Ludwigia
  - Pampas Grass
  - Alligator Weed
  - Asthma Weed
  - Bitou Bush and Boneseed
  - Ground Asparagus Fern
  - Tussock Paspalurn
  - Green Cestrum
  - Willows

Progressing catchment-based GIs-linked weed mapping
Continuation of the biennial Sydney North Regional Weeds Conferences held in 1999 and 2001, with plans for a Sydney-wide conference in 2004
Active participation in regional annual Weedbuster Week activities and events
Local council representation on Garden Escapes Steering Committee with NSW Nursery Industry
Progression of a regional noxious weeds list for Sydney North
Representation on the Sydney Harbour and Lower Hawkesbury Nepean Catchment Blueprint working groups
Working closely with neighbouring regional weed committee to facilitate catchment wide initiatives
Development of incentive-based programs for private landholders, eg: Rural Land Incentive Scheme in Hornsby and the Ground Asparagus Fern incentive project in Pittwater.
Community partnerships for Bitou and Ground Asparagus Fern projects on the Northern Beaches
Support for biocontrol programs, eg: Bitou, Bridal Creeper and Lantana agents
Development and launch of Regional Weeds Committee Website for Sydney North, with plans to facilitate similar websites for the other three committees in Sydney.

REGIONAL WEEDS STRATEGY

Main objective:

> *To provide a framework for the coordinated, regional approach to weed management in the Sydney North region.*

The Regional Weeds Strategy and the noxious weeds brochure "Stop the Spread[1]" were launched by the Minister for Agriculture at Lane Cove NP in December 1998.

The Strategy has been developed to be consistent with the provisions of the National and State Weed Management Strategies but offers a greater degree of detail relevant to the region. Local and Catchment strategies developed under the "umbrella" of the Regional Strategy provide direction for the "on-ground" management of weeds, that is: organisation, species and location specific.

IMPLEMENTING THE REGIONAL STRATEGY

Following its adoption by the Sydney North committee, the Strategy was then endorsed by respective organisations ensuring commitment towards the achievement of its actions and objectives.

In order to develop and implement a dynamic achievable strategy, a series of actions have been developed that can be grouped into the following broad categories:

- Research
- Legislation
- Community Education, Awareness and Involvement
- Planning and Management
- Resource Allocation

Implementation of the Strategy is the responsibility of the Sydney North committee and as such members of the committee have nominated to work toward the actions through a series of working groups that focus on issues relating to the above categories. Examples are:

- Regional plan convenors
- Conference planning
- Brochure development
- Regional field day planning
- Garden escapes steering committee
- Bitou and Asparagus Fern community partnership steering committees

REGIONAL NOXIOUS WEEDS EDUCATIONAL MATERIAL

Initiatives include:

- Local councils and state agency Bushcare and environmental community newsletters, mayoral messages and local newspapers regularly feature articles on regional weeds of concern and related projects.
- Council-based weed profile sheets and council websites containing weed information
- Weedbuster Week activities also include weed information displays at local shopping centres and in council foyers.

- The "Stop the Spread" brochure developed by the committee aims to increase community awareness of noxious weeds and their impact on the environment. The brochure contains photo plates and descriptions of noxious weeds in the region, and provides information on how the community can help to reduce their spread and their responsibilities under the Noxious Weeds Act 1993. "Stop the Spread" is distributed widely by member organisations particularly as part of their enforcement process, and is entering its 6th 20 000 print run.
- The committee has also been developing a regional website to raise awareness of declared noxious weeds, other environmental, potential garden escapes, weed alerts and new incursions with information on their control.

COORDINATING THE COMMITTEE

The committee employs a part-time coordinator, funded one-day per week by a project officer grant from NSW Agriculture. The coordinator commenced work in October 1998.

The coordinator's responsibilities include:

- Administering and coordinating the Sydney North Regional Weeds Committee
- Assisting working groups in implementing Strategy actions
- Coordinating activities for Weedbuster Week
- Coordinating production and implementation of regional weed action plans
- Coordinating and assisting in the development and updating of the Strategy and educational material
- Publicising local and regional weed control policies, action and events

Noxious weed management is only one of the duties carried out by members of the committee. The employment of a coordinator has been a boost to the committee, allowing it to achieve more than it would otherwise and increasing the motivation and commitment of individual representatives.

REGIONAL AND CATCHMENT-BASED WEED PLANS

Regional convenors in Sydney North have to date submitted nine regional weed plans and sought funding support where-ever possible. Apart from on-ground works, the plans also include awareness raising measures, such as regional weed specific brochures and road signs.

Funding supplementary to the NSW Agriculture grants, has been through the National Weeds Program, NHT Envirofunds, Stormwater Trust, Environmental Trust, Sydney Harbour Catchment Board interim funding and Crown Lands funding.

In addition to localised Sydney North plans, the committee is also jointly submitting and participating in regional plans with neighbouring committees. Several new plans will be developed as Sydney wide.

In May 2001, the regional committee adopted the Cowan Catchment Weed Strategy developed by all stakeholders in 1998. This strategy adopts a "whole of catchment" approach to weed management and bushland restoration. The regional committee is currently seeking Sydney Harbour Catchment Blueprint funding to develop similar strategies for other local catchments in the region. The regional target specific weed or suite of weed plans are integral components to the implementation of these strategies eg. the Pampas free objective under Cowan Catchment strategy.

REGIONAL WEEDS CONFERENCE

Sydney North held a regional noxious weeds conference in Willoughby in 1999 and 2001 to promote awareness of regional noxious weed strategies and related issues. The conferences were attended by 160 Bushcarers, Bush Regenerators and industry staff, with a guest appearance by the rogue of the countryside, Woody Weed. Presentations were given by key industry and agency speakers with keynote addresses by John Dengate and Don Burke and sponsored by the NSW Biodiversity Strategy.

In 2004 Sydney North is planning a joint regional weeds conference with the three other Regional Weeds Committees in Sydney.

ENGAGING THE COMMUNITY

Community involvement in Sydney is well established through Bushcare, Coastcare and Landcare groups. This fantastic support and on-ground work by dedicated members of the community is coordinated by local councils and state agencies. The Bushcare Officers coordinating these efforts across greater Sydney have formed a Volunteer Coordinators Network to share information.

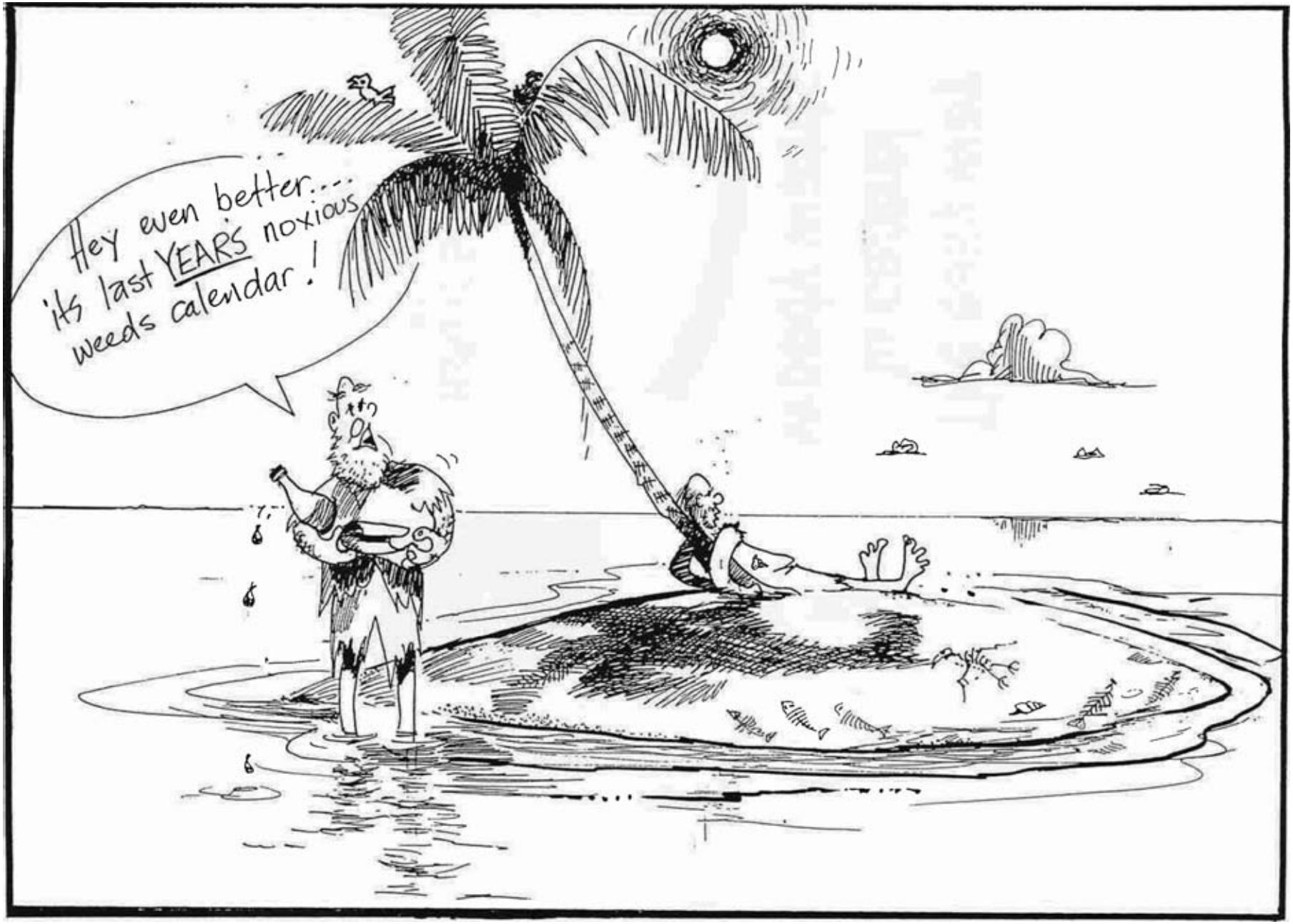
Weedbuster Week activities during October each year are a focal point for raising awareness of regional weeds and related issues in the wider community. In Sydney North these activities include:

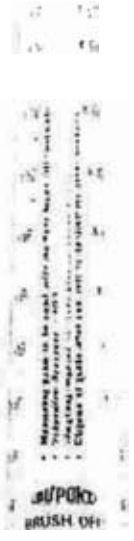
- Joint displays at local shopping centres providing: advice on weed control, weed specimens, and free native plants.
- School poster competitions.
- Regional field days.
- Local media articles
- Biennial Regional Weeds Conference

CONCLUSION

"Implementing the strategy requires a partnership between all the land owners involved. Without this the resolve of the remainder is weakened Jack Gregory, Cowan Catchment

The cooperative and coordinated regional approach to weed management in Sydney's north has been very successful so far. The measure of it's success will not be the number of weeds removed, but the increase in the quality and quantity of native bushland.


Hey even better.... its last YEARS noxious weeds calendar!



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brush controller

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Weeds – Solutions to Success or

Solutions to minimise weeds success

− What's being done in Qld to minimise weed spread.

This paper will focus on Queensland initiatives aimed at minimising the human induced spread of weeds.

Why?

The most cost effective technique in the management of weeds is prevention and early intervention. This fact has been embedded as a principle in the National Weed Strategy 1999. Another principle of this strategy is that successful weed management requires a coordinated national approach involving all levels of government.

The cost of weeds to agricultural industries alone in Australia has been estimated at over $3.3 billion per annum.

A recent economic assessment has shown that:

- every $1 spent on pest prevention yielded a return of $31 in benefits,
- eradication of newly established weeds yielded a benefit cost ratio of 16:1 and
- containment of widely established weeds such as prickly acacia and rubber vine had a benefit cost ratio, of about 2:1.

Until recently, most resources have been dedicated to controlling and containing established weed outbreaks with little attention given to preventing weed spread and early intervention in the process of weed establishment.

Background to the Queensland weed seed spread projects

The first project specifically on the prevention of weed seed spread in Queensland was undertaken between 1999/2000 financial year. This project was in response to:

- An increase in demand for vehicle and machinery inspections by public utilities and agricultural industries
- Different services and charges being offered by different Department of Natural Resources and Mines (NR&M) districts.
- An increase in awareness of the ability to prosecute or be prosecuted for spreading declared weeds.

The Management Group steering this project had a strong industry representation. The information and materials they produced were intended to assist:

- industry,
- service utilities, and
- state and local governments

to establish their own practical and effective policies and procedures that aim to significantly reduce the spread of weed seeds.

Major components of the Queensland Weed Seed Spread Project included:

- Developing best practice procedures for cleandowns, inspections and washdown facility construction
- Developing and introducing a Voluntary Vendor Declaration scheme for weed seed spread
- Coordinating construction of washdown facilities and their signage, and producing location maps
- Protocol development with industry groups, service utilities, government departments and private companies

Since the first project the Land Protection (Pest and Stock Route Management) Act *2002* was finalised and gained Parliamentary approval. This act was assented to on 24 April 2002 and will hopefully commence on 1 July 2003, replacing the Rural Lands Protection Act 1985. Contained in this Act are two provisions aimed at minimising the spread of weed reproductive material. The inclusion of these two provisions was principally due to the increased awareness generated by the first project.

The two provisions are:

1. Making it an offence to supply 'things' that are contaminated with a Class 1 or any of the Class 2 weeds listed below. However, for the Class 2 weeds, a person may supply contaminated 'things' if they provide a written notice that states that the 'thing' is contaminated.

   Examples of 'things' include: fodder, grain, gravel, machinery, mulch, packing material, sand, soil, stock, vehicles or water.

Common Name	**Species**
American rat's tail grass	Sporobolus jaquemontii
Giant Parramatta grass	Sporobolusfertilis
Giant rat's tail grass	Sporobolus pyramidalis and S. natalensis
Parramatta grass	Sporobolus africanus
Parthenium	Parthenium hysterophorus
Prickly acacia	Acacia nilotica.

2. Making it an offence for a person to drive or transport a vehicle or any thing that they know, or should know, contains parts of a declared weed capable of reproducing. Presently there are over 90 species of weeds that have been declared.

What's happening now

To meet the expectations raised by the first working group and to meet legislative requirements a second project was initiated. The aim of this project is to coordinate the development of strategies, policies and procedures for the minimisation of weed seed spread by human activity.

What we are and what we intend to do:

1. Develop a department policy to minimise weed seed spread by employees, contractors and consultants. This policy will require all employees to clean vehicles, machines and implements suspected of being contaminated with a declared weed.

2. Expand this policy to all Queensland government departments and agencies.
3. Develop a weed hygiene declaration, to provide assurance that a product is weed free or to notify that a product is contaminated with a weed. This declaration will be required for the six species listed above, but is voluntary (but highly recommended) for any other weed species.
4. Develop a strategy for enhancing the present network of clean down facilities and inspection services. This can include the establishment of an external network of vehicle/machinery inspection providers for certification of "cleanliness" in respect of weed reproductive material. The inspection providers will be required to have undertaken training in two units under the Conservation and Land Management Training Package accredited by the Australian National Training Authority.
5. We have requested funding under Weeds of National Significance to start the process of developing practical ways to limit the human induced spread of weeds at a national level. The different approaches by different States and Territories, existing literature and expert knowledge will be summarised and assessed.

DEE MURDOCH
SENIOR REHABILITATION SCIENTIST
MANAGER - SINGLETON
HLA - ENVIROSCIENCES P N LIMITED

Solutions to Success - Defence Style

Singleton Military Area

- Managed by Department of Defence
- 14 000 ha is size
- National centre for training of military staff
- Largest tract of native vegetation in the Hunter Valley
- Agricultural activities ceased 1941
- Stewardship approach to land management by Defence

Noxious Plants on Site

- African Boxthorn
- Noogoora Burr
- Nodding Thistle
- Paterson's Curse
- Prickly and Tiger Pear
- Tree of Heaven
- Mother of Millions

HLA

Environmental Weeds

- Morning Glory
- Lantana
- Farmers Friends
- African Olive
- Balloon Vine
- Moth Vine
- Almost every species of thistle

Nationally Significant Species

- Large eared Pied Bat
- Brush tailed Rock Wallaby
- *Eucalyptus glaucina*

Environmental Management Plan

- Developed for Dept of Defence during late 1990's
- Provides a framework for prioritising on ground works
- Facilitated engaging contractor to under weed control program

HLA ‘s Program of Works

3 year contract

- Annual planned program of works
- Seasonal priorities
- Emergency actions

Monthly reports to Defence

Natural Resource Management

- Weed management and control aligned to :
  - Fire management
  - Water quality
  - Sediment and erosion control
  - Feral animal control
  - Protection and enhancement of native vegetation

Issues Specific to Defence

Potential introduction of weeds from across Australia due to movement of machinery and personnel

- Access difficulties due to military activities
- OHS considerations for site users including UXO’s

  Requirements of military personnel relating to access across the site e.g. ABT and drainage lines
- Heavy equipment traversing the site

Other Options

Control of weeds in No Go areas

- Manual
- Biological
- Fire
- Limited herbicide application
- Impact of the drought especially on residual herbicides
- Trained competent Field Technicians

Monitoring

- Monitoring program for all weed control works
- Risk assessment undertaken for new infestations and control of known occurrences

  Mapping of infestations
- Recording of pesticides as per Pesticides Act 1999

Training of Site Users

- Feedback on new infestations
- Weed of the Month information sheets

  Limiting site access

  Use of wash down bay
- Regular liaison with military staff

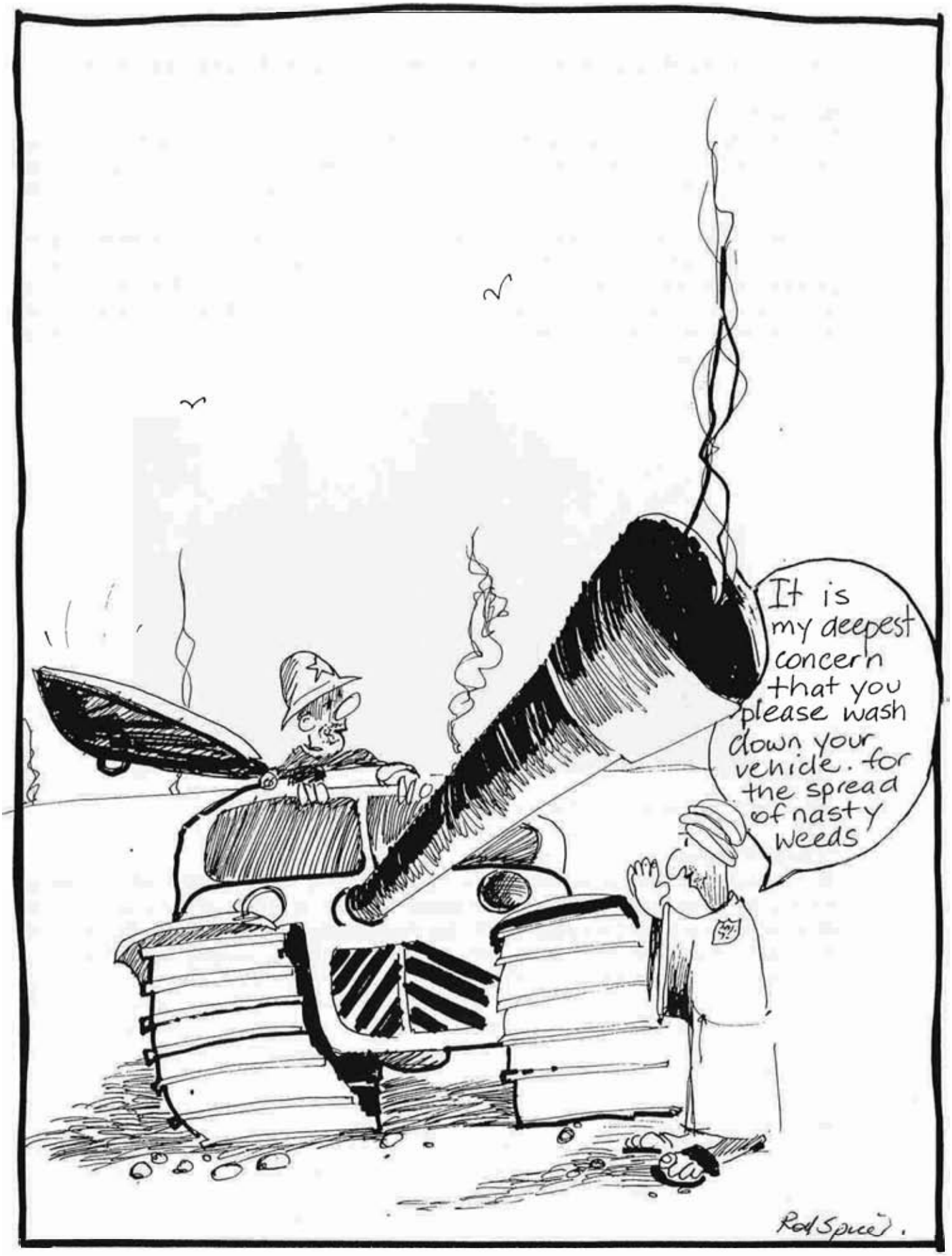
  "Get them involved and accountable"

"An ounce of prevention is better than pound of cure"

- Early immediate control of new high priority infestations
- Seasonal management of priority species e.g. Thistles, African Boxthorn to limit seed set

The Future

- Commitment by Defence to continue to prioritise weed management and control
- Looking at new control techniques
- Increased training of site users


It is my deepest concern that you please wash down your vehicle. for the spread of nasty weeds
Rod Spicer.

WILLOW CONTROL IN THE HAWKESBURY LOWER NEPEAN CATCHMENT

Introduction

The lower reaches of the Hawkesbury-Nepean River system support a substantial population with its associated agricultural and recreational pursuits. The vegetation of the floodplains and riverbanks is under intense pressure from land clearing, urbanisation, weed invasion and erosion.

Through the Riverbank Management Program within the Department of Sustainable Natural Resources at Windsor, a series of projects have been established to control the spread of one particular problem weed – willows (Salix species). Prior to 1970 there were few willows present and those were mainly Weeping Willows. Last year it was estimated that there were –30,000 willows established unintentionally in the Hawkesbury-Nepean River with scope for future increases in this number.

Willow gallery in the Nepean River, Castlereagh, *NSW.*

Ecology of Willows

Willows have the ability to spread aggressively by producing roots on broken off branches that fall into the water and/or by seed that can spread over vast distances. Willows have also been observed to cross breed with other species that flower at the same time. Black Willows (*Salix* nigra) have been observed flowering twice in one year and also changing sex from female to male. Each tree can produce hundreds of thousands of seeds, starting as early as 3 years of age. The follow-through changes to stream ecology caused by large numbers of these trees involve changes to flow rate, direction and intensity as well as changes to water temperature and light regimes, dissolved nutrients, water uptake and associated biodiversity both within the stream and in the riparian zone.

Methods of Control

Seedlings up to 1m can be hand-pulled with high success rates. The frill and inject method involves making incisions around each stem and filling these with herbicide. This method is completely species specific and causes little, if any, disturbance to other vegetation or fauna. Willows can be frilled at any time of year with kill rates above 95%. Follow-up is an important facet to successful control and involves revisiting areas 6-12 months later to re-treat where necessary or to treat any missed trunks.

As part of the procedure, after frilling willows are left standing to decompose over time. It has been observed that the rate of decomposition varies but it takes roughly 4-5 years for a 6m tree to crumble to a stump. Without the heavy leaf load in the canopy, dead willows rarely fall from the base. Revegetation is undertaken in areas where soil stability is of concern.

Partnerships and Funding

As well as working with property owners, these projects have necessitated the formation of relationships with Councils and other Agencies, as well as with some large corporations. These relationships are integral to the success of the project. By promoting a concerted effort to target this easily identifiable problem, funding has been received from various sources. Between March 2000 and June 2003, a total of $230,000 from various sources has been invested in the area. A further $85,000 has been spent in the Colo River and $56,000 has been approved for 2003-04 for Phase II of a Willow Control Project in Hawkesbury lower Nepean River.

Native Vegetation Conservation Act 1997

Various Acts and Regulations are effective for the areas of work involving Threatened Ecological Communities and Aboriginal Sites. The Native Vegetation Conservation Act involves State Protected Lands which include the banks of prescribed streams and rivers. There is a comprehensive process involved after obtaining owner consent, to make an application under this Act for consent to remove vegetation from riverbanks. The process proscribes conditions of consent that support best management practices and also highlights any areas of special concern. To assist the process, a River Management Plan (Willows) was written to assist other projects with this process and best management practice.

Limitations & Difficulties

- There are significant time constraints involved because of the necessity to obtain property owner consent under the Native Vegetation Conservation Act. Depending on the numbers of property owners in a target area, this process can take months. If one owner refuses to cooperate, it can mean failure of the whole project.
- Whilst willows can be controlled completely, locating and treating every last tree may also be time consuming and difficult, considering the large distance over which they have become established.
- The scale of this work and the associated time constraints can be daunting and restrictive.
- Access to remote river sections is often restrictive.

Addressing Concerns

- Willows have been considered effective in preventing riverbank erosion. In certain situations, willows are allowed to remain on the riverbank in order to increase stability, but native seedlings are planted to provide long term stability while willows are removed later.
- Questions of liability have been raised if treated willows should be responsible for damage to infrastructure (eg pumps and bridges) during a flood event.
- Main public concerns have been about other weeds and why willows should be targeted.

Progress in our Area

Over the first six months of the Willow Control Project Phase I, a team of two working 4 days a week was able to frill an estimated 9700 stems using only 178L of herbicide. Over the same period, they also planted over 2000 native longstem *Casuarina cunninghamiana* as replacements for the willows.

The aim is that all Black Willows and their hybrids will have been treated by the end of June 2003. In Phase II, 2003-04, fragile willows will be targeted whilst following-up on Black Willows and their hybrids. Phase III in the following year (depending on funds) will involve the final follow-up of all seeding and fragile willow species in the target area.

The Colo River has been successfully cleared of Black Willow in the National Park and works continue in the lower reaches on private properties. This project is run by the Friends of the Colo community group, and NSW National Parks and Wildlife Service and has been highly effective in the Wilderness area.

Future Outlook

It is likely that there will be no more seeding or fragile willows in the Hawkesbury lower-Nepean Catchment after 2005.

Trish Chadwick, B.Sc.,
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Farm Management Certificate, Tocal Agricultural College, NSW; Bachelor of Science Degree (Biology/Conservation) Macquarie University; Bushland Regeneration Certificates II & IV, Richmond TAFE; Employed by Hawkesbury-Nepean Catchment Management Trust in 1998 on project management of willow control projects, transferred to Department of Land and Water Conservation April, 2001, which became Department of Sustainable Natural Resources in April, 2003.

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GUMBOOTS SAFETY & NON SAFETY INCLUDING LADIES

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DRILL & HI VIS DRILL
MICRO MESH HI VIS
LACOSTE HI VIS
OVERALLS INCLUDING 2/TONE,
HI VIS JACKETS, BLUEY'S

HEAD PROTECTION:
HARD HATS
HAT BRIMS
SUN HATS
HI VIS SUN HATS
ACCESSORIES

FACE PROTECTION:
FACE SHIELDS
MESH SHIELDS

EAR
EARMUFFS, HELMET MUFFS. BANDS, PLUGS

EYE WARE
SAFETY GLASSES, TINTED AND CLEAR (ALL UV PROTECTED)
CHEMICAL, INDUSTRIAL GOGGLE PROTECTION SHIELDS

BACK BRACES
KNEE PADS
BARRIER TAPE
FLAGGING TAPE
REFLECTIVE TAPE
ANTI SLIP TAPE
AISLE MARKING TAPE
BARRIER FENCING

TRAFFIC CONTROL EQUIPMENT:
"A" FRAMES, BARRIER BOARDS, STOP/SLOW BATTONS, CONES 4 SIZES PLAIN & **REFLECTIVE,** SAFETY CHAM. EXPANDABLE BARRERS BOLLARDS, BUNNINGS FLAGS, NIGHT LINE AND BREAK DOWN **KITS.**
BANNERS, TRUCK SIGNAGE, REGULATION WARNING STICKERS.

VESTS:
REFLECTIVE, NON REFLECTIVE.

SIGNS:
LARGE RANGE OF SIGNAGE, LABELS, STICKERS, BILLBOARDS.

FLASHING LIGHTS:
POWER PROTECTION:
CABLE HOOKS AND STANDS
AGENTS FOR SAFETY VIEW MIRRORS
RAIN WEAR HI VISIBILITY

FIRST AID:
REGULATION KITS
RESTOCKING OF KITS
SNAKE & SPIDER KITS
INSECT REPELLENT
SUN BLOCKS
REGISTRY OF INJURY BOOKS
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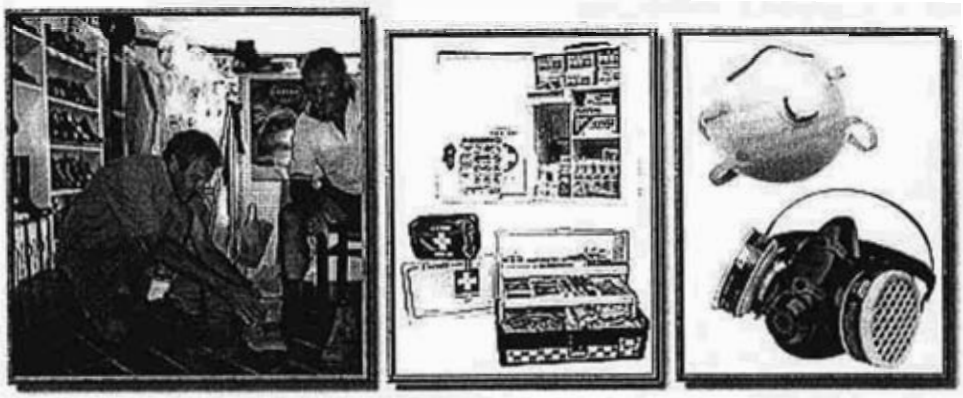

PERENNIAL GRASS WEEDS: AN OVERVIEW OF MANAGEMENT OPTIONS

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INTRODUCTION

A variety of perennial grass weeds have already degraded a significant areas of pastoral land in eastern Australia and are likely to do so until a more holistic approach to their control is adopted. Most of these infestations occupy the slopes, tablelands and the coastal districts. Despite the array of research and literature detailing the various control options, these perennial grass weeds have persisted and spread to more regions. It is no wonder that two perennial grass weeds (Chilean needle grass and serrated tussock) are listed in the 20 weeds of national significance.

In the 1970's and 80's, proposed eradication of perennial grass weeds was primarily with the use of herbicides – often called the "spray and forget method". A few decades later, the attitude towards control of these weeds has shifted from eradication to containment and more prudent applications of herbicide. Furthermore, a critical component of weed management, competition from desirable species and grazing management, are gradually being incorporated into landholders' management plans. In some cases people have decided that eradication is unlikely and are utilising the weed to their advantage.

Weeds of concern are: Chilean needle grass (CNG) (Nassella neesiana), African lovegrass (ALG) (Eragrostis cuwula), giant Parramatta grass (GPG) (Sporobolus *fertilis*), serrated tussock (ST) (Nassella trichotoma), Coolatai grass (Hyparrhenia *hirta*), Johnson grass (Sorghum halepense), long style feather grass (Penniseturn villosum) and Espartillo' (Achnatherum caudatum).

MECHANISMS FOR DOMINATION AND PERSISTANCE

There are two main components to the perennial grass life cycle. Firstly, the vegetative plant is the visible portion of the life cycle. Often research in the past has focused solely on this. For a more complete perspective of the grass life cycle, the seed bank must also be understood.

Achieving satisfactory levels of control of perennial grass infestations using herbicides is a common phenomenon. However, it is inevitable that re-infestation occurs at such a rate that a second treatment may be required within one to three years. Clearly herbicides applied in this manner will not be enough to seriously reduce perennial grass populations over several years. Other complementary tactics are required to prevent to build up of perennial plants. These tactics put pressure on the seed bank enabling better long term control.

Many annual grass weed such as annual ryegrass (*Lolium* rigidum), barley grass (Hordeum leporinum) and wild oats (Avena spp.) have short lived seed banks (Medd et al. 1995). Attempts to prevent seed production of these species have led to substantial reductions in weed densities and seed bank levels (Cook 1998, Peltzer and Matson 2002). A rule of thumb is that perennial grass weed seed banks persist longer than annual grass weeds.

In a study by Gardener *et al*. (1999), Chilean needle grass (CNG) seed bank did not decline greatly after three years, even without additional seed input. Initially starting at 4,600 seeds m^{-2}, the seed bank was measured at 1,500 seeds m^{-2} in the third year. This equates to an annual decline rate of 30% per annum. Most annual grass weed have an annual decline rate in the order of 70 to 90%. In order to make serious long term declines in populations, a regular effort to minimize seed production is required.

Longevity of seed banks is clearly one mechanism for persistence, however this mechanism is even more important if there is a significant quantity of seed produced each season, Up to 670,000 seed m^{-2} can be produced from giant Parramatta grass (GPG) (Andrews 1995). CNG has the ability to produce seed such that 15,000 seed m^{-2} can be measured in the soil (Gardener 1998). This feature of some perennial grasses is useful considering that most desirable pasture species produce far less seed than their competitors. Whalley *et al*. (1999) states that some non-weedy grass species can only produce between 0.2 to 1.5% of the quantities of perennial grass seed (CNG and GPG were used as examples). By dominating the seed bank perennial grasses are the first to establish in bare patches found in degraded pastures.

Seeds also have the capability to disperse over vast distances. CNG seeds are commonly found on stock and humans because their seed has a sharp point and can penetrate clothing and fleeces. Another mechanism for GPG is its sticky seed in wet conditions that enable it to stick to almost anything.

Once a seedling has established its survival and spread within a paddock is almost guaranteed without the use of appropriate grazing management and/or herbicides. Growth rates are usually greater than desirable species. For example, Coolatai and Johnson grass have C4 photosynthetic pathways, giving them a competitive advantage over C3 pathway plants, particularly in warmer environments. All perennial grasses listed in the introduction have the capability to grow above the normal pasture canopy and compete for nutrients, light and water. In many cases perennial grass weeds have become monocultures across once productive land. Furthermore, these weedy grasses become more unpalatable than other introduced pasture plants (Storrie and Gardener 1998) and are less likely to be grazed by stock, set at low density stocking rates.

Biological control has been a failure for controlling grass weeds. The greater majority of biological agents target broadleaf weeds. However, Briese *et al*. (1999) proposed that *Puccinia* rusts and *Corticium* spp. could be useful agents against *Nassella* spp. In the absence of successful biological agents, herbicides and pasture competition are the best options to manage perennial grass weeds.

HERBICIDE APPLICATION

There is not a large range of herbicides to effectively control perennial grasses. Glyphosate (Roundup®, Weedmaster® etc) and flupropanate (Task Force®, Propanate® herbicide etc..) are the two most commonly used herbicides, with the former being a non-selective herbicide. Flupropanate is a selective herbicide that is more expensive than glyphosate. However the use of flupropanate, is a desirable option, especially for lighter weed infestations, because desirable pasture species usually survive and compete with seedling weeds. The cost of pasture re-establishment must also be incorporated into the cost of glyphosate application.

2,2-DPA (Dalapon®, Propon® etc), is a selective herbicide that works best if applied in autumn months (McMillan et al. 1992 and Lodge et *al.* 1994). It is regarded as being less effective than flupropanate and is rarely used.

Selective grass herbicides (Group A mode-of-action) such as Fusilade®, Verdict® and Sertin® do not kill established perennial grasses (McMillan and Cook 1989 and McMillan *et al.* 1992). These herbicides have been shown to kill seedling serrated tussock grasses (Pritchard and Bonilla *1999).* In one report by Cook (1999), the use of Fusilade® stunted established CNG plants and markedly reduced the number of seed heads, thereby reducing seed production. This report also suggested that low rates of glyphosate (glyphosate (360g/L) at 1 L/ha) could *be* just as effective as Fusilade®. This form of spray topping is a useful tool that can be used to minimise seed input into the seed bank in certain situations.

The limited registrations of Group A herbicides for control of perennial grasses and the unpopularity of 2,2-DPA, the main choices of herbicide will be between glyphosate and flupropanate.

The pros and cons of flupropanate:

The withdrawal of Frenock® from the Australian market in the mid 1990's, caused some people to think perennial grass weeds such as GPG and African lovegrass would take over their properties. This is an acknowledgment of the selective and effective qualities of flupropanate. It is a herbicide that works well, needs little pasture management to assist weed control and is applied infrequently (usually every 2 to 5 years).
Application rates commonly used for perennial grass control are between 1.5 to 3L/ha (for flupropanate 745g/L formulation). At current prices, flupropanate is roughly 10 times the cost of glyphosate. Although more expensive, flupropanate negates the need for re-establishing pastures, as many more palatable species may survive. The residual activity of the herbicide controls emerging seedlings, however it has been found that areas treated with 6L/ha had significant quantities of CNG seedlings 14 months after treatment (McMillan *et al.* 1992).

Flupropanate has a narrow margin for error. The rates of 1.5 to 3L/ha give reliable and selective control, but rates above this are likely to cause damage to desirable species (McMillan et al. 1992) and rates below 2L/ha are often ineffective. Unfortunately higher rates are often unavoidable due to double overlap of boom spray in headlands and when swerving to avoid obstacles. Therefore some patches in paddocks may be treated with 6L/ha and consequently most grasses are killed and replaced with broadleaf weeds.

Another problem with flupropanate is its slow brownout of target species. In some cases effective brownout may take up to 6 months. There are a few important considerations of slow brownout; firstly it is not likely to control seed production if applied to weeds in early head emergence and secondly if spraying tasks were spread over several weeks, it is hard to see what was treated. In the second case there is likely to be more errors for spot spraying than boom spraying. Using marker dyes will reduce operator error, however these are often visible until the next rain. Gramoxone® mixed with flupropanate can overcome this problem. Because Gramoxone® is a desiccant herbicide it will scorch the plants quickly making them easily noticeable to a spray operator within one day. It will also render seeds sterile if sprayed at the correct growth *stage.* This *stage* is usually between flowering and the milky dough stage of the seed. Research by McMillan *et al,* (1992) have shown that Gramoxone®/flupropanate mixtures are slightly antagonistic, reducing the long term effectiveness of the flupropanate component, particularly if the Gramoxone® rate is≥. 1 L/ha.

However, pre-treatment of perennial grasses is not required prior to flupropanate application. Practices such as slashing, burning (Lodge *et* al. 1994) and heavy grazing (McMillan and Strachan 1985) prior to treatment did not improve control compared with spraying flupropanate without any pre-treatment.
Flupropanate is best applied during the driest time of the year. Light to moderate rainfall following application gives the best results. Poor results are likely if little rain follows application or if rainfall is too excessive, say 200 mm, soon after application. Flupropanate is a soil active/root uptake herbicide, and heavy rainfall events may wash the herbicide away from the root zone.

Applying flupropanate through wiper machines may save money and reduce pasture damage. Experience from the Northern Weeds Research and Demonstration Unit (NSW Agriculture) has suggested that reasonably widespread and uniform infestations are best controlled when flupropanate is boom sprayed. It is recommended to use spot spraying or wipers for isolated patches, but note, that flupropanate can move 1 to 2 m away from the original spray target. This phenomenon arises due to movement of flupropanate in the soil and also by recycled flupropanate residues in decaying organic matter.

The pros and cons of glyphosate:

The main advantage glyphosate has over flupropanate is price. Most farming decisions are based on minimising cost and maximising benefit. Glyphosate does not offer any selective control when used through a boom spray. Pasture damage is usually excessive and results in broad leaf weed and seedling perennial grass emergence. However, glyphosate kills most weedy perennial grasses at similar rates to flupropanate when applied through a boom spray. Boom spraying glyphosate is an ideal choice if the pasture/roadside is essentially a monoculture of a perennial grass weed. Most monocultures of weedy perennial grasses heavily suppress desirable species, while a selective herbicide treatment of flupropanate will leave a sparse covering of desirable species that will be prone to broadleaf weed infestations
The temporary removal of flupropanate from the market has focused attention on finding alternative herbicide tactics (Michalk et al. 1999). Rayner and Peirce (2002) have highlighted the need to use wipers so that herbicides are applied more selectively to taller more erect weeds. As most noxious perennial grass weeds fit this growth habit and glyphosate causes unnecessary pasture damage, Pritchard and Bonilla (1999) have suggested that glyphosate be used via wipers to control serrated tussock. Wiper applications of glyphosate are successful on grasses such as GPG, reducing infestation quickly to 10% of the original population after the first application (Storrie and Cook 1999).

Wiper technology is not a perfect science because the application depends type of wiper, speed of travel, number and differing direction of wipes, height of target weed and prescence of desirable species, height of wiper, dilution of herbicide and distribution of weeds. If applied correctly, control of perennial weeds should be approximately 90%. Surviving plants could be too small to reach the wiper, ones that were either sheltered by other plants or flattened before the wiper passed. This level of control is below that of flupropanate (normally > 95% control), but exceptionally good for the cost. Furthermore, if there is an adequate height differential between the weed and the desirable species, wiper applications of glyphosate can be safer to non-target species than flupropanate.

Clearly, one has to be much more proactive to successfully use glyphosate through wipers than someone spraying flupropanate. Grazing prior to wiping will tend to leave the unpalatable tall perennial grasses relatively unscathed whilst the palatable pasture species are grazed low to the ground. Wiping in opposite directions will greatly assist coverage of herbicide over tussocks/clumps. More frequent wiper applications are required with glyphosate because it has no residual effects on emerging seedlings. Depending on the weed species, pasture competitiveness and level of control, wiper applications might be required every 6 months to 2 years. Using a wiper is much slower than driving with a boom spray. It may take up to 20 times as long to treat an area due to restricted travelling speeds, limited width of wipers and the need for wiping in the opposite direction. However, wiping can also be used effectively to prevent seed set.

Glyphosate cannot be applied anytime of the year. Evidence from McMillan and Strachan (1984) pinpointed the time between mid January and mid March, ie. early autumn, as the optimal time to apply glyphosate on African lovegrass. There is much literature that concludes that autumn applications of glyphosate on perennial species are ideal. The reasoning behind this is that glyphosate, along with the sugars/starches from photosynthesis, are transported in autumn months, to the roots/rhizomes for the over-wintering period. In spring, the net movement of starches/sugars is up, away from the roots/rhizomes, maybe this explains why perennial grasses tend to sprout again from the basal tissue even though most of the above-ground biomass is killed.
However, an early summer application may be necessary with wipers to get a height differential between the target and non-target species.

PASTURE AND WEED MANIPULATION

Using herbicides alone to solve perennial grass problems is not the best solution. Whalley ***et al.*** (1999) concluded that a new approach to solving the perennial grass is required. There must be pro-active management integrating all techniques available to the land manager

A commonly used cultural technique is slashing. The reasons for selecting slashing may be to prevent seed set, reduce the vigour of the weedy plant, reduce the biomass of the weed so that light can reach desirable species or to improve the aesthetic appearance of the infestation. Slashing alone will not remove the established plants but may increase the proportion of more desirable species (Storrie and Cook 1999). Slashing at the incorrect time (late head emergence) usually results in the spreading of seed to new areas. This supports the fact that infrequent roadside slashing will promote the spread of some species, for example the noticeable spread of Coolatai grass along roadsides in the north-west slopes and plains district of NSW.
The burning of perennial grasses will generally have the same effect as slashing, except that damage to both desirable species and weeds is more severe, without the possibility of spreading seeds. Burning has a narrower window of opportunity than slashing (fire bans and wet conditions).

Cultivation may be required if the infestation has basically smothered all desirable species Increased erosion risk, soil compaction and loss of soil organic matter and macropores are negative consequences of cultivation.

Agro-forestry may be an option in areas that are at best marginally useful for agricultural production. A study by Campbell and Dowling (1999), found that good control of serrated tussock was evident 3.7 years after planting trees.

Many of the perennial grass weeds are very palatable to stock in the short vegetative stage. At this stage some land owners consider it to be a beneficial plant. Five per cent of survey respondents consider CNG as a beneficial plant (McLaren *et al.* 2002). Gardener *et al.* (1999) also stated that CNG is quite useful in cooler months, particularly if the plant is the dominant species in the pasture. Coolatai grass can be successfully grazed by sheep using heavy stocking rates of wethers (up to 15 d.s.e. per hectare) without any loss of condition (Lodge pers. cornrn.). African lovegrass can also be grazed at 20 sheep/ha and has resulted in only a 10% increase in African lovegrass over 3 years whereas with the 10 sheep/ha stocking rate the increase was 250% (McMillan and Strachan 1985). However, all these stocking rates caused reductions in palatable pasture species. Clearly grazing pressure can manipulate pasture composition and pastures need to be rested more than normal after any effective treatment to ensure the survival and regeneration of the beneficial species (McMillan and Strachan 1985 and Whalley *et al.* 1999). It is recommended that high stocking rates are used for short periods followed by long rest periods, with the heavy grazing targetting the vulnerable parts of the grass weeds' life cycle.

Heat treating, steaming and spraying non-synthetic chemicals have at best suppressed perennial grass weeds for short periods.

If some of the successful cultural techniques are employed, in conjunction with strategic use of herbicides, the impact of perennial grass weeds should be greatly suppressed.

TAKE HOME MESSAGES

- It is unlikely that dense infestations of weeds will be eradicated with herbicides or a combination of herbicides and cultural practices. The concept of eradication might only be feasible if the infestations are limited to small patches which are easy to treat and monitor.
- If eradication is not likely landowners can utilize some perennial grass weeds to their advantage by grazing at the appropriate times, and with appropriate stocking rates.
  A combination of herbicides and cultural practices will be more effective than using a single tactic.
- The seed bank of perennial grasses is an important component of the grass life cycle. Control strategies that target seed production will prevent the rapid increase in plant populations and limit the spread on the weed.
- Management of pastures or desirable species is also important in preventing re-infestation of weedy perennial grasses. Pastures must not be limited by poor nutrition or prolonged over-grazing.

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HELPING COUNCILLORS TO BECOME MORE EFFECTIVE - ROLES, RESPONSIBILITIES AND OBLIGATIONS IN WEEDS MANAGEMENT

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SUMMARY

The need for attention to training for Councillors is outlined as the reason for this paper. The impact of weeds in our economy follows and an outline given on the Noxious Weeds Advisory Committee in NSW and the Technical Committee is also mentioned. NWAC[1]s functions are listed before covering the part played by those who have responsibility for weeds management. A weed is defined as a basic consideration before a suggestion is made about improving the effectiveness of Councillors in the very important work they do in accepting their obligations for community benefit.

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Some of the Councils in NSW, despite their strong commitment to Local Government and to overall diligence in their work, feel that weeds can be left to the Council staff and other experts. There are apparently many reasons for such a view and my interest does indicate that it is fairly common. "Why is it so?" as Julius Sumner-Miller would say! It is a fact that Council Weeds Officers, Rural Land Protection Board staff, Environmental Management groups (both Statutory and others), farmers and their advisers are becoming more knowledgeable and competent in the field of weed management. But the question arises "Are Councillors as interested, motivated and active in weeds management as they (we!) need to be to give the leadership in policy development toward best 'weeds effort'" outcomes. I believe we can do better.

There is a valuable opportunity for Councillors to better understand their role as necessary contributors to the policy and planning aspects of their Council work in weed control, better understand their responsibilities and meet their obligations. Even in rural areas, so many Councillors are urban dwellers who work in Local Government with their colleagues who are in primary production as farmers, as Foresters, as National Parks and open space managers, as Coasts and Estuaries managers and as Catchment "conscious" people without confidently knowing just how to set specific weeds policies as Council elected members. Further, Councillors have good reason to leave weeds work (even on Council property) to those who work the land and maintain it because that's where the skills and responsibility lie.

Generally speaking, the "experts" do very well but they do face an enormous problem, some say an almost insurmountable problem with weeds. Weeds do have a dramatic impact on agriculture, the environment and the economy. Local Control Authorities (LCA's) such as Councils do have, and accept, their responsibility in weed management. How it can be done better is a vital question for our future production, biodiversity, lifestyle and economy (among just about everything else!).
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Before we look at how we may develop Councillor decision-making for mutual benefit, we should pause for a moment to consider the roles of the various groups in this state, in both its urban as well as its rural areas.

In NSW there is a scheme of declaring weeds as noxious weeds under the Noxious Weeds Act. The Minister makes the declaration on advice from the Noxious Weeds Advisory Committee of which I am the Local Government Association member. There is a Shires Association member as well on the Committee (of eighteen) representing a wide spectrum of interests. The Committee was established by the Minister to assist with the administration of the Act. NWAC, as it is known, has the following functions:

- To provide a forum for all matters relating to the control of noxious weeds
- To provide advice to the Minister on all matters related to noxious weeds control
- To recommend to the Minister allocation from the government's Noxious Weeds Grant and to ensure public authorities are accountable for those funds
- To recommend to the Minister plant species to be declared, by category, as noxious weeds

There is also a Technical Weeds Committee (Minister appointed) which has seven members from NSW Agriculture, including the five Noxious Plants Advisory Officers and three NWAC delegates .

The function of the Committee is:

- To make recommendations to NWAC on allocations from the Noxious Weeds Grant Scheme
- To provide technical advice to NWAC on noxious weed declarations and control categories
- To attend to other matters relating to the control of noxious weeds as requested by NWAC

The responsibilities for the implementation of the Noxious Weeds Act rests with NSW Agriculture, Local Control Authorities, private landholders and identified community based groups.

Of major interest here is the Local Control Authorities' responsibility for implementing the Noxious Weeds act within their area by:

- Controlling noxious weeds on Council land
- Undertaking a private property inspection program to ensure landholders are controlling noxious weeds as categories
- Issuing notices and if necessary carrying out prosecutions of private landholders who do not comply with provisions of the Act
- liaising with public authorities concerning noxious weed control on public authority lands and informing NSW Agriculture where weed control on public authority lands is unsatisfactory

Local control authorities maybe a multi-purpose council or an organisation, such as a county council or weed control authority, formed for the purpose of providing noxious weed control services for a number of general- purpose councils.

For your information, the following is also included for completeness.

Public Authorities are responsible for:

- Preventing noxious weeds from spreading from their land
- Notifying LCA's of any occurrence of W1 weeds

Private landholders are responsible for:

- Controlling all noxious weeds on their own land according to the specified control category
- Notifying LCA's of any occurrence of W1 weeds

Community based groups, such as Landcare, Dunecare and catchment management committees, play a vital role in increasing community awareness of, and involvement in, weed management.

A Regional co-ordination scheme is also in place.

Noxious weeds are rarely confined to one local government area and hence, control programs are likely to be more effective if they are developed on a geographic region or catchment basis.

The effective control of noxious weeds in New South Wales requires co-operation between NSW Agriculture, LCA's, public authorities, private landholders and the community.

The effective control of noxious weeds in New South Wales requires co-operation between NSW Agriculture, LCA's, public authorities, private landholders and the community.

Regional noxious weeds advisory committees play an important role in co-ordinating noxious weed control programs and they are a forum for the exchange of information and ideas and for the involvement of community groups in developing weed control programs.

Of course, as one would expect, NSW Agriculture is responsible for the overall administration and management of the Act. Key personnel in NSW Agriculture and their roles are:

- Program Manager (Quality Assurance and Plant Protection):
  Chairman of the Noxious Weeds Advisory Committee, delegated authority to issue permits under Section 34 of the Act
- Program Leader (Weeds)
  Chairman of the Technical Weeds Committee
- Senior Inspector (Weeds)
  Oversees all aspects of administration and operation of the Act
- Noxious Plants Advisory Committee
  Assist with administration and operation of the Act, assist public authorities to co-ordinate noxious weed control programs, develop educational and promotional programs for noxious weeds.

- Secretary Noxious Weeds Advisory Committee
  Responsible for operation of NWAC and TWC, communication with councils concerning grant process, changes in declaration of weeds, applications for permits under Act, maintenance of records on notifiable noxious weed outbreaks, liaison with Councils and public.

The above outline should help those Councillors not members of a Regional Committee or NWAC, understand better how they, and their Council, fit into the pattern under the Noxious Weeds Act, its implementation and administration.

As you can gather, Councils do have an important role in weed control at an "on ground" level. Councils inspect local properties and can (and do) issue notices and carry out prosecutions. To this end, most Councils either appoint their own Weeds Officers or share one or become part of a County Council (Weeds). Some allocate part-time duties to a Council Officer who works in the vegetation, parks and gardens or a similar field. The action which a Council takes should be seen by Councillors as most important. Therefore, Council members must take a strong interest in the matter and seek well prepared and well founded reports before they make their decision. When one realises that the cost to Agriculture of weeds, through a variety of impacts in some four billion dollars annually, it can be seen that even at Council level, weeds must get very careful attention. Weed control is a major consideration for almost every Council and certainly a matter for all Councillors.

There are many means of weed control at our disposal. They can be applied with best impact only if Councillors are familiar with the problems and the methods, or have advice within their Council, to access these before making major or even minor weed decisions. For this reason, our Weeds Officers must be well trained in a whole range of fields, such as weed identification, methods of control, how they apply in particular situations with given species at a given season, legal requirements and so on. The economic, social, environmental and biodiversity effects of weeds in a local Council area, and the appointment and continued professional development of Weeds Officers, are paramount reasons why elected members must take an interest in weed management, whether they work on the land (depending upon it for a living) or not. Weeds are everybody's business. The education and training available for Weeds Officers today is very good. While they have a way to go, NWAC has advanced them very considerably in recent years, in close collaboration with TAFE, TOCAL College and other vocational training establishments. Weeds Officers are essential professionals for Councils.

Councillors have a responsibility also to ask of themselves "What is a weed?" and as well, 'What is their impact in my Local Government area?" and "What part can I play to improve the fight against them - to decrease or even eliminate a particular impact?" By answering such questions, and others, Councillors become truly professional operators because they are working diligently for their constituents as they implement wise policies which they make. Weeds management constitutes but one field of endeavour in Local Government. However, its importance to the social and economic welfare of farmers, forest growers, players of sport, recreation reserve users - indeed every member of the public - cannot be overemphasised.

At the risk of stating the obvious, it is yet instructive to present a widely accepted definition of a weed. A weed is any plant growing out of place. It can even be plants of a previous crop! If it grows where it's not wanted (eg, kikuyu in a cricket pitch) it is a weed. The Australian National Weeds Strategy defines a weed as "A plant which has, or has the potential to have, a detrimental effect on economic, conservation of social values"[1].

In NSW, there is a process for declaration of a noxious weed and they are categorised as well. Declared noxious weeds are identified as a threat to a region or local area and legislation requires that the weed be controlled.

The action legislated depends upon the category of the weed in its declaration. There are four major categories and some sub categories. The categories and their definition are readily available on NSW Agriculture's web page http://www.agric.nsw.gov.au/ap/weeds (or from your weeds officer). The action required is an obligation which cannot be taken lightly and if an order is issued, it must be complied with at the occupiers peril of a substantial penalty. The action required under the Act ranges from notifying the presence of the weed on land (or in water) to the Local Control Authority AND the weed must be fully suppressed and destroyed (a "W1" weed), to "the weed must not be sold, propagated or knowingly distributed". There are National, State and Regional Strategies for Weed Control and Councillors should be aware of these, or at least have access to, their principles (or detail from the Council Weed Officer). Not all Regions have a Regional Weeds Advisory Committee but they are being established over time.

NWAC has a Sub Committee which deals with Education, Training and Extension and this group has an allocation of funds for Local Government Elected Member Training. While much of the planning has been done, there have been some changes. However, it is useful to outline, as is done below, what is proposed. Before that is done, some background is provided against which the program has been developed.

There has been general agreement among members of (as it was) the Education, Training and Extension Sub Committee of NWAC that substantial benefits can accrue as Local Government elected members are fully engaged in the planning and administration of weeds management at the local Council level. As already stated, these local decision-makers play a critical role on the ground in the control of weeds on private land and on their own Council land and, most particularly roads and open space (eg, sporting fields, recreation reserves and waterways). Some workshops are planned to improve the effectiveness of Councillors and to this end to:

a) Identify the present interest, involvement, knowledge and understanding of Weeds Management for **all** Councillors.
b) Agree on what the level of each of these should be.
c) How the gaps (ie, between the current situation and the agreed ideal situation can be filled) and
d) Set up an awareness program to assist Councillors to become most productive in weeds management.
e) Ensure that councillors are involved in the further planning of their own training and education and have a real ownership of it and a commitment to it for their effectiveness

The workshops will be facilitated and will utilise the skills and knowledge of Councillors, Weeds Officers, NWAC members, NSW Agriculture personnel and perhaps an outside specialist (eg, a person who is currently involved in preparing and teaching training programs).

This **is not** a weed control course for Councillors. Rather, it is designed to develop awareness of the role of Councillors, how important to **weeds** management are their responsibilities and, as well, the obligations of various **parties** in the whole process. If Councillors become more interested in the many and varied ways they can fill their role in this field and get to know where they can get information and what assistance is available, a huge step forward will be made. Farmers who are Councillors work in weed control right throughout their own working year and can assist, as well be assisted tremendously. All Councillors will do a better job as Local Government decision makers when they are best informed about, for example, the relevance of the Noxious Weeds Act and all its implications, among other essential information, **as** already outlined above. This paper has set the scene for Councillors in the hope that the workshops will attract many sf them. It really does not need to be emphasised here again that all parties are committed to the workshops, most importantly, their value eventually to every one of our communities.

The role of Councillors, their responsibilities and their obligations form a foundation for their work in serving Local Government in the management of weeds by Councils. If this paper does, as is expected, increase their interest in becoming more effective and **ready to** "own" the Council **weeds** effort, then it has achieved a great deal. Across NSW Councils, there are many very competent, committed and productive Councillors in weed management. There are also highly trained and effective Weeds Officers in Local Control and other authorities. It is the **intent** of this paper to get an understanding among all groups of how they can better work together to go further along the track of solving the problem which affects every person in all of our communities. A conference such as this NSW Weeds Conference is of tremendous benefit to all who participate and indeed to all who participants serve in the future. Even the informal discussion and "out of session" networking are developmental for us all.

It is the firmly held belief of NWAC, and specifically the view of The Education and Training Sub-committee, that much of the benefit accrued will be expressed through the even more effective volunteer work of our committed, elected representatives.

FOOTNOTE:

(1) This information has been taken from a variety of NSW Agriculture publications, other specialised documents and NWAC documents for which credit is acknowledged.

{More complete information is available from the website - NSW Agriculture www.agric.nsw.gov.au/weeds, which has a tremendous amount of information.)

USEFUL REFERENCES:

(1) Agriculture and Resource Management Council of Australia and New Zealand et al: The National Weeds Strategy; Commonwealth of Australia, 1997, which is excellent on its topic.

(The following NSW Agriculture publications are especially useful and easy to read and were referred to in the preparation of this paper.)

1. Getting Your **Share** of the State Assistance For Noxious Weed Control. NSW Agriculture (available in similar name each year).

2. New South **Wales Weeds** Strategy - Co-ordinating the Fight

3. **Noxious** and Environmental Weed Control Handbook 2001/2002 **(Revised** 2001)

4. **Efficient Weed** Management - Protecting Your **Investment** in The Land - (Written by Darren Bayley) 2001

5. Noxious **Weeds Grants** - Funding Applications **Guidelines** and Forms For Local Councils and Other Public Authorities - (Latest edition for current year.)

6. EPA of NSW: Environment Matters - (Pesticides Series); NSW EPA

7. National Parks and Wildlife Service (NSW) - Weed Manaaement Proarams - 2002, 2003 (published each year)

8. Regional Weeds Advisory Committees:

   Regional Weeds Strategy (Not all are available yet for the regions, but some Regions such as the Mid North Coast, have excellent strategies prepared and documented (See your Weeds Officer, who may have your regional copy. However, these officers can very capably point you in the right research direction.)

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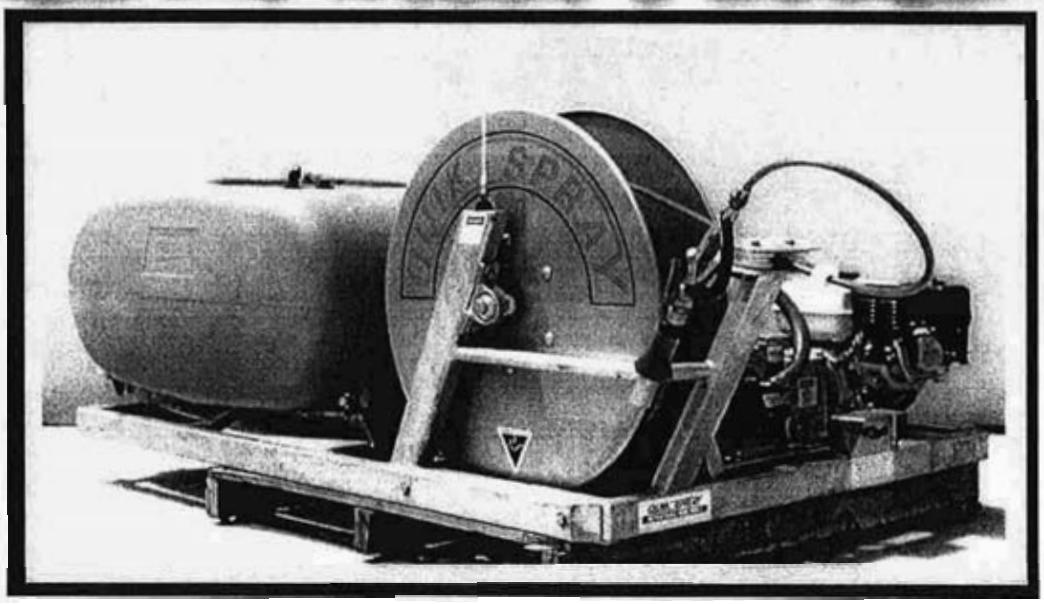

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COORDINATING AND PRIORITISING WEED MANAGEMENT IN THE RIVERINA

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Weeds – a growing economic and environmental cancer.

In the keynote address to the 11th Biennial Noxious Weeds Conference at Moama in September 2001, Rick Roush summarised the high cost, main problems and possible solutions for weed management in Australia. He painted a disturbing picture of new weed arrivals, expansion of existing weed problems and general failure of the Australian public to recognise the threat of weeds to biodiversity and agricultural production. The poor standing of weed issues also appears to be evident at political levels. For example, a survey of 130 Federal Government politicians, conducted at a "Science Meets Parliament" event in November 2002, ranked weeds last (along with pests and quarantine) in a list of 20 issues that parliamentarians wished to discuss (Science Meets Parliament 2002). However weeds are generally accepted to cost Australian agriculture at least $3.3 to $4 billion annually and are recognised as second only to land clearing as the most important cause of biodiversity loss (see "Land Degradation" at www.abs.gov.au).

Why then are weeds low on the political and public agenda? Perhaps the poor standing of weeds issues is due to weed management stakeholders having different weed priorities and an uncoordinated approach to weed control rather than a failure of politicians to recognise the importance of weeds.

Compounding these problems is the almost universal failure to achieve eradication or containment once weeds become naturalised (Panetta and Scanlan 1995), so total weed impacts and costs are cumulative. In addition, because resources for weed management will always be limiting, it is imperative that the available resources are used to the best effect.

The need for standardised priorities and coordination.

Although the Minister for Agriculture is ultimately responsible for declaring plants as noxious weeds, it is normally left to Local Control Authorities (LCAs) or Regional Weeds Advisory Committees to recommend which weeds should be declared. As LCAs are responsible for the control of noxious weeds in their jurisdictions, it is their prerogative to ensure that plants recommended for, or retaining, noxious weed status have been assessed as likely to be cost-effectively reduced in distribution as a result of declaration, and that the control strategy is affordable (Panetta and Scanlan 1995). Serious problems may exist where this prerogative is either not exercised or is exercised in different ways by different LCAs.

In the Riverina a need was recognised to develop a standard protocol whereby weed management resources across the region are allocated on a priority basis, taking into account all relevant factors, including the biological and ecological characteristics, distribution, feasibility of control, affordability and benefit-cost-ratio.

LCAs commonly retain a high allocation of resources for widespread weeds of major economic importance, even though no amount of funding would reduce their regional distribution. Potentially serious new or emerging weeds may receive inadequate attention, with the risk of them becoming widespread problems of the future. Because new weed introductions and new declarations are ongoing and very few weeds already declared are reviewed to determine their continued suitability for declaration, there is a risk of having a list of declared weeds too long to manage effectively. This can lead to resources being allocated in a scatter-gun approach that targets many weeds, but few of them effectively (ie with a demonstrated reduction in distribution) because of inadequate resources.

Further exacerbating the problems are differences between LCAs and other land managers in approach, policies, priorities, funding commitment and technical competence. Exactly the same differences result in the more readily observed major variability that exists between landholders in weed management effectiveness. An informed national, state-wide or regional perspective as well as a local perspective is often lacking. Vital decision-making is too often made without regard for all relevant information.

The net result has been variable and often inefficient weed management. There is an obvious need for an agreed objectively based system of regional prioritisation. To achieve the latter it is vital to educate LCAs and the community on the proper role and limitations of legislation, and to simultaneously focus on both the prevention of new weed introductions and the management options (including bio-control) for widespread weeds. All weeds, including serious widespread weeds, must be and be seen by the community to have been considered in the prioritisation process.

Developing the Prioritisation Protocol

The prioritisation process was initiated by Cr. Doug Harris, Chairman of Western Riverina Noxious Weeds Advisory Group (WRNWAG). On the 25th July 2001 a workshop was conducted in Hay for LCA members of WRNWAG. The initial workshop only included the LCA members as organisers were conscious of keeping numbers at manageable levels; the intention being to include all stakeholders at a later date. To ensure the workshop had input and insight from all levels within LCAs the attendance of a Weeds Officer, a Councillor and an administrative representative was requested. Of the 13 member councils, 12 participated with most providing two or three representatives. At the completion of this workshop it was obvious that further work was required to complete the process. However, some key criteria were agreed upon as being important to consider in the decision-making process and resource allocation. These were: weed characteristics, current weed intensity and spread, history, impact, community awareness and support, controllability, cost effectiveness, potential impact and possibility of land use changes. Additionally it was acknowledged that some criteria were more important than others.

The outcomes of this workshop were reported on the 24th October 2001 at the WRNWAG meeting in Hay and it was resolved to appoint a sub-committee to develop this process further.

A similar workshop report was given to members of the Eastern Riverina Noxious Weeds Advisory Group (ERNWAG) on the 7th November 2001. They resolved to conduct a similar workshop in Wagga Wagga on the 5th March 2002. Run under similar guidelines as the WRNWAG workshop, this group also identified specific criteria that is important in the decision-making process for weed priorities and the allocation of resources. The criteria were: level of infestation, weed history, controllability, impact, awareness and biological and ecological features. It was noted that these were very similar to those determined by the WRNWAG group.

Meanwhile WRNWAG's sub-committee met at Jerilderie on the 7'' February 2002. At this meeting literature was reviewed on existing ranking systems and whether they met the desired criteria. It was decided to trial Rod Randall's system. (''Which are my worst weeds? A simple ranking system for prioritising weeds'' - Randall 2000). Rod's system includes four sections; A. Invasiveness of the Weed (Questions), B. Impacts of the Weed (Questions), C. Potential Distribution (Maps and Questions) and D. Have you got a priority weed? (Flowchart). Each section and question has an allocated score attached to it. Each weed is given an overall score when all sections are completed and added.

A report on the ERNWAG workshop was presented to all members of ERNWAG on the 2nd April 2002. It was resolved that the two groups work together to fonnalise a regional protocol for weed prioritisation. Representatives from ERNWAG were nominated to work with the WRNWAG sub-committee, the combined group becoming the Riverina working group.

Testing the system

The working group trialed the system on the list of weeds currently declared in the Riverina, by dividing into three teams that met separately to complete the questionnaire. Team scores were compared at Hay on the 2nd June 2002. Scores between different teams varied greatly, which was of some concern. However some teams were scoring weeds on a local rather than a regional basis and this accounted for much of the variation. All members agreed that the system was appropriate, easy to use and would be able to be readily explained to stakeholders and the community. It was also agreed that the priority listings would be more accurate if the region was split into relevant land type/land use categories and weeds were ranked for each of the relevant land categories (sub-regions). A number of questions within the system also had to be modified to eliminate ambiguity. An unplanned benefit of the exercise was that in the process of completing the questionnaire all working group members realised they had knowledge gaps and that the whole exercise had been a considerable learning experience.

Regional prioritisation

The working group determined that sections A (Invasiveness) and B (Impact) were likely to be similar throughout the region, but results in sections C & D may vary considerably with location. Therefore all 27 LCA weed officers in the region were asked to complete Sections C & D for every weed declared in the Riverina, as well as for a few new and emerging weeds not yet declared. For each LCA, between 36 & 44 weeds were ranked by the system. Sections A & B were completed by the working group.

Collation of the scores revealed some, sometimes major, anomalies between neighbouring LCAs for particular weeds. To explore these differences and provide additional feedback on the suitability of the system for individual LCAs, weed officers from adjacent LCAs met, together with one or more working group representatives. The major causes of differences in scores were a misinterpretation of questions and the incorrect use of the flowchart in Section D. The differences were resolved and minor changes made to the question to prevent further ambiguity. Once these problems were rectified the database was updated. Based on the scores a priority list and four priority groups of weeds were developed for each of the four proposed sub-regions. Priority 1 weeds - not currently present in the Riverina sub-region. Priority 2 weeds - present with limited distribution, several small infestations in sub-region. Priority 3 weeds – Present with moderate distribution, numerous to large partially dispersed infestations in sub-region. Priority 4 weeds – widespread throughout the region. For each priority category, the working group developed a recommended policy for action that could be uniformly adopted by all LCAs.

At this time the working group also decided that it was time to seek further LCA endorsement before the process was taken to other stakeholders for input. Cr. Doug Harris on behalf of E/WRNWAG made presentations at a meeting of "F" Division of the Shires Association of NSW (12th February 2003) and at a meeting of the Riverina East Region of Councils (26th February 2003). A paper was also submitted to the Murray Region of Councils and Riverina Region of Councils. The working group sought agreement with the principle of a uniform approach in the region whereby a weeds regional (or sub-regional) priority ranking is linked to resource allocation and a common weed management policy. More specifically the organisations were asked to endorse the following proposal:

Members of E/WRNWAG develop policy and recommendations for all LCAs to endorse, based on:-

- a prioritisation process that places weeds into one of four priority groups.
- a common Council policy is adopted for each priority group.
- the process is used to regularly review and update the declared noxious weed list.
- the policy is adopted and incorporated into Riverina's Regional Weed Strategy (being developed).

All of these organisations endorsed the proposal.

Stakeholder consultation

At the time of writing the working group had commenced further stakeholder consultation. The first forum, held in Deniliquin on 2nd April 2003, was attended by 25 persons, including representatives from State Forests, Department of Land and Water Conservation, Agronomists, Country Energy, State Rail and Landcare. All participants agreed with the proposal and gave the working group some constructive input. The working group has also contacted the four Catchment Management Boards in the region (Murrumbidgee, Murray, Lachlan and Lower Murray Darling), requesting that the Boards partner the working group in further stakeholder consultation meetings within the region. The working group hopes to complete the consultation process by the end of 2003.

Conclusion

It has taken a period of just under two years to come this far. Not only has the project been a learning process for all but it also promises to be a sound and uniform system by which the limited resources available are used to the best effect. Other benefits include increased protection of industries and the environment, more effective and efficient use of resources, improved weed management by LCAs, greater ability to lobby for increased resources and funding, opportunities for increased stakeholder input and activity, LCAs assisted with community education and not judged on their inability to handle weed problems that they do not have the resources to handle and, last but not least, 27 **Shires working together to protect the region.**

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WITHER THE WEEDS COUNTY COUNCIL ?

Other Models for Cooperative Noxious Weed Management Between Councils

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INTRODUCTION

The purpose of this paper is to canvass a number of options for a more flexible approach to cooperative arrangements between councils for implementing noxious weed management. The Noxious Weeds Advisory Committee and NSW Agriculture do not presume to dictate structures for weed management to local government. This paper makes no recommendations. Its aim is to provoke discussion and analysis within local government of other methods for achieving desired outcomes for noxious weed management.

IS THE COUNTY COUNCIL STRUCTURE THE BEST COOPERATIVE MODEL?

The New South Wales Weeds Strategy promotes the concept of cooperative arrangements between councils to implement local government noxious weed control responsibilities. The method of giving effect to this concept has been the formation of county councils within the meaning of Chapter 12 of the Local Government Act or weed authorities formed by deed of agreement. The existing counties and weed authorities have provided valuable cooperation on a range of specific weed programs for many years.

Compared with single purpose councils, county councils and other formal cooperative arrangements between councils provide a number of advantages for noxious weed management. These include:

- Engendering a long term commitment by councils to noxious weed programs.
- Enabling a team of skilled staff to be assembled.
- Specialist skills in a range of technical fields can be built within the team.
  Staff can be concentrated to deal with new weed problems in a part of the county when necessary.
- Ensuring specialist vehicles are fully utilised.
- Larger herbicide orders increase purchasing power.

Despite the support of the Weeds Strategy and financial assistance from the noxious weed grant, in recent years local government has been reluctant to enter into such arrangements. During the six years the NSW Weeds Strategy has been in effect, only one new weeds authority has been created.

Currently, only fifty-five councils or 32% of all general-purpose councils in NSW are constituents of a weeds county council or weeds authority.

It has not yet been clearly established why general purpose councils are reluctant to join weeds county councils. Possible reasons include:

1. a perceived loss of loss of autonomy in relation to noxious weed management to control expenditure, operational programs and regulatory activities, and

2. the extra costs associated with administering an independent weed management organisation within the State Government environment when there is no straight-forward financial advantage to form a county council, and

3. county councils or other cooperative arrangements are not treated as a worthwhile sub-regional body in contrast to a single local government authority.

The first reason is possibly a perception fostered by localism that fails to take into account the benefits of county councils and other cooperative arrangements. It is best countered by the constituents of the existing county councils.

The second reason has more foundation. An analysis of the noxious weed grant returns for county councils in the north of New South Wales has shown that the cost of administering a county council when compared with the rise in incomes from all sources has climbed significantly in recent years. Funds from both the noxious weed grant and constituent councils are used to pay administration expenses. Funds that are drawn from a limited pool and spent on administration obviously reduce the amount of money that is available to be spent on the core business of the county council. Most counties now spend more on administration than they spend on controlling noxious weeds on roads. Many of the administration costs are fixed costs that cannot be reduced. Some of these fixed costs that are partially greater include:

In the case of a county council
- Employment of a general manager,
  County councillors meeting fees,
  Auditors fees,
  Separate insurance policies
- Separate policy development and maintenance

These costs are also paid each year by the constituent councils in support of their own administration. The disadvantage of county councils is thus exposed. For the benefit of being independent, some administration and the associated costs must be duplicated. The noxious weed grant returns for counties in northern New South Wales show that the cost of this duplicated administration is commonly around $10,000 per constituent member of a county council. On average, the constituents pay about 60% of this cost and the noxious weeds grant pays about 40%.

The Noxious Weeds Advisory Committee supports county councils by recommending to the Minister that payments be made to support county council administrative expenses. In the disbursement of the 2002-03 noxious weeds grant, $447,511 from the total available funds of $7,035,000 or 6.4% of available funds was allocated to support county council administration. Yet, if all councils in New South Wales became constituents of a county council with three to four constituents, the amount of grant funds that would need to be allocated to support administration would be approximately $1.54million or 22% of available grant funds.

The third reason raised involves there being no clear commitment and focus as to what approach the State Government prefers and is willing to fund at appropriate levels. For instance there are project officers working as part of regional advisory committees (reasonably large) and there are counties (probably on the small side). If there were larger counties and the authority, autonomy and sustainable financial funding was assured for these counties maybe there would be more counties or similar structures.

It is apparent that the structure of a county council, as defined by the Local Government Act, is too rigid in that it requires a separate and independent administration. Should costs continue to increase at a rate greater than the incomes available and the lack of clarity of roles and funding arrangements from the State Government continues, it is doubtful if the current model for cooperative noxious weeds management is sustainable.

OTHER MODELS FOR COOPERATIVE ARRANGEMENTS

– Are there better models than the county council structure?

Some of the possibilities are:

- Weed Authorities form by deed of agreement,
- Delegation of service from several councils to one provider council,
- Regional Coordination through a Regional Chief Weeds Officer.
- Larger County Councils
- Transfer noxious weed management to Rural Lands Protection Boards
- Transfer Weed Control Coordination to NSW Agriculture

Each of these models may be expanded upon.

- **Weed Authorities formed by deed of agreement**

  An independent cooperative arrangement created by a contract between a number of councils. The contract binds the constituent councils for a number of years. There are at least two possible models.

  The first is where the weed authority is formed as a business unit of one of the constituent councils. All member councils pay an agreed contribution to support the weed authority. The host council supplies administration to the authority for a fee. Examples of this arrangement are the Mid North Weight of Loads Group based at Gloucester Council that patrols regional and local roads in the areas of 17 surrounding Councils and the Clarence Valley Weeds Authority based at Maclean Shire Council, that implements noxious weeds programs for Maclean and Pristine Waters Shires and Grafton City Council.

  The second model has the Regional Organisation of Councils supply the administration for a fee and recovers that fee from all constituents. An example of this model is Illawarra District Weed Authority.

In both models, oversight of the weeds authority is provided by a committee of councillors. The chief weeds officer, inspectors and operational staff are employed by the authority.

Advantages

- Easier to form than a county council
- Easier to disband than a county council
- No councillors fees
- No requirement for a general manager, although an executive/chief weeds officer would still be required.

Disadvantages

- Administration costs are still duplicated.
- Easier to disband than a county council
- Requires ongoing commitment from participants.

Delegation of service from several councils to one provider council

The Noxious Weeds Act permits local control authorities ie councils, to delegate all of their functions under the Act to another body. In this model, a number of adjoining councils would delegate their functions under the Act to one host council. The host council would operate an expanded weeds unit for both itself and for the other member councils. Administration is provided by the host council as part of the normal council management.

Possible increased overhead costs incurred by the host council (around 15% of operation) would be recovered from the other member councils as a proportion of the annual contributions.

Oversight of the auspiced weeds unit would be provided by a committee of councillors drawn from all member councils. The chief weeds officer, inspectors and operational staff would be employed by the host council and be appointed as inspectors under the Act by all member councils.

Advantages

- No duplication of administration expenses.
- More economical than a county council structure ($40k)
- Easier to establish than a county council
- Easier to disband than a county council

Disadvantages

- Easier to disband than a county council
- Transparency of administration at both the management and operational levels is essential to maintain the confidence and support of the members.

Coordination by a Regional Chief Weeds Officer

This is the minimalist model for coordination of weed management activities across a cooperating group of member councils. In this model each council continues to operate their own weeds unit. Coordination of field activities would be provided by a regional chief weeds officer (RCWO). This officer would be employed either by one of the member councils or by the Regional Organisation of Councils and the salary of the officer would be paid by contributions from the member councils. To be effective, the RCWO would be appointed as an inspector by all member councils and would have an agreed level of authority to direct the weeds staff of each member council.

Oversight of the RCWO would be provided by a committee of senior staff from the member councils. The inspectors and operational staff of each council would normally remain in their own council area. However, to create the flexibility to deal with major outbreaks of high priority weeds, the weeds inspectors of all member councils would be appointed as inspectors under the Act by each of the member.

Advantages

- Economical
- Efficient
- Easy to establish

Disadvantages

- The level of authority of the RCWO would need to be very clearly expressed in the statement of duties for the position, in order to reduce the opportunity for dispute between the RCWO and council managements or weeds staff.
- The oversight committee would need to meet frequently to ensure the RCWO was adhering to an agreed program.
- Conflicts can occur between priority of weeds issues as against priorities of the individual councils.

- **Larger County Councils**

Most existing county councils have between three and five constituent councils. To improve economies of scale, county councils could be expanded to between eight and ten constituents.

Advantages

- Would enable better sized regions to come under the management of one organisation rather than just parts of regions.
- Far more economical than county councils half this size particularly if overheads auspiced by one council such as the Mid North Weight of Loads Group.

Disadvantages

- Rejected by councils during the consultation phase of the NSW Weed Strategy.
- May not significantly improve economies of scale as a number of fixed costs will still remain.

Transfer Noxious Weed Management to Rural Lands Protection Boards (RLPBs)

Amend the Noxious Weeds Act to make RLPBs the local control authorities for the purposes of the Act.

Advantages

- Eliminate duplication of noxious weeds and noxious animal inspections.
- RLPBs are similar in size to many weeds county councils.

Disadvantages

- Environmental issues may receive less attention that needed.
- RLPBs are not active in the western division and not present at all in metropolitan areas.
- Would require legislative amendment.
- Councils would still need a noxious weeds budget to control weeds on council land.
- Many RLPBs are not yet corporatised and weed management programs could be ad hoc and reactive.

- RLPBs would need to increase their rates to have sufficient funds to match the noxious weeds grant.
- Administration costs are still duplicated.

- **Transfer Weed Control Coordination to NSW Agriculture**

  Amend the Noxious Weeds Act to make NSW Agriculture responsible for the private property inspection and regulation functions under the Act.

  Advantages
- Regulatory decisions would not be clouded in local or personality issues.
- State-wide weed management programs would be easier to implement.
- Any downtime by existing NSW Agriculture regulatory officers could be absorbed into weed control coordination activities.

  Disadvantages
- The NSW Agriculture Regulatory Officer Agreement offers higher salaries than does local government.
- The noxious weed grant is an annual grant. The NSW Treasury would need to convert it into a recurrent grant, which would be most unlikely.
- Would require legislative amendment.
- Currently, the cost of employing weeds inspectors is borne by local government with support from the noxious weeds grant. The current allocation from the noxious weed grant supports the employment of 133 full time equivalent (FTE) weeds inspectors because councils continue to absorb cost increases as rate pegging allowance provides limited increases in income.
- The full cost of employing a permanent inspector by NSW Agriculture is approximately $110,000 per FTE officer. This means that the same amount of state government funds that currently supports the employment of 133 inspectors by local government would only pay for the employment of 36 FTE inspectors by NSW Agriculture.

CONCLUSION

This paper has proposed several models for cooperative arrangements between councils to implement noxious weed management. It should be seen as a starting point for discussion between councils that are not members of a cooperative arrangement for noxious weed management and for county councils searching for a more cost effective management model.

No management structure is sacrosanct. The management structure must serve the core business of the organisation. If the reverse is the case, the organisation will surely fail.

ACKNOWLEDGMENTS

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Mr John Rutledge, formerly, General Manager, New England Weeds Authority, Armidale

Mr Peter Gray, Noxious Plants Advisory Officer, NSW Agriculture, Dubbo

Mr Syd Lisle, State Weed Control Coordinator, NSW Agriculture, Orange


DAILY PLANET
DEPT. OF AGRICULTURE HOLDS FIRM IN WAR AGAINST WEEDS. THE MINIONS
THE LAST REBORN
DEPARTMENT OF AGRICULTURE

The Conservation and Land Management (CLM) Training Package and the Cooperative Research Centre for Australian Weed Management (Weeds CRC) – supporting weed management across Australia.

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Summary

The availability of the new nationally accredited Conservation and Land Management (CLM) Training Package has enabled recognition of the skills and knowledge required for competent weed management. Additionally the national recognition of CLM qualifications means that those who achieve a certificate or diploma specialising in weed management can work in other States and be recognised for the training and skills that they have acquired. Prior to the endorsement of the CLM training package, this national recognition was not available. In many instances there is a multitude of weed management training resources already available for various industries or within organisations. However during the development and endorsement of the CLM training package, gaps or inadequacies in training resources have been identified. The Cooperative Research Centre for Australian Weed Management (Weeds CRC) has recognised this need for resources and through its Education Program, has committed to working with training organisations to develop a variety of current and appropriate materials to support the delivery of CLM units in weed management.

What do the National Competencies mean to weed management professionals?

Presentations at previous Australian weed symposia and conferences (Carter ***et*** *al.* 2000, Kidd 2001, Carter ***et*** *al.* 2002, Kidd ***et*** *al.* 2002) have highlighted the relevance to weed management professionals of the new national competencies in weed management. The authors of these papers have also commented on the important roles played by the National Weeds Strategy and various weed management professionals in helping to establish a nationally recognised level of weed management training. The national competencies that have been developed and that are now part of the CLM Training Package set benchmarks for weed management qualifications.

Obtaining nationally recognised qualifications in weed management or including weed management units as part of other land management qualifications, agriculture or horticulture training, allows portability and recognition of training between States for weed management professionals and land managers. It allows the development of training programs for employees and contractors and enables traineeships in weed management to be undertaken with training assistance accessed through apprenticeship or trainee schemes. In New South Wales, a number of council weeds officers have taken up the opportunity to have their skills and knowledge formally recognised and completed certificates or diplomas in weed management.

Where do existing qualifications fit into the National Competency Standards and qualifications?

Currently, weed management training at the certificate or diploma level can be undertaken through various Registered Training Organisations (RTOs). However, previous training or experience in weed management can be recognised through the gathering of evidence to allow the conferring of CLM qualifications via skills recognition. Hence prior training or experience can be formally accredited and contribute to a nationally recognised qualification.

The weeds officers from NSW who recently completed their certificates or diplomas in weed management obtained their qualifications through a combination of training and what has been previously known as 'recognised prior learning' or RPL. RPL (or previous experience and/or qualifications) is now known as Skills Recognition. By using Skills Recognition a candidate is able to provide documented evidence to their assessors who then in turn determine whether the candidate has met the required criteria for the various weed management units and what further evidence or training is still required.

What specific weed management training will be offered in the CLM package?

There are a number of units available in the CLM package that will improve the skills and knowledge of land managers. These are offered at various levels (from Certificate II through to the Diploma or Level V units). Examples of available units are listed below:

Level 2	Level 3
RTD2004A Collect, prepare and preserve plant specimens RTD2312A Inspect machinery for plant and animal and soil material RTD2313A Clean machinery of plant, animal and soil material RTC2401A Treat Weeds	RTC3401A Control Weeds RTD 3405A Monitor and evaluate the local pest management action plan RTC3704A Prepare and apply chemicals RTD3076A Maintain biological cultures RRD3707A Release biological agents
Level 4	**Level 5**
RTD4402A Define the pest problem in a local area RTD4403A Develop a pest management action plan for a local area RTD4404A Develop monitoring procedures for the local pest management strategy RTD4405A Coordinate the local pest management strategy RTD4406A Implement pest management action plans RTD4407A Investigate a reported pest treatment failure	RTD5401A Define the pest problem in a regional or broader context RTD5402A Develop a strategy for the management of target pests RTD5403A Develop a system for monitoring the pest management strategy RTD5404A Coordinate the pest management strategy in a regional or broader context RTD5405A Evaluate the pest management strategy RTD5512A Manage the implementation of pest control legislation

The selection of units for the various levels of CLM accreditation is relatively flexible. Units can be chosen from within the CLM and/or other Training Packages.

Which Registered Training Organisations can provide the CLM training?

Generally, the RTOs that are able to provide training in CLM are listed on the National Training Information Service (NTIS) website. By accessing this website (**www.ntis.gov.au**) a search can be made for providers of the CLM training package. At the time of compiling this paper, 55 RTOs from across Australia were listed on this site.

For specific CLM weed management qualifications, it is essential that the RTO which is contacted be asked about their current weed management resources and training. There are RTOs in each State which have an excellent track record in weed management training. A number of these RTOs are now working with the Weeds CRC to develop appropriate resource materials for the various CLM units that are relevant to weed management.

What is the Weeds CRC and how is it assisting the Vocational Education and Training Sector?

The Cooperative Research Centre for Australian Weed Management (Weeds CRC) is an extensive network of weed research, extension, education and management experts within Australia. It is a federally funded initiative that has six core partners and eleven supporting participants. It is committed to enhancing the sustainability of farming systems and the conservation status of natural ecosystems across Australia through improved weed management.

There are five programs within the Weeds CRC (more information on these programs can be found on the Weeds CRC website **www.weeds.crc.org.au**). One of these programs (Program 5) focuses on education. The Education Program in the Weeds CRC is 'committed to adding value to current weed training, developing new initiatives and improving the skills of weed managers.' The program has a number of key tasks that are targeting the tertiary, vocational education and training (VET) and school sectors.

Task 5.2.1 aims to develop and deliver curricula resources to the VET sector. This task is lead by Birgitte Verbeek (NSW Agriculture, Wagga Wagga) and is currently sourcing, preparing and delivering **a** range of resources needed by the VET sector for competency based training in weed related areas. The Weeds CRC has funded an education officer to help deliver this task. The education officer for the VET sector, Annabel Bowcher, is located at NSW Agriculture's Wagga Wagga Agricultural Institute. Her role is to work with the RTOs that provide weed management training and develop resources that will contribute to quality training in the area of weed management.

Resources include various forms of education materials (eg regional case studies, assessment tasks, exercises etc), information on best management practice and any other materials that may be requested by RTOs. At present, resources relevant to farming systems and natural ecosystems have been developed. These resources relate to subjects such as biological control, inspecting and cleaning machinery, herbicide resistance and integrated weed management.

It is hoped that many of the people involved in weed management throughout Australia will be able to contribute to the development of new and relevant resources. Many of the resources being produced for the VET sector will also be applicable to community groups such as Landcare and Bushcare. Most resources will be available free of charge via the constantly updated Weeds CRC website that is located at **www.weeds.crc.org.au.**

How can obtaining nationally recognised qualifications in weed management be encouraged?

Now that the framework has been put into place for nationally recognised weed management qualifications and there are RTOs providing the training, there is a need to encourage organisations and agencies involved in weed management, weed management professionals and other land managers to participate in the training. Those in relevant industry positions, government agencies and organisations that deal with Australia's $4 billion dollar weed problem, should investigate the training that is available to themselves and other staff members. Employers should realise the importance of investing in well trained and formally accredited staff. Relevant training is an investment for both the futures of the individual and the workplace.

The Weeds CRC takes the subject of education extremely seriously and will continue to strive to improve the skills and knowledge of industry and the community with respect to weed management. The endorsement and availability of the CLM training package should be viewed as an important step for improving weed management across Australia. Employers and employees involved in all forms of land management (eg agriculture, horticulture, councils, national parks, forestry, transport, public utilities etc.), weed management professionals and volunteer land managers are encouraged to take up the challenge and enhance their own or their employees skills and knowledge through CLM training. Those who seek to become nationally accredited in weed management will ultimately be making a vital contribution to weed management across Australia.

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WEED MAPPING

Two weeds officers working independently to find and acquire a reliable, reasonably priced GPS based data collection and mapping system for our Shires.

Rob did most of the original research which showed existing systems were over priced, over optioned, complicated and intimidating to users. Pricing for most of these systems were beyond the budgets of weeds departments. On top of the initial cost, annual runtime licenses and satellite differential charges put these systems beyond reach.

For ourselves and the market in general what we wanted was not readily available.

Demonstrations of available systems revealed that they were capable of complicated and extensive engineering and demographic type uses but did not address the basic requirements of weeds officers and their employers.

While reading a Landcare magazine Geoff Portbury found that a Ballarat company Osprey Computing, had developed a program specifically for a Landcare group to meet their GPS mapping, image recording and reporting needs. After receiving enthusiastic feedback from the Landcare Group using the system, Geoff then field tested the program.

After a short period of use the program was found to meet most of the requirements of those weeds officers who had expressed an interest. These being:

1. Affordable, costing approximately $1300 including GPS receiver, cables and software.
2. User friendly.
3. Minimal ongoing costs for developer support and updates.
4. Ongoing product development.

To test the programs suitability to our own and the Regions requirements, three well attended show and tell come training days were held across the Eastern and Western Riverina Region.

Benefits arising from these training days were to upgrade the skills of those participating regardless of their level of expertise in the use of this type of equipment. Further it demonstrated that GPS based mapping has a genuine place in the Noxious Weed control industry.

All participants came away believing that the training days were a worthwhile exercise. To date six Shires and one County Council have taken up the program with more under consideration.

The Streets Ahead program is successful in its simplicity, low cost and its potential ability to do what is required by councils and the Department of Agriculture for reporting and recording noxious weed infestations. Operators with little computer or technical knowledge can manipulate the program easily.

From our point of view as Weeds Officers in the field we believe programs of this type will provide a worthwhile, every day useful tool, for those working in the weeds area. The acquisition of a GPS/GIS mapping system has become almost secondary compared to the benefit we have received from the research and learning undertaken to progress this far.

It has proved to us that any idea can be brought to fruition by ground level troops and do not necessarily have to come from above.

Authors: Robert Ferguson holds a contract with Temora Shire Council to provide the services of: Weeds Inspector, Weed control operations both noxious and general, RTA required road verge weed control, and all associated reporting, recording and community awareness duties. In current position for five years. Ex farmer, five years broad acre spraying contractor. In addition to weeds contracts Robert owns and manages a Canola Windrowing business and delivers Smart Train level three & four courses on a part time basis through Murrumbidgee College of Agriculture.

Geoff Portbury's original career was in the steel fabrication industry based in Melbourne. Moved to Jerilderie in 1981 and was self employed in a steel fabrication partnership for nearly 10 years. Began weed control work with Jerilderie Shire in 1990, became an inspector in 1995, then took control of the Shire's Noxious Weeds unit in October 2001 on the senior weeds inspectors retirement.

Geoff prepares all noxious weed grant applications and reports, carries out control work and is responsible for all inspectorial work within the shire.

Geoff is the manager of the Council's store sheep saleyards, controlling the six sales of the year and all required maintenance and organisation. He is also the Shire ranger responsible for stock control within the Shire.

ALLIGATOR WEED MANAGEMENT

What is Alligator Weed

Alligator Weed is described as an aquatic plant, but it can, and does, grow well as a terrestrial plant. The aquatic form can float freely in water, anchor in the bank and the bed of streams or channels, and spread out both across the water and onto land from there, or fragments deposited on land from various sources can grow roots and spread.

In water, Alligator Weed generally grows as long, spreading stems which extend to form a dense mat over the water surface. The stems are hollow, a distinguishing feature of the plant, and this gives them buoyancy. Roots trail from nodes along the stems into the water to gather nutrients, or delve into the sediment in shallow water and along the bank.

In terrestrial populations, the form can change to become a completely different looking plant. The stems' hollowness is reduced to pinpoint size, and the stems become tougher but not woody. The roots change from long white fibrous strands to thick knotted reddish-brown roots.

Alligator Weed leaves occur in opposite pairs, are a bright green, and "spear-shaped". The small white ball-shaped papery flower has a short stalk and appears either in the leaf apex or terminally on the stem.

Method of Spread

It is important to note Alligator Weed only spreads by vegetative means in Australia – it does not produce viable seed here.
This means that all populations are the result of either downstream flow of weed pieces or human or animal intervention (movement of viable fragments).

A viable fragment is any small section of stem containing a node from which roots can grow, in much the same way wandering jew or many succulents can spread.
Dispersal mechanisms so far recorded include:

- Fragments breaking off after physical disturbance or herbicide application, floating to a new location and rooting,
- Green waste mulch containing Alligator Weed spread on cycle paths or garden beds,
- Contaminated machinery (eg slashers, mowers, bulldozers, cars, trailers) moving from one site to another with weed fragments in the machine,
- Bits caught on boat propellers or other parts of recreational water craft,
- In the hooves of cattle grazing or drinking where Alligator Weed grows,
- Possibly by ducks using the weed for nesting material,
- Earthmoving activity in Alligator Weed areas,
- Root fragments in fill material.

Whilst these may seem obvious and preventable weed spread events, so long as there is widespread ignorance of the weed, its importance and its ease of spread, such occurrences will unfortunately continue.

Why is it **a** weed?

Alligator Weed, like most weeds, has the ability to grow prolifically and overrun other vegetation. This causes it to pose a threat to ecosystem health and value, interfere with production and usage of land and water, and potentially cause significant damage to infrastructure.
In addition, it is proving very very hard to get rid of. In fact, there are few places where Alligator Weed has been found where it has been successfully eliminated. Millions have been spent both here and in America to reduce the problem.

An example. Last **year** I **found** a happily spreading **infestation** of Alligator Weed in an overflow swale offshooting **from** a flood-filled lagoon. The swale had filled during a flush in the river which had deposited fragments of the weed in the **wet** sediment. These had **promptly** sprouted as a terrestrial mat, with the roots probing into the wet sand. The summer of 2002103 was a drought year. There was absolutely no rain for several months and I visited the area to see what was there. The swale at first appeared empty. Then I noticed a pair of little green leaves. I dug into the bone dry sand. The leaves were attached to a reddish knotted root. With no water, the weed was still alive and growing.

This ability of Alligator Weed to grow vigorously in many situations means that it is not just waterways and wetlands that are at risk.

Alligator Weed has virtually wiped out the turf industry in the Hunter, has been shown to have detrimental effects on some grazing cattle, has been found in vegetable crops and has overrun large areas of lowlying previously productive land. In the Hawkesbury, the lowlands are famous for agricultural production, with the turf industry alone **worth** an **estimated** $35million per annum(Attwater 2002). If Alligator Weed became **established** on a turf **or** vegetable farm **here,** it would be disastrous. New housing estates, construction **and** earthmoving sites, **cycleways,** public gardens and golf courses, drainage lines, culverts, farm dams and **urban backyards have** all been affected in different areas.

Herbicides

What can you do with an aquatic plant that can live without water?

Spray it?

Unfortunately, Alligator Weed appears to have an inbuilt mechanism for thwarting herbicide control.

If actively growing in water, the leaves above the water can be sprayed with a suitable 360g a.i/L glyphosate product such as Roundup biactive®™ and will die. However, the leaves, stems and roots below the surface survive, and as the dead fragments develop an abscission layer and drop off, small viable sections are still able to **sprout** if that fragment deposits in a suitable place. Which is almost anywhere!!. The remaining plant regrows.

Diclobenil has been used in non-potable water but the registrations have changed. Some generic brands may still be able to be used in water.

Metsulfuron-methyl is also the main chemical registered for land-based Alligator Weed. Any treatment needs to be repeated at least three times in a season and preferably checked each year for five years.

Port Stephens Council and Maitland City council have limited use permits to use metsulfuron methyl in non-potable water. Camden Council also has a permit for metsulfuron methyl, but only on terrestrial plants. In the past, restricted permits have been issued for metsulfuron methyl and diclobenil for use on Alligator Weed in the Byron and Wilson creeks, but these have expired.

NSW Agriculture is carrying out some herbicide trials which are searching for more effective treatments, and these will be discussed later.

OTHER METHODS OF ATTACK

Physical removal

Small infestations may be physically removed by digging out all sections of the plant. This is difficult to ensure, particularly where it is growing amongst rocks or tree roots or in wet sediments as the root system can be very extensive. The recommendation is digging out all material to a depth of over a metre, and all material thus removed be disposed of by deep burial. A permit from NSW Agriculture is required to carry out any removal or transportation of Alligator Weed. Again, follow-up is advised.

Weed harvesters

Physical removal of aquatic mats has been attempted using a weed harvesting machine, with some success. It is clear that weed harvesting is only a means to gather the majority of the biomass, and other methods are needed to clean up the rest of the weed material either anchored in the bank or fragments broken off. Hawkesbury River County Council removed nearly 140 tonnes of weed biomass from the Hawkesbury River in a trial in 2001. Of this, 18 kgs was fragments broken away from the main mat by the harvester, and collected by hand from small boats. The weed material removed was stockpiled on dry land and sprayed whenever green shoots appeared. Disposal of harvested material will be an issue if weed harvesting is to be employed for Alligator Weed control. At this stage there are limitations on the suitability of current weed harvesting models – they are generally designed as multi-purpose vehicles, and many of the logistics are yet to be satisfactorily resolved.

Booms and Screens

There are situations where prevention of further spread of Alligator Weed has been achieved by using booms. This can only occur in relatively contained areas, where the booms can be in place without disrupting use of the waterbody, and are not likely to be damaged by rough waters, excessive wind, floods or traffic. The Hunter Alligator Weed Task Force has investigated the value of using booms with skirts to contain a small Alligator Weed population after herbicide application. As mentioned earlier, herbicide application tends to cause an abscission layer to develop, and fragments of the weed can break off and drift downstream with the possibility of re-establishing elsewhere. Booms were trialled around a treated Alligator Weed infestation to see if these fragments could be contained and collected. Maitland and Port Stephens Councils are the contacts for this work.

Screens have so far been of limited benefit, although the concept has received only slight attention. In cases where Alligator Weed may spread through drain pipes or small channels, it was envisaged screens would prevent this, but again logistics and interference have rendered them ineffective.

Screens would need to act in a similar fashion to a gross pollutant trap, and be regularly maintained to have any foreseeable benefit.

Biological Control

In general terms, biological control offers the best possibility for effective, long term, affordable management of Alligator Weed, if suitable agents can be found, successfully reared and gain a good foothold.

To date there have been three insects released in Australia for Alligator Weed. Only one of these has had any real success, but a second may be in line for further investigation.
The most significant and successful creature is the *Agasicles hygrophila* or Alligator Weed flea beetle. Both the adult and larval stages feed on aquatic Alligator Weed, the grubs pupating within the hollow stems and chewing their way out, and both the grubs and the adults eating the leaves.

Some spectacular results have been achieved with the flea beetle, but they do not provide reliable, predictable or complete control. They have been more effective in warmer areas, but not very consistent in the Hawkesbury system. They do not feed on terrestrial forms of the weed.

Currently there is a hiatus in research into Biological control, awaiting further funding. A first year of study was carried out in Argentina, Uruguay, Paraguay and Brazil, the weed's home range, looking for more possible agents to develop a short list of candidates to bring to Australia for host specificity studies. There are a number of promising organisms, but more research is needed. Hopefully an application to continue this work will be successful.

The study carried out in Argentina did discover some more features of Alligator weed, including the possibility there may be two different biotypes, one of which successfully produces viable seed. To date this has not occurred in Australia, thank goodness. A range of organisms has been identified, but a lot more study is required to determine their taxonomy, biology, rearing methods, host ranges and potential impact on the weed. Two insects are recommended at this stage for further study in Australia: *Amynothrips andersoni* and another flea beetle, *Disonycha argentinensis.*

Mycoherbicides

A mycoherbicide is the development of a fungal pathogen into a control agent. Studies are currently being undertaken to discover if there are potential fungal pathogens on Alligator Weed. Research in Florida and Brazil suggests a fungus *Nymbia* may prove useful but this has not to date been discovered on Alligator Weed here. Two other organisms, a *Fusarium* and a *Colletotrichum* have been found on Alligator Weed in the Sydney Basin recently, and studies will continue on these.

This work is being done by Bertie Hennecke from the University of Western Sydney, Hawkesbury, and Ross Gilbert and Bruce Auld from NSW Agriculture.

Conclusion

The brief overview above serves to illustrate the difficulties faced in the management of Alligator Weed in Australia. We have limited effective options, limited budgets and manpower, and a weed that seems to be successfully spreading and outwitting our efforts. Education and awareness are essential tools to prevent inadvertent spread. We await further funding to finance low cost solutions including new biological control agents, better herbicides and integrated management regimes.

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About the author

Rebecca Coventry has been working in various weed management positions for NSW Agriculture for nearly 3 years, including Executive Officer for the Hawkesbury Nepean Aquatic Weeds Task Force and Sydney Basin Aquatic Weeds project officer. Prior to that she worked as Natural Resources Officer for the Hawkesbury-Nepean Catchment Management Trust, as South Creek CMC Coordinator, and as Salt Action Education Officer for NSW Agriculture in Deniliquin.

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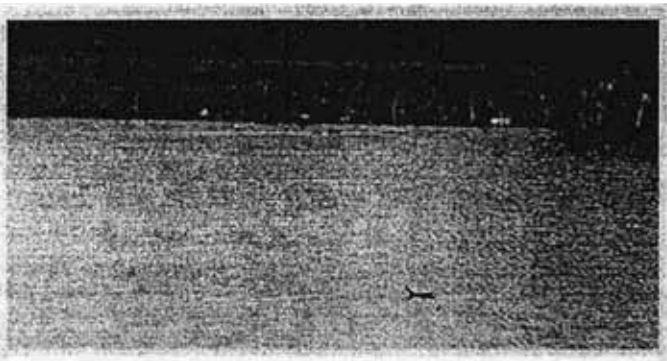
Harvester Specifications-

- Cuts to 6 metres deep by 2.4 metres wide
- Turns in it's own length
- Collects 96%of cut material
- Collects and compacts product in a 1cubic metre bag
- Will operate in 0.8 metres of water
- This system of harvesting assists in aeration of water
- Pumping system is self priming
- Ten inch pump allows for large debris to pass through it

Salvinia prior to commencement



Same Pond, 8 days later after removing 40 tonnes of Salvinia

Small trailer with crane used to remove product from bank

Low profile trailer with it's own ramps which creates easy access to most ponds and lakes

Provisional Patent Application Number 20023007683

EMERGING WEED THREATS TO IRRIGATION IN VICTORIA

Jim Wilding and Roger Baker, Goulburn – Murray Water

Senegal Tea Plant - *Gymnocornonis spilanthoides*

Origins and distribution

Senegal tea is a native of Central and South America. It was first imported into NSW from India as an aquarium plant in the 1970s and has since become naturalised in all Eastern states. In Victoria it was first found in a 2 km strip along a backwater off the Goulburn River at Nagambie in December 2000.

Within two months of this discovery a further two sites were found at Harcourt and Carrum. It is unknown how the first two sites were originally infested but the farmers dam at Carrum was from a suite of aquatic plants supplied by a now out of business nursery. It is very likely that there are many more, undiscovered naturalised sites, growing in Victoria.

Impacts

Senegal tea has a very rapid growth rate of up to 15 cm per week often becoming a tangled mass which smothers native vegetation, restricts access to the water and decreases water flow. The infestation at Lake Nagambie threatens the Goulburn River and has a potential to spread to the River Murray and the irrigation systems of Northern Victoria.

Legislation

Senegal Tea is a declared noxious weed in all states except for Victoria and the Northern Territory.

Reproduction and Dispersal

The main method of dispersal is through the aquarium and ornamental pond trade. Once established it can spread by seed or broken stem fragments as well as by animals, vehicles, boats and construction equipment. It is possibly spread by the poor practice of emptying fish tanks into natural water bodies.

The plants are dormant during winter with seed germinating during spring and summer. The stems begin erect but eventually collapse with new roots developing from the stem nodes (the joint on the stem where the leaf begins). Fragments produce new shoots and roots very soon after separating from the mother plant.

The plants normally occur on the margin of water bodies where they spread outward into the water often becoming a floating mat.

Control

Recommendations from publications include :

- Raking from water and spreading thinly to dry in the sun. Repeating as required.
- Handpulling of small isolated infestations ensuring all parts of the plant are removed and incinerated.
  Handpulling and placing in a sealed plastic bag and left in the sunlight to rot and then disposed of in a land fill tip.

There are no herbicides registered for the control of Senegal tea in Victoria. The National Registration Authority has approved the minor use of Roundup Biactive to control Senegal tea in Queensland.

Parrots feather - *Myriophyllum aquaticum*

Origin and Distribution

Parrots feather is a perennial aquatic or semi-aquatic native to the Amazon River in South America. It has become naturalised in warmer climates world wide. The plant was first recorded in Australia in the 1960s after being introduced as an aquarium and pond plant. In irrigation areas in Victoria it has historically been confined to Lake Nagambie. It has recently been found in a drain at Merrigum and the National channel near Gunbower, at Campbells Ck and at Gisbourne.

Impacts

Parrots feather's long trailing submersed stems often impede water flow. It is becoming a major weed in irrigation supply and drainage channels, lakes and water storages in Victoria. Goulburn –Murray Water wants to control this plant before it becomes established throughout the irrigation supply system. To achieve this goal we need to know the location of any infestations in Victoria.

Legislation

Parrots feather is a declared noxious weed in Western Australia and Tasmania. In Victoria it can be freely grown and sold.

Reproduction and Dispersal

The main method of dispersal is through the aquarium and ornamental pond trade. In naturalised situations broken stem fragments as small as 2 mm in length are the usual method of dispersal. There are only female plants in Australia so seeding is does not occur.

Habitat

The plant will survive in both static and flowing water. It grows in mud and gravel, as well as around submersed stumps and other aquatic plants. It is most successful when established in shallow water but it will survive as a free floating plant in deep water. The plant is well adapted to moderate water level fluctuations, with emergent stems capable of surviving on dried earth for months during summer.

Control

Parrots feather spreads by stem fragments therefore mechanical removal is not recommended. Herbicides have been used with little success.

Arrowhead - *Sagittaria graminea*

Origin and Dispersal

Arrowhead is a native of the southern part of North America. It was first reported in Brisbane in 1959. It is believed to have been introduced as an ornamental plant to Victoria in the late 1960s.

At present there are major infestations in G-MW four eastern irrigation areas and there have been reports of minor infestations in the remaining two irrigation districts. It is the most abundant plant for many sections of the Murray River.

Description

Arrowhead is an emergent, erect plant, up to one metre high when mature. It grows in a number of forms. The most recognisable form has lance shaped or arrow shaped leaves (thus the name) which are a distinctive green colour. The next most prominent form has long, narrow, strap like leaves. These are often more yellow in colour and can grow adjacent to or separate from the lance-shaped plants. The other form grows underwater with strap-like, but much shorter leaves, which grow in a rosette arrangement up to 50 cm long.

Impacts

Arrowhead is an aquatic plant which is becoming an increasingly serious problem in irrigation areas. It spreads rapidly, blocks channels and greatly reduces the effectiveness of the water distribution system.

Legislation

It is a declared noxious .weed in Western Australia, South Australia and Tasmania.

Reproduction and Dispersal

Arrowhead spreads rapidly due to its many means of reproduction. Not only does arrowhead reproduce by the germination of seeds, it also has several methods of vegetative reproduction available to it. The plant has corms which when detached from the plant become a new individual plant. Other localised spreading occurs from underground rhizomes.

Habitat

Arrowhead is found along river and creek banks, lagoons, irrigation channels and drains, dams etc generally in water depths less than one metre.

Control

Due to the many methods of reproduction and the several growth forms of the plant control is elusive. Mechanical control will spread the plant and effective control with herbicides is unpredictable and often gives only suppression.

The authors have been involved in the research and management of aquatic weeds since the 1980s. Much of their time has been spent on the innovative use of acrolein to control submersed aquatic plants in irrigation and drainage systems and the control of difficult to kill emersed plants.

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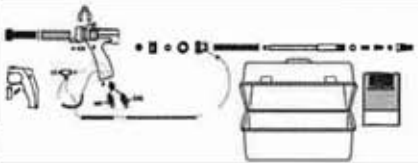

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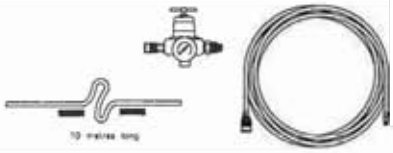

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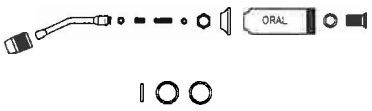

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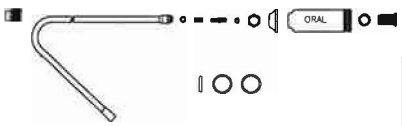

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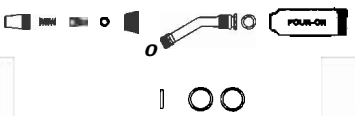

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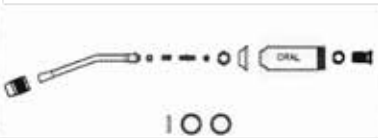

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NOXIOUS WEED CONTROL AND THE NATIVE VEGETATION CONSERVATION ACT 1997[1]

by Stephen Gowlland[2]

Information contained in this paper is correct at the time of writing (May 2003). However the review of the *Native Vegetation Conservation Act 1997,* potential revision of the exemptions and the gazettal of Regional Vegetation Management Plans in some regions of New South Wales may cause changes to the controls over clearing of vegetation. Contact the Department of Sustainable Natural Resources for up-to-date information.

Introduction

The introduction of the *Native Vegetation Conservation Act 1997* (NVC Act)[3] was not intended to become an impediment to the control of noxious weeds. Noxious weeds can pose a threat to the integrity of native vegetation communities, and should be controlled. Noxious weeds rarely proliferate in undisturbed native bushland but can become serious problems in degraded areas or where major land use change has occurred.

The NSW Department of Sustainable Natural Resources (DSNR) [formerly the Department of Land and Water Conservation] supports the control of noxious weeds in a way that is consistent with the Department's statutory responsibility to conserve native vegetation in the social, economic and environmental interests of the State.

Noxious weeds vs native vegetation

Noxious weeds (and other 'environmental' weeds) are one of the major causes of environmental degradation in NSW. They can prevent the regeneration of native plant species, ultimately displacing a native vegetation community. This displacement can result in loss of habitat for native animal species and can even lead to the local extinction of these species.

Once weeds have invaded an area, the whole structure of the vegetation can change. Commonly, fuel loads can increase, changing the area's fire regime. Some species can shade out ground cover, leading to accelerated rates of soil erosion. Weed invasion can also lead to changes in water flow, rates of runoff and nutrient cycling.

Vegetation reform in NSW

To combat the potential loss of vast areas of native vegetation, the NSW Government began a reform of native vegetation management in August 1995, with the introduction of *State Environment Planning Policy No 46 – Protection and Management of Native Vegetation* (SEPP46). Following community consultation, the *Native Vegetation Conservation Act 1997* was introduced in January 1998.

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[1] This paper has been compiled from literature published by DSNR and other public documents.

[2] Stephen Gowlland is the Hunter Region Vegetation Coordinator with the Department of Sustainable Natural Resources of NSW.

[3] Extracts from the NVC Act and other Acts are shown in shaded boxes throughout this paper.

Objectives of the NVC Act

The objectives of the NVC Act are listed in Section 3 of the NVC Act. Clearing controls through the application process are targeted to meet objectives (a), (c) and (f), while permitting development that is of an ecologically sustainable nature.

3 Objects of Act

The objects of this Act are:

(a) to provide for the conservation and management of native vegetation on a regional basis, and

(b) to encourage and promote native vegetation management in the social, economic and environmental interests of the State, and

(c) to protect native vegetation of high conservation value, and

(d) to improve the condition of existing native vegetation, and

(e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation, and

(f) to prevent the inappropriate clearing of vegetation, and

(g) to promote the significance of native vegetation,

in accordance with the principles of ecologically sustainable development.

What is clearing?

Clearing is defined in Section 5 of the NVC Act. The definition is very broad and includes many activities that are not immediately perceived by the public as 'clearing', such as logging, lopping or substantially damaging vegetation.

5 efinitio learing"

(1) In this Act, ***clearing*** native vegetation means any one or more of the following:

(a) cutting down, felling, thinning, logging or removing native vegetation,

(b) killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation,

(c) severing, topping or lopping branches, limbs, stems or trunks of native vegetation,

(d) substantially damaging or injuring native vegetation in any other way.

(2) In this Act, ***clearing*** protected land means any one or more of the following:

(a) cutting down, felling, thinning, logging or removing any vegetation on protected land,

(b) killing, destroying, poisoning, ringbarking, uprooting or burning any vegetation on protected land,

(c) severing, topping or lopping branches. limbs. stems or trunks of any vegetation on protected land,

(d) substantially damaging or injuring any vegetation on protected land in any other way.

(3) For the purposes of subsection (2), ***vegetation on protected land*** means:

(a) any native vegetation on the protected land, and

(b) any tree on the protected land (regardless of whether it is dead or alive, standing or fallen, or whether it is indigenous),

but does not include any type of non-indigenous vegetative groundcover.

(4) For the purposes of this Act, ***clearing*** native vegetation, or ***clearing*** protected land, does not include sustainable grazing. Sustainable grazing is the level of grazing that, in the opinion of the Director-General [DSNR], the vegetation concerned is capable of supporting without resulting in a substantial long-term modification of the structure and composition of the vegetation.

(5) For the purposes of this Act, the clearing of land by burning during a bush fire within the meaning of the *Rural Fires Act 1997* does not affect any requirement of this Act with respect to any subsequent clearing of the land (whether by burning or otherwise).

What is native vegetation?

Native vegetation is defined in Section 6 of the NVC Act. Note that native vegetation includes all strata levels of a vegetation community including groundcover, but does not include marine vegetation.

6 Definition of "native vegetation"

(1) In this Act, ***native vegetation*** means any of the following types of indigenous vegetation:
- (a) trees,
- (b) understorey plants,
- (c) groundcover,
- (d) plants occurring in a wetland.

(2) For the purposes of this definition, ***groundcover*** means any type of herbaceous vegetation, but it is only to be regarded as native vegetation for the purposes of this Act if it occurs in an area where not less than 50% of the herbaceous vegetation covering the area comprises indigenous species. In determining that percentage, not less than 10% of the area concerned must be covered with herbaceous vegetation (whether dead or alive).

Note. Sub:section (2) takes into account seasonal impacts (such as drought) in determining the amount and type of groundcover occurring in an area.

(3) For the purposes of this Act, ***native vegetation*** does not include any mangroves, seagrasses or any other type of marine vegetation within the meaning of the *Fisheries Management Act 1994.*

State protected land

State protected land is defined in Section 7 of the NVC Act.

7 State protected land

(1) The Minister may, by order published in the Gazette, identify:
- (a) any land the surface of which generally has a slope greater than 18 degrees from the horizontal, or
- (b) any land that is situated within, or within 20 metres of, the bed or bank of any part of a river or lake specified in the order, or
- (c) any land that is, in the opinion of the Minister, environmentally sensitive or affected or liable to be affected by soil erosion, siltation or land degradation,

as State protected land for the purposes of this Act.

(2) Any such order must identify the land concerned in such a manner as the Minister thinks appropriate (whether by the use of a map, land description, or otherwise).

(3) The Minister may, by order published in the Gazette, do any of the following things in relation to State protected land:

(a) revoke the status of the land as State protected land,

(b) alter the identification of the State protected land.

Note. *State protected land* is defined in this Act to include any land previously defined as *protected land* under the Soil Conservation Act 1938. An order under subsection (3) therefore will be able to deal with any type of State protected land even though it has not been identified by an order under subsection (1).

(4) Any land that is State protected land ceases to be State protected land if:

(a) the land is identified as regional protected land in accordance with a regional vegetation management plan,

(b) the land otherwise becomes land to which a regional vegetation management plan applies.

Those familiar with State protected land generally differentiate between the three classes by reference to Section 7 subsection (1) as category "a" steep lands, category "b" riparian land and category "c" environmentally sensitive land.

Class "a" and "c" land applies to land within a prescribed catchment area and is mapped. Class "b" land is identified from a list of "prescribed" streams. State protected land maps and a list of prescribed streams can be inspected at the offices of DSNR. Similarly, regional vegetation management plans and any maps of regional protected land (where they exist) can also be viewed at the offices of DSNR.

When is clearing consent required?

The NVC Act requires all persons intending to clear vegetation on State protected land or native vegetation on any land to which the NVC Act applies, to obtain development consent, where necessary, from the Minister for Natural Resources prior to carrying out clearing.

Circumstances under which the Minister's consent may not be necessary are limited to where clearing is undertaken in accordance with exemptions, exclusions or a regional vegetation management plan (RVMP) which are provided by the NVC Act.

Minister for Natural Resources is the consent authority for clearing native vegetation

Often there is confusion over the role of local government in the granting of clearing consent. Section 14 of the NVC Act clearly specifies the Minister for Natural Resources as the consent authority for the clearing of native vegetation and the clearing of vegetation on protected land, where the land or clearing is not excluded from the operation of the NVC Act or is exempt from the need to gain clearing consent.

Further, Section 20 states that, if clearing consent is given under the NVC Act, a proponent cannot be required to gain further consent for that clearing under any other Act or planning instrument. This means that local environment plans containing tree preservation orders cannot be used to prevent clearing that is authorised under the NVC Act. However, all clearing applications are referred to the Council of the appropriate local government area. Any representations made by a Council are taken into account when assessing a clearing application.

Sections 14 and 20 of the NVC Act are reproduced below for reference.

14 Consent authority for clearing

For the purposes of the EPA Act, the Minister is the consent authority for any development application made under that Act for any clearing that requires development consent because of this Part.

Note. Section **15 of** the ***Interpretation Act 1987*** provides that a reference in any Act to "the Minister" is a reference to the Minister administering the Act.

20 Clearing not affected by other instruments or Acts

(1) If native vegetation or regional protected land is, or is about to be, cleared in accordance with:

(a) development consent as required by a regional vegetation management plan, or

(b) a regional vegetation management plan,

that clearing cannot be prohibited, restricted or otherwise affected by any other environmental planning instrument or by the provisions of any Act (other than this Act, the *Plantations and Reafforestation Act* 1999 or the EPA Act) to the extent to which that instrument, or those provisions, prohibit, restrict or otherwise affect that clearing.

(2) However, subsection (1) does not operate to exclude any requirement for:

(a) consent under section 90 of the *National Parks and Wildlife Act* 1974, or

(b) a licence under *the Protection of the Environment Operations Act* 1997,

that might arise in relation to any such clearing.

Note. Section **90** of the ***National Parks and Wildlife Act 1974*** prohibits the destruction etc of relics or Aboriginal places without the consent of the Director-General of National Parks and Wildlife.

Exclusions from the NVC Act

Clearing for the control of noxious weeds may be excluded from the operation of the NVC Act if either the land on which the clearing is to take place is listed in Section 9, or the clearing is listed in Section 12.

Section 9 of the NVC Act lists land that is excluded from the operation of the NVC Act,

9 Land excluded from the operation of Act

This Act does not apply to the following land:

(a) land that is within a zone designated "residential" (but not "rural-residential"), "village", "township", "industrial" or "business" under an environmental planning instrument,

(b) land to which *State Environment Planning Policy No* 14 – *Coastal Wetlands* applies,

(c) land to which *State Environment Planning Policy No* 26 – *Littoral Rainforests* applies,

(d) land that is a State forest, national forest, flora reserve or timber reserve under the *Forestry Act* 1916,

(e) land that is acquired under section 15 of the *Forestry Act* 1916 for the purposes of a State forest (not being any such land that is acquired for the purpose of a timber plantation within the meaning of the *Timber Plantations (Harvest Guarantee) Act 1995*),

(f) land that is dedicated or reserved under the *National Parks and Wildlife Act* 1974,

(g) land that is acquired under section 145 of the *National Parks and Wildlife Act* 1974 for the purpose of obtaining land for dedication or reservation under that Act or for the purpose of preserving, protecting and preventing damage to relics or Aboriginal places,

(h) land that is subject to a conservation agreement entered into under Division 7 of Part 4 of the *National Parks and Wildlife Act* 1974,

(i) land that is subject to an interim protection order made under Part 6A of the *National Parks and Wildlife Act* 1974,

(j) land that is subject to a conservation instrument within the meaning of the *Heritage Act* 1977,

(k) land that is critical habitat,

(l) Lord Howe Island

Section 12 of the NVC Act lists clearing that is excluded from the operation of the NVC Act. Note that subclause (c), relating to the clearing of noxious weeds authorised under the *Noxious Weeds Act* 1993 (NWA), is discussed in more detail later in this paper.

12 Clearing excluded from the operation of Act

This Act does not apply to the following types of clearing:

(a) any clearing authorised under the *State Emergency and Rescue Management Act 1989*, in relation to an emergency within the meaning of that Act,

(a1) any clearing authorised under the *Rural Fires Act* 1997 in relation to any emergency fire fighting act within the meaning of that Act,

(b) any clearing carried out in accordance with a bush fire management plan under the *Rural Fires Act 1997*,

(c) any clearing authorised under the *Noxious Weeds Act 1993*,

(d) any clearing carried out in accordance with a property management plan approved by the Director-General of National Parks and Wildlife for the purposes of the

Threatened Species Conservation Act 1995,

(e) any clearing authorised under a license issued under Division 1 of Part 6 of the *Threatened Species conservation Act* 1995,

(f) any clearing that is, or that is part of, designated development within the meaning of the EPA Act,

(g) any clearing authorised to be carried out under Division 3 or 4 of Part 7 of the *Fisheries Management Act* 1994,

(h) any clearing authorised under a license issued under Division 6 of Part 7A of the *Fisheries Management Act* 1994,

(i) any clearing carried out in accordance with a license issued under section 131 of the *National Parks and Wildlife Act* 1974,

(j) any clearing authorised under the *Mining Act* 1992,

(k) any clearing authorised under the *Petroleum (Onshore) Act* 1991,

(1) any clearing that involves the carrying out of harvesting operations on an accredited timber plantation (within the meaning of *Timber Plantations (Harvest Guarantee) Act* 1995) in accordance with a timber plantation (environment protection) harvesting code in force under that Act,

(m) any clearing that involves the removal or lopping of any tree or other vegetation in accordance with section 88 of the *Roads Act* 1993,

(n) any clearing carried out in accordance with a consent under Division 3 of Part 9 of the *Roads Act* 1993,

(o) any clearing carried our in accordance with a permit under Part 3A or me *Rivers and Foreshores Improvement Act* 1948,

(p) any clearing carried out in accordance with a license, permit or approval under the *Water Act* 1912.

Clearing authorised under the *Noxious Weeds Act 1993*

Section 12 (c) of the NVC Act excludes "clearing authorised under the ***Noxious Weeds Act 1993***" (NWA) from the operation of the NVC Act. But, what constitutes clearing that is authorised under the NWA?

The NWA enables the Minister responsible for that Act to make an order declaring a plant to be a noxious weed. The order must specify that one or more control categories (W1, W2, W3 or W4) apply to the noxious weed. Control categories W1 and W2 specify the weed must be fully suppressed and destroyed. A W3 weed must be prevented from spreading and its numbers and distribution reduced. The action specified in relation to a W4 weed varies depending upon the sub-classification of the weed from W4a to W4g, however most of these sub-classifications require some form of control of the weed.

Local weeds authorities (such as local council or county council), or the Minister responsible for the NWA, may issue a notice on a landholder requiring the carrying out of obligations to control (including in many circumstances the clearing of) noxious weeds.

It is considered that, if the NWA requires the removal of noxious weeds, then that must come within an "authorisation" and therefore the clearing of weeds that fall within the categories W1, W2 and W3 would be authorised. Clearing within weed control category W4 may be "authorised" depending on the requirements specified in the notification of the weed.

It should be noted that the authorising of the control of noxious weeds does not expressly authorise the clearing of native vegetation. However, if the clearing of a noxious weed cannot be undertaken without damage to native vegetation (or damage to any vegetation on protected land) only the collateral damage that is reasonable (and not substantial) and is necessary for the authorised clearing can be considered to be excluded from the operation of the NVC Act.

Note that proposals to control noxious weeds which involve the clearing of native vegetation (or the clearing of any vegetation on protected land) will require development consent from the Minister for Natural Resources unless the proposal falls within any other exemption or exclusion under the NVC Act, or the noxious weed cannot be reasonably and practically controlled without causing some clearing of native vegetation.

The question of what may be considered to be reasonable (and not substantial) clearing of native vegetation necessary for the clearing of noxious weeds requires the balance of such matters as the effectiveness of different weed control mechanisms in different circumstances, the practicality and cost (viability) of alternative control methods, and the actual level of damage or destruction of native vegetation.

Exemptions from the need to obtain clearing consent

Certain clearing activities are exempt from the need to obtain clearing consent under Section 2 of the NVC Act. This is not to be confused with land and clearing that is excluded from the operation of the NVC Act.

The exemptions vary depending whether the land upon which the proposed clearing is to take place is State protected land, lies within the western division of NSW or is covered by a regional vegetation management plan.

On land outside the Western Division of NSW, the 'clearing of native vegetation proclaimed as a noxious weed' is exempt from the need to obtain clearing consent on land that is not protected land. Note that this exemption only applies to the clearing of noxious weeds that are native vegetation (eg: Galvanised Burr (Sclerolaena birchii)). This exemption may not apply in areas where a regional vegetation management plan has been gazetted.

Regional vegetation management plans

Where a regional vegetation management plan (RVMP) sets up exemptions, the exemptions that apply to State protected land do not apply unless they are specifically adopted for that plan.

At present, only two RVMP's have been gazetted, namely: the Mid Lachlan Regional Vegetation Management Plan, and the Riverina Highlands Regional Vegetation Management Plan. Other RVMP's may be gazetted later this year. Public announcements will be made at the time of gazettal.

If clearing that is authorised under the NWA is excluded from the NVC Act, then it is also excluded from the operation of any RVMP that may apply. DSNR has provided advice to regional vegetation committees (RVC) that, until the uncertainty of when the exclusion of the authorised clearing of noxious weeds from the NVC Act applies can be overcome, RVC's should include an exemption for noxious weed control in any draft RVMP.

The recommended wording of that exemption is as follows:

1) The clearing of vegetation declared to be a noxious weed under the *Noxious Weeds Act 1993.*
2) The clearing of other vegetation in the course of destroying noxious weeds but only:
   (a) to the minimum extent necessary to destroy noxious weeds, and
   (b) in accordance with the Noxious Weed Control Exemptions for the XXXXX Region obtainable from the Department of Sustainable Natural Resources.

Any exemption must involve only minimal risk of environmental damage. The methods of noxious weed control approved under this exemption are those that are generally less damaging to non-target plants. A list of noxious weed control techniques that generally would cause minimal risk of damage to the environment are described in Appendix 1.

By comparison, noxious weed control using aerial spraying, broad scale-boom spraying with non-selective herbicides, ground injection, spreading herbicide granules, broad-area slashing or pushing with tractor or dozer can involve clearing of significant areas of vegetation other than the target noxious weeds.

DSNR officers can advise whether a RVMP has been gazetted for areas covered by local weeds authorities.

Application process

Clearing of noxious weeds authorised under the *Noxious Weeds Act 1993* is excluded from the operation of the NVC Act. However, if it is necessary to damage or destroy native vegetation for the control of noxious weeds, clearing consent may be required under the NVC Act. Unless any of the exclusions or exemptions removes the need for consent, development (clearing) consent must be obtained. DSNR officers can provide advice on specific proposals to clear native vegetation.

Once it has been decided that a clearing application is required, proponents should contact the DSNR to discuss the proposal, conduct an on-site inspection and find out what information is required to support a clearing application.

Each application is assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EPAA), using the criteria set out in Section 79C (I). This section is reproduced below.

79C Evaluation

(1) **Matters for consideration – general**

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application:

(a) the provisions of:
   (i) any environmental planning instrument, and
   (ii) any draft environmental planning instrument that is or has been placed on public exhibition and details of which have been notified to the consent authority, and
   (iii) any development control plan, and
   (iv) the regulations (to the extent that they prescribe matters for the purposes

of this paragraph)
that apply to the land to which the development application relates,

(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,

(c) the suitability of the site for the development,

(d) any submissions made in accordance with this Act or the regulations,

(e) the public interest.

DSNR assessment guidelines set specific heads of consideration that apply to the clearing of native vegetation. The assessment process aims to consider the social, economic and environmental costs and benefits of each clearing application.

Following assessment, each application is usually either approved (with conditions) or refused. A determination is forwarded to the applicant advising of the outcome of their application. In the case of a clearing consent being given, the determination comprises a set of conditions to control the clearing activity, a map showing the area that has been approved to clear, and an explanation of the reasons for conditioning the consent. Applicants who are not satisfied with the determination may lodge an appeal in the Land and Environment Court within twelve months of the determination.

Due to a high level of consultation between applicant and DSNR assessing staff at the pre-application stage, a high percentage of clearing applications are approved. However, some applications that do not meet the objectives of the NVC Act are refused.

Current situation

As part of the ongoing native vegetation management reform process, it is expected there will be changes to the circumstances outlined in this paper brought about by the following:

- a five year review of the *Native Vegetation Conservation Act* 1997,
- the report of the Independent Scientific Group into the review of the exemptions,
- Government response to the recommendations outlined in the Wentworth Group's report, *A New Model for Landscape Conservation in New South Wales*,
- the possible gazettal of several more regional vegetation management plans that cover large areas of NSW, and
- changes in procedures for the administration of clearing applications.

The information contained in this paper is correct at the time of writing (May 2003). For up-to-date information, advice should be sought from local DSNR offices.

Conclusion

Although the relationship of the *Native Vegetation Conservation Act* 1997 with the *Noxious Weeds Act* 1993 may seem complex at first, the connection is focussed on whether the proposed clearing for the control of noxious weeds requires development (clearing) consent under the NVC Act, whether the proposed activity is excluded from the operation of the Act, or if it is exempt from the need to apply for clearing consent.

The control of noxious weeds and the conservation of native vegetation must be balanced so that noxious weed control can proceed at a level that causes minimal environmental harm. Dialogue between DSNR, NSW Agriculture and local weeds authorities must continue to develop effective noxious weed control methods that are sympathetic to native vegetation communities. All organisations are bound by the statutory responsibilities bestowed on them by their respective legislation, but with cooperation and open communication, a practical and effective balance can be reached.

APPENDIX 1

Noxious Weed Control Techniques That Cause Minimal Environmental Harm

This section details techniques involved in selected forms of noxious weed control that minimise environmental harm. Use of these techniques will reduce "unavoidable clearing".

Hand removal

Hand removal of noxious weeds includes pulling the whole stem of each plant from the ground by hand; digging ("grubbing") plants, generally with a mattock, and cutting larger trees with a chainsaw or axe.

Hand removal of noxious weed vine species:

- where the vines are on the ground, hand removal means rolling the aerial parts of the vine (stems and leaves) into heaps and either, cutting rooted stems as near as practicable to ground level followed by immediate application of a herbicide to the cut surface of the stems, or pulling rooted stems from the ground by hand;
- where the vines are hanging from trees, hand removal means either cutting stems followed by immediate application of a herbicide to the cut surface of the stems, or pulling rooted stems from the ground by hand.

When noxious weeds are "grubbed" out using mattocks or similar tools, care should be taken that unnecessary soil disturbance does not occur.

When removing any noxious weed tree species with saw or axe, the stump and roots must be left in place to prevent destabilisation of the soil, especially on riverbanks and steep land.

Cut and paint

The cut and paint method means cutting each noxious weed trunk or stem off completely, at a level below the first branches or as near as practical to ground level, followed by immediate application of a herbicide to the cut surface of the cut trunk or stems. This is usually done with a brush, dropper or small back-pack gun. With some plants, care needs to be taken not to allow the cut surface of the stem to come in contact with the ground or it will take root.

Spot spraying

Spot spraying means the following forms of hand spraying:

- spraying the foliage of individual noxious weeds or clumps with a herbicide using a hand-held spray or micro-jet wand.
- spraying of the basal stems of noxious weed with herbicide using a hand-held spray wand.

The exemption does not include the use of fixed wands or nozzles mounted in fixed position on vehicles (ie not hand-held) for either of the above techniques. Note however that some forms of boom spraying are approved for use, as detailed below.

Wherever they are approved for the purpose, selective herbicides should be utilised by landholders in order to minimise the effects of spray drift on non-target vegetation.

Spot spraying must only be carried out in accordance with label directions relating to weather and other matters, and spray always directed away from any nearby waterway other than when controlling aquatic noxious weeds.

Stem injection and ringbarking

Ringbarking is done with an axe or chainsaw while stem injection means making one or more drill-holes or cuts (''frills'') around the trunk below the branches of noxious weed tree species, followed by immediate injection of herbicide into each hole or cut. Holes and cuts are angled downwards into the trunk to prevent herbicide escape. The herbicide can be applied with injection axes or with vaccinating type guns. Stem injection must only be undertaken in accordance with label directions.

As neither of these techniques involves plants other than the target species there are no other particular precautions needed.

Wick-wiping in native pasture

Wick wiping means weed control undertaken using tractor-mounted wick-wipers designed to control weeds that stand up above pasture. To improve the result and minimise impacts on native (and other) pastures, native pasture must be grazed low prior to treatment. The exemption may not be used for wick-wiping in other circumstances such as blackberries amongst native regrowth.

Small-scale slashing and small-scale boom spraying

Small-scale slashing and small-scale boom spraying means the treatment of individual plants or clumps or dense infestations of noxious weeds where the clearing is limited to those areas and does not extend to significant areas of other vegetation between the plants or clumps. Small-scale slashing or boom spraying therefore refers to the manner of treatment, not to the size of the area treated.

For example, slashing or spraying of all the individual clumps of old dense blackberries in a paddock to promote new growth prior to spraying where the slashing is limited to the affected area is small-scale. Slashing or spraying the whole paddock, including these clumps, is not. See reference below to boom spraying in native pasture with selective herbicides

As in spot spraying, wherever they are available, selective herbicides should be used in small-scale boom spraying in order to limit the effects on non-target vegetation.

Broad-scale boom spraying with selective herbicides in native pasture

Broad-scale boom spraying is the spraying from the ground (not from the air), of wider areas than just those where the noxious weeds occur - usually whole paddocks or numbers of paddocks. Broad-scale boom spraying has the potential to effect significant areas of predominantly non-target vegetation. For that reason, there is considerable onus on landholders to utilise this exemption with great caution and to fully document work undertaken.

The exemption cannot be used for broad-scale boom spraying when non-selective herbicides, such as Glyphosate, are used and it can only be used when the non-target species are native grasses.

The exemption is therefore only to be used for broad-scale boom spraying in native pasture when the selective herbicide used is approved for use in, and will not effect, the native pasture species present. As native pastures can include a range of both native grasses and forbs (herbs other than grasses), choice of an appropriate selective herbicide is critical. If in any doubt, contact NSW Agriculture or the local noxious weed authority.

BRIAN CURTIN - BIOGRAPHY

About the author:

Brian Curtin is the Pesticides Officer responsible for field operations in the Newcastle/Hunter region. The EPA is responsible for the administration and enforcement of the Pesticides Act 1999 and regulations. As such the EPA enforces the proper use of all pesticides, including those used in agriculture, on public lands and on domestic and commercial premises. As a member of the Pesticides Operations Team Brian undertakes a range of tasks, including education of pesticide users regarding new regulations, through to ensuring compliance with the legislation.

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ASSESSING AND MANAGING RISKS RELATING TO USE OF CHEMICALS IN PEST CONTROL: NEW INITIATIVES IN PESTICIDE REGULATION IN NSW

Pesticide Regulation in NSW

Brian Curtin, EPA

About the author:

Brian Curtin is the Pesticides Officer responsible for field operations in the Newcastle/Hunter region. The EPA is responsible for the administration and enforcement of the Pesticides Act 1999 and regulations. As such the EPA enforces the proper use of all pesticides, including those used in agriculture, on public lands and on domestic and commercial premises. As a member of the Pesticides Operations Team Brian undertakes a range of tasks, including education of pesticide users regarding new regulations, through to ensuring compliance with the legislation.

Synopsis:

Pesticides reforms in NSW

- The Pesticides Act 1999 commenced on 1 July 2000
- It covers everyone who uses pesticides
  Fines/penalties have significantly increased
  There are now on the spot fines
  You must choose the right pesticide, read and follow the label and not cause harm

Implementation Priorities
- Record keeping
  Training
- Notification

Training
- Aims to ensure competency of users
- All who use pesticides as part of their business
  Recognises prior learning
  ChemCert and SMARTtrain prior training recognised
  - 80 submissions being considered

Notification
  NRA Label directions
- Mandatory notification
- Voluntary guidance on notification

Pesticide Amendment (Records) Regulation
- Gazetted on 14 December 2001

Part of Pesticides Act 1999
- Commenced 31 July 2002

Why was Record Keeping introduced?

- To ensure all commercial users keep records so that:
- information is readily available to deal with any problems
- residue or contamination issues can be readily tracked
- assist user in identifying pest control problems
- help show that user acted responsibly

Non-agricultural situation

In carrying out a business, eg pest control operator
- While acting as landlord
- During pest or weed control on behalf of a public authority

While spraying places such as golf courses, bowling greens, ovals or road verges
- Exemption – home style pesticide used in small quantities

Record Keeping details
- Enforcement

Education then Audit programs for compliance

Penalty Infringement Notices [PINs]
- Prosecutions

Need more Record Keeping information
- Call EPA Pollution Line
- Tell31555

Visit website
www.epa.nsw.gov.au/pesticides

12th NSW Biennial Noxious Weeds Conference

Pesticides Act 1999
Mandatory record keeping

Brian Curtin
Pesticides Officer
NSW EPA

NSW EPA
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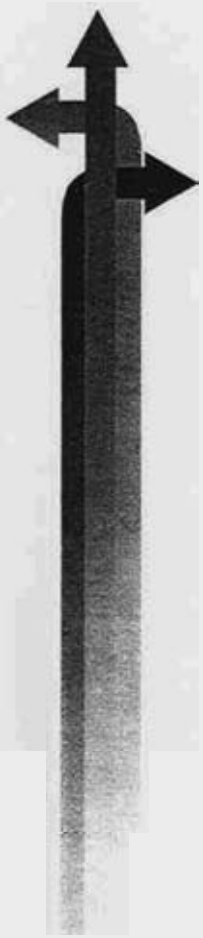

Appropriateness of regulations: *Pesticides*

52% said that pesticides are having a **harmful** effect on the **environment** *(quite a lot or very harmful)*

39% said that pesticides are having a **harmful** effect on **health** *(quite a lot or very harmful)*

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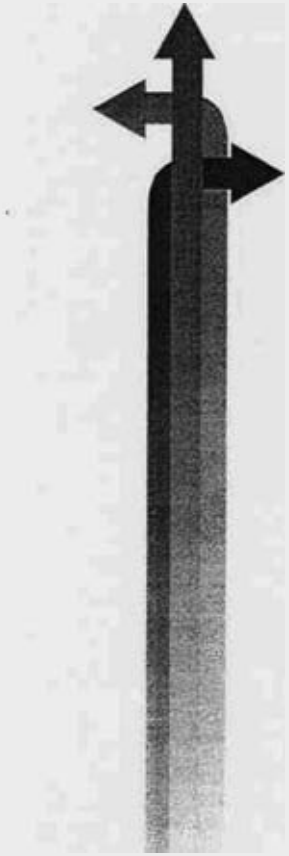

Control of Use

- NSW reforms of control of use of Pesticides
  - ⇨The new Act commenced on 1 July 2000
  - ⇨It covers everyone who uses pesticides
  - ⇨Everyone involved in making a decision to use a pesticide can be held responsible
  - ⇨Fines/penalties have significantly increased
  - ⇨There are now on the spot fines
  - ⇨You must choose the right pesticide, read and follow the label and not cause harm

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IMPLEMENTATION PRIORITES

- Record keeping
- Training
- Notification

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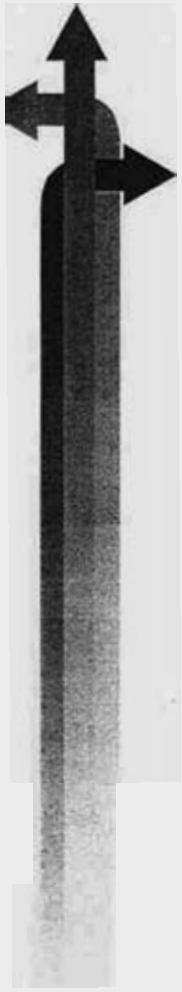

Training

- Aims to ensure competency of users
- All who use pesticides as part of their business
- Recognises prior learning
- ChemCert and SMARTtrain prior training recognised
- ~ 80 submissions being considered

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Notification

- NRA Label directions
- Mandatory notification
- Voluntary guidance on notification

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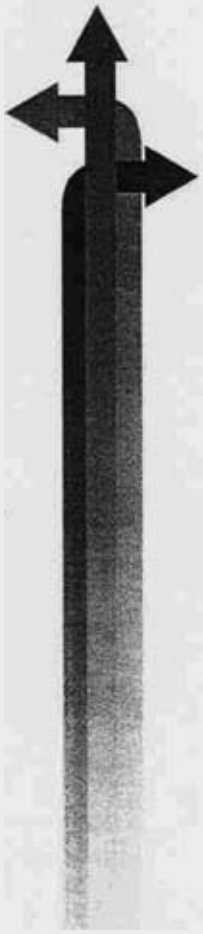

Pesticide Amendment (Records) Regulation

- Gazetted on 14 December 2001
  - ⇨Part of Pesticides Act 1999
- Commences 31 July 2002
  - ⇨To allow time to plan compliance

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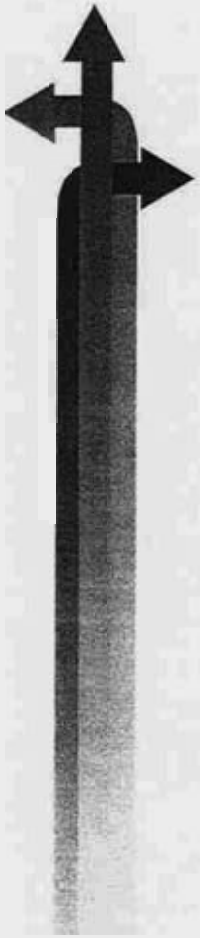

Why was Record Keeping introduced?

- Part of a framework of considered and rigorous best practice pesticide usage.
- To ensure all commercial users keep records so that:
  - ⇨ information is readily available to deal with any problems
  - ⇨ residue or contamination issues can be readily tracked
  - ⇨ assist user in identifying pest control problems
  - ⇨ help show that user acted responsibly

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Non agricultural situation

- Pesticides used
  - ⇨ In carrying out a business, eg pest control operator
  - ⇨While acting as landlord
  - ⇨During pest or weed control on behalf of a public authority
  - ⇨While spraying places such as golf courses, bowling greens, ovals or road verges
- Exemption – home style pesticide used in small quantities

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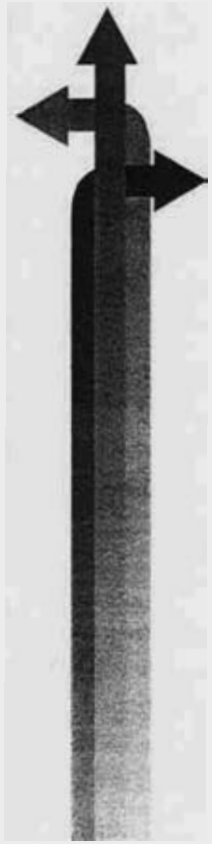

Who applied the pesticide

- Owner/self employed applicator
  - ⇨Name, address and contact phone numbers
- Contractor/employee applicator
  - @Name of the applicator
  - ⇨Name, address and contact phone numbers of the employer

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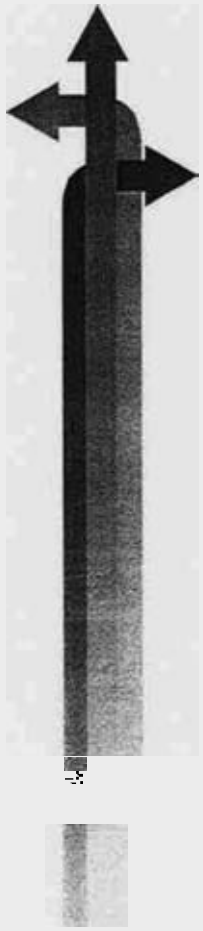

Details on the property owner or occupier

- Name, address and contact details
  - Can be the lessee or rental occupier, if more appropriate

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What was used

- Acceptable - full product name
  - e.g. Bloggs Glyphosate 360 Herbicide
- Not acceptable - generic name
  - e.g. chlorpyrifos

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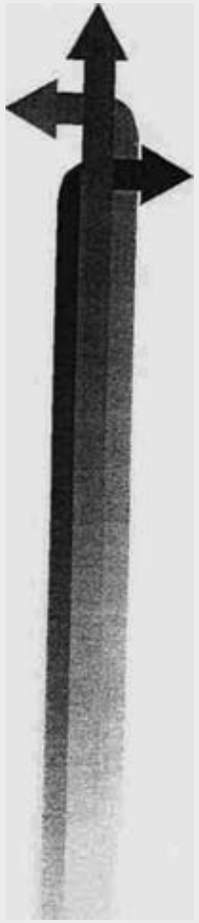

When was the pesticide applied

- Date
- Start time
- Finish time

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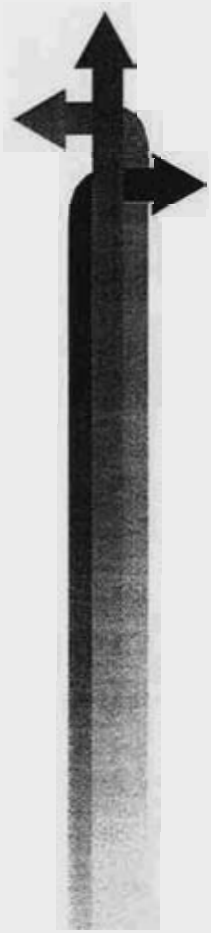

Where was the pesticide applied

- Property address
  - ⇨Delineation of area
    - *Sketch map or aerial photo, or
    - *Description (which rooms treated)
  - ⇨Order paddocks, areas, or blocks treated
    - *Only for agricultural or forestry applications

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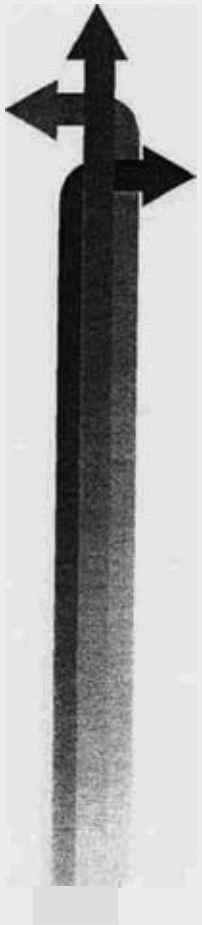

Which crop or situation

- Name the crop or situation targeted

  - Name of pest [not a requirement] – good practice

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How was the pesticide applied

- The equipment that you used
  - e.g.: air blast sprayer, boomspray, wick wiper etc
    - Equipment settings [not a requirement] – good practice

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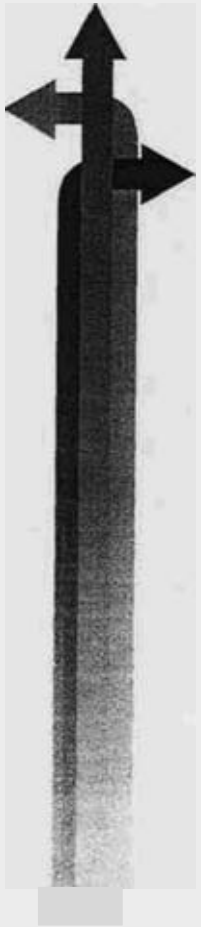

How much was used

- What concentration used
- Total amount of pesticide mix made up and used
- The size of the area covered with the pesticide where appropriate, (usually in Agriculture)

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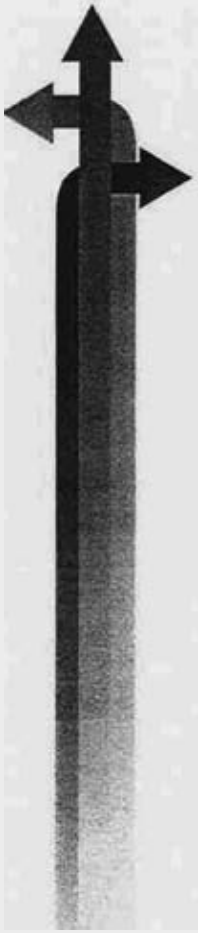

Weather

- Required only if
  - Applied outdoors by spray equipment
    - Estimate of wind speed
    - Estimate of wind direction
    - Other details if label requirement [record compliance]
- Record any significant changes during the job
- Not required for
  - Indoor applications, laying baits or livestock treatments using dipping equipment

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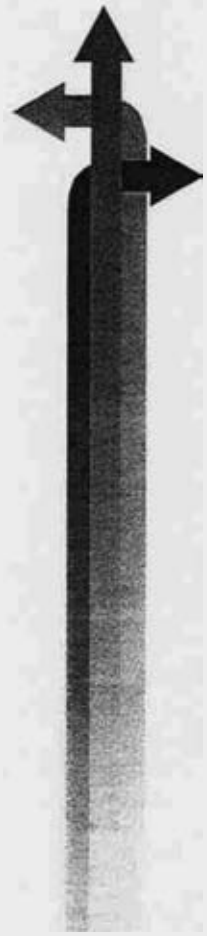

Flexible Reporting

- No special form
  - ⇨EPA proforma available
- No need to record information that doesn't change on each record
  - ⇨Refer to applicator's details, chemicals register
- Integration with other records

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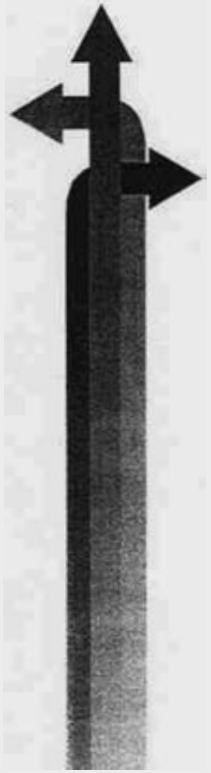

Record Keeping Features

- Who makes the record [written in English]
  - ⇨ Applicator or another person
- How soon
  - ⇨ Within 24 hours
- Keep for

  c33 years
- Kept by
  - ⇨ Applicator [self employed]
  - ⇨ Owner/occupier (agricultural), employer, public authority, greenkeeper.

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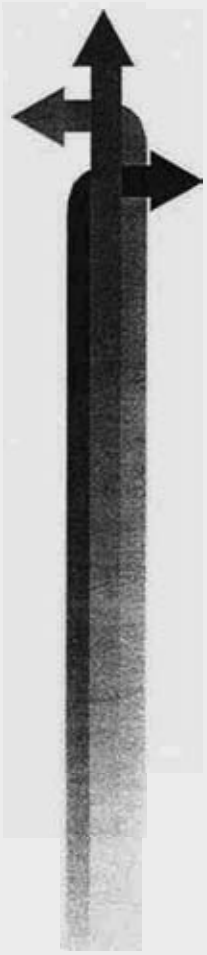

Enforcement

Education then Audit programs for compliance

- Penalty Infringement Notices [PINs]
  - ⇨$150 - $400 [individuals]
  - ⇨$300 - $800 [corporations]
- Prosecutions
  - ⇨$22,000 (maximum) [individuals]
  - ⇨$44,000 (maximum) [corporations]
- Corporations responsible for actions of employees in certain circumstances

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Need more Record Keeping information

- ⇨Call EPA Pollution Line
  - ➦131 555
- ⇨Visit website
  - ➦**www.epa.nsw.gov.au/pesticides**

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Weeds
The Real World and Red Tape
– a farmer's perspective

Firstly I would like to thank the organizing body of the twelfth New South Wales bi-annual Noxious Weeds Conference and Expo for giving me the opportunity to give my personal perspective of weed control in the Manning Valley. I must stress that little in this address is based on Scientific fact but does come from the economic reality of actively managing a family, 2000 hectare, 1200 head beef cattle enterprise.

The theme of this conference is Weeds, Solutions to Success. This may sound impressive but in reality weed control in coastal New South Wales is in disarray and we are losing that battle of weed invasion. I believe that there are two key issues that need be addressed. Firstly, land managers themselves. Do they have the will, finances and knowledge to undertake sustainable weed control programs? And secondly, the relationship between land managers and government agencies.

The last fifteen years has been a very challenging period for agriculture. The mid 1980's saw high interest rates and then drought in 1992-93. This was followed by severe price declines in the beef industry in the mid 1990's. Deregulation of the dairy industry followed by an extreme drought in 2001-2002 has put a huge financial drain on many agricultural enterprises. As a result of these factors and a general rise in the cost of production the amount of money being targeted for weed control has been limited. Most landholders would be hoping for a sustained period of increased profitability so that some weed control "catch up" can occur. Also of major concern is that the average age of farmers is increasing and many cannot physically do the manual work that weed control demands. There is also a group of farmers who do not have the knowledge or the will to control their weeds. For instance they may have moved to the country to retire on a rural holding and spraying lantana and crofton weed is not a priority.

There has been many advances is technology over recent years. Whether it be grazing management, new chemicals, or application methods. I am also sure that there will be many good ideas that will arise from this conference. But how does this technology and the practical solutions make it to the "coal face"? How will the 65 year old farmer who left school at the age of 14 learn this new knowledge? How many landholders are attending this conference? I believe that there is a major black hole in the transfer of knowledge from government and scientific agencies to the average farmer on the land. In past years this role has largely been filled by the Department of Agriculture which appears to be only a skeleton of it's former self. It is of no coincidence that over the last 10 or 15 years as the role and influence of the Department of Agriculture and to a lesser extent the Soil Conservation Service has declined, so has the relationship between State Government agencies and landholders. There is a growing level of frustration in the rural community over red tape and the abundance of inappropriate environmental legislation. Landholders have been forced into a situation where they break the law or at the very least push these laws to the limit to simply maintain or enhance existing pastures. Much of this legislation was designed to give greater protection to high conservation flora and fauna but it has failed miserably in this regard.

I had hoped that after 3 years of being a landholder representative of the Manning Regional Vegetation Committee that some sensible solutions would be implemented. Even though the task was long, arduous and the process flawed I do believe we prepared a draft plan that gave areas of high conservation increased protection, and landholders greater flexibility to manage and enhance areas of existing native and improved pastures. The fate of this plan now seems to be unknown. It is most likely buried in the Sydney offices of the Department of Land and Water Conservation, because of a five year review of the native Vegetation Act, or railroaded by the Wentworth report, which is big on ideology but short on substance, or perhaps simply because the plan does not fit some predetermined model.

Eighteen months ago I was also a member of a committee that was set up to write a code of practice for Aerial spraying in relation to weed control and pastoral improvement. The committee comprised of landholder representatives, a Department of Agriculture officer, Department of Land and Water Conservation field officers, an Aerial operator and an agronomist. After many meetings and much deliberation acceptable guidelines were agreed to and written up by local departmental officers. This document was sent to the regional offices of the Department of Land and Water. It is with much personal disappointment that this document has not been seen or heard of since.

It appears that Government agencies such as the Department of Land and Water Conservation and the EPA are all to ready to "wield the big stick". Unfortunately they lack the basic understanding of the issues on the ground, which in turn makes it near impossible for them to work with landholders to find practical solutions. These issues have lead to a rising level of anger in rural communities. I think if we do not see some common sense solutions found soon, we will see normally moderate and mild mannered farmers take the drastic action of civil disobedience and or legal action to protect their rights to farm free hold land.

I have prepared a cost analysis of a paddock which has been in a weed management, pasture improvement program since 1993. (Photo 1) This will highlight the problems faced by many landholders and the huge productivity gains that can be achieved. This paddock is roughly 100 hectares in size, very steep slope, southeast aspect and made up a well-drained grey brown basalt soils. It was first rung barked in the 1930's and then the regrowth recleared in 1965. The principle management tool until 1993 was fire and heavy grazing. The regime lead to minimal ground cover, weed invasion, nutrient run off, and a general deterioration in soil structure. Many people say this is land that should never have been cleared. I agree, but it is just not economically viable to return this type of land to its native state. This land will be forever modified by the invasion of noxious weeds such as blackberry, crofton weed, parramatta grass and native weeds such as bracken fern, poa tussock and bladey grass. The alternative is to implement a weed eradication pastoral improvement program where production and profitability is trebled. (See attachment: River Paddock)

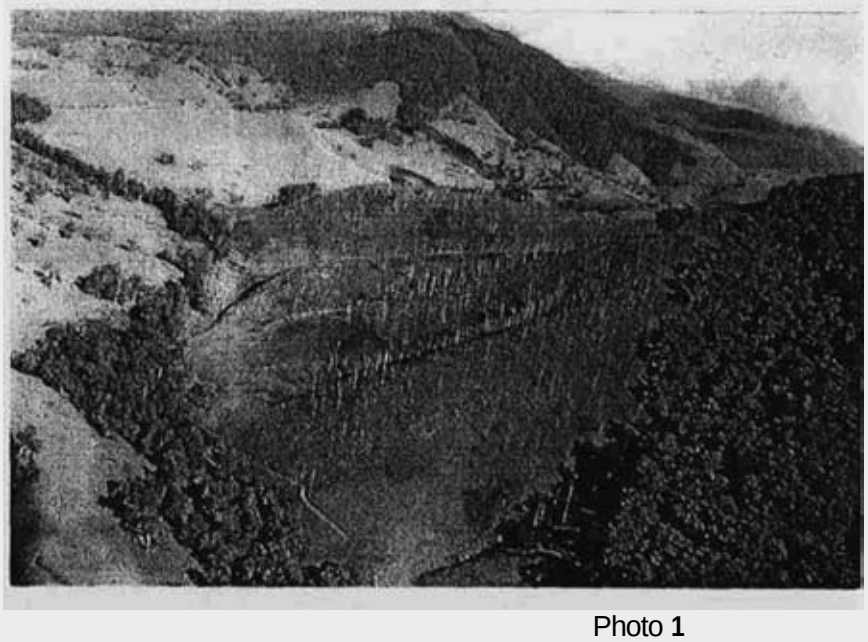

Photo **1**

This improvement program has been costly, but is clear to see the huge productivity gains that can be made, with many flow on effects to the local community. Why is it that many farmers risk the wrath of the DLWC undertaking improvement programs such as I have detailed? It is very simple, the Native Vegetation Conservation Act of 1997 gives farmers no flexibility to undertake weed control programs without the need for government interference. The definition of clearing is a major problem in itself.

I quote " In the Act, ***clearing*** native vegetation means any one or more of the following:

(a) cutting down, felling, thinning, logging or removing native vegetation
(b) killing, destroying, poisoning, ringbarking, uprooting, or burning native vegetation
(c) severing, topping or lopping branches, limbs, stems, or trunks of native vegetation
(d) Substantially damaging or injuring native vegetation in any other way'' (Native vegetation Conservation Act 1997 No133)

This means that if you damage Native vegetation in the process of a weed control program in any way, you are in breech of the act. There are some exemptions but these are limited, especially on State Protected Land where most of the major weed incursions occur. In recent years the DWLC has been especially critical of tree regrowth being cleared, (read cleared under the definition of the act). Quite often it is unavoidable that there is some collateral damage to native regrowth in weed control programs. This may occur from spray drift form aerial chemical application, spot spraying or dozing. Surely we need to keep things in perspective. The status report prepared by the Manning Regional Vegetation committee clearly states that this region is typified by tree regeneration not degradation. The reduction of the use of fire, which at best is only a 'band-aid' management practice causing long-term environmental damage and the introduction of improved pasture species and dense ground cover limits nutrient loss and mass movement of soils. The net gain to the environment seems obvious. (Photo 2)

Photo 2

I feel passionate about many of the issues I have raised in this presentation. Productivity gains that can be made through pasture improvement weed control programmes will secure the future profitability of many farms. This will lead to a strong and diverse rural community's that do not rely on government assistance to survive as seen in many other countries. I believe that the two greatest threats to our future sustainability are exotic disease outbreak and inappropriate environmental legislation.

River Paddock 100ha's

Unimproved production (1992) Carrying capacity 20 cows + calves =4140kg x $1.60kg

Turn off 18 Calves x 230 kgs =$ 6624

Year	Improvement Programme	Cost	Income
1993 335kg	Spraying $30/ha Chemical $17.50/ha Seed $39/ha Seeding $30/ha	$154 x 100ha =$ 15 400	40 Calves x = 13 400kgs x $1.60 **= $21 444**
	Fertiliser $37.50/ha $154 ha		
1994 330kg	-----		35 Calves x = 11 550kgs x $1.60 **= $18 480**
1995 320kg	Fertiliser $37.50ha	$37.50 x 100ha = $3750	35 Calves x = 11 200 kgs x $1.60 **= $17 920**
1996 325kg	------		36 Calves x = 11700kgs x $1.60 **= $18720**
1997 340kg	Aerial Target Weed Spraying Spraying $30/ha Chemical $16/ha Seed $45/ha Seeding $30/ha Fertilizer $37.50/ha $158.50/ha	Spraying $121 x 60ha = $7260 Fertiliser $37.50 x 100ha =$3750	32 Calves x = 10880kgs x $1.60 **= $17408**
1998 340kg	-----		40 Calves x = 13 600kgs x $1.60 **= $21 760**

1999 335kg	-----		37 Calves x = 12395kgs x $1.60 **= $19832**
2000 340kg	Handgun spot spraying Labour 20 hours x $50 = $1000 Chemical 441t x $6/lt = $264	**Spraying** = $1264	40 Calves x = 13 600kgs x $1.60 **= $21 760**
Year	**Improvement Programme**	**Cost**	**Income**
2001 320kg	Aerial Weed Spraying Spraying $35/ha Chemical $ 16/ha Seed $50 ha Fertilizer $40/ha	Spraying x 20 ha = $2720 Fertiliser x 100 ha = $4000	38 Calves x 21 260kgs x $1.60 = $19456
2002 300kg	-----		37 Calves x 11 100kgs x $1.60 **$17760**

Ten year period

Average cost of Pasture Improvement & Weed Control	$3814 p.a.
Average income	$19450 p.a.
Net income	**$15636 p.a.**

Against $6624 in 1992
Net gain per year $9012

*$1.60 average price over 10 year period for comparison

Ted Laurie is a fifth generation Beef Cattle farmer from the Moppy Region, west of Gloucester, New South Wales. He and his family own and manage a two thousand hectare, 1200 head beef cattle enterprise. They have successful Devon and Angus Cattle studs, winning the Hunter Beef Cattle Producer of the Year in 2000. Ted has also judged Cattle at the Royal show of England, Sydney, Brisbane & Perth Royal shows and many regional shows in New South Wales. He is also a committee member of the Manning Regional Vegetation Committee and chairman of the upper Barrington Landcare group.

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OH&S
WORKCOVER
RTA
EPA
DLWC
COUNCIL


the last working Australian runs from his life..
Rod Spice

Mid North Coast Catchment Blueprint and Weed Control

Mike Holton
Mid North Coast Catchment Management Board

What this talk covers

- The Board and Board area
- The Catchment Blueprint
- Blueprint Weed Actions
- Blueprint Implementation.

What are Catchment Management Boards (CMBs)?

Following a review of TCM the NSW Government replaced 43 CMCs & 5 Regional Catchment Committees with 18 CMBs in mid-2000

The change was designed to:-

- build on & strengthen the TCM process
- strengthen whole-of-government/community partnerships
- establish a target-based approach to natural resource management (NRM)
- focus investment on regional issues and locations of greatest need.

What area does the Mid North Coast CMB cover?

Area: 17,364km^2

Population: 150,000

What is the role of the MNC CMB?

- Promote healthy & productive catchment systems
- Set strategic direction for NRM through planning
- Initiate project proposals and direct investment to priority projects.

What are Catchment Blueprints?

- Natural resource management (NRM) plans prepared by CMBs across NSW
- Statutory plans under the Catchment Management Act
- Advisory plans, not regulatory plans
- Plans that are policy (through NSW Cabinet endorsement)
- Plans that will guide investment of funds and resources
- Prepared to NSW Government specifications.

The key elements of the Blueprint

The 5 Catchment Targets

Address priority issues related to:

1. Land use
2. River health
3. ASS
4. Vegetation
5. Biodiversity.

(Note that Targets overlap and the Blueprint should be viewed in its totality).

Management Actions

- There are 79 Management Actions (projects) developed to implement the Targets

- The Prioritised Actions will guide investment in NRM

- There are 4 Board-wide Actions designed to support all targets.

Board-wide Management Actions

- Action B(1): Prepare 5-Yearly State of the Catchment Reports

- Action B(2): Identify and overcome barriers to Blueprint implementation

- Action B(3): Identify incentives for Blueprint implementation

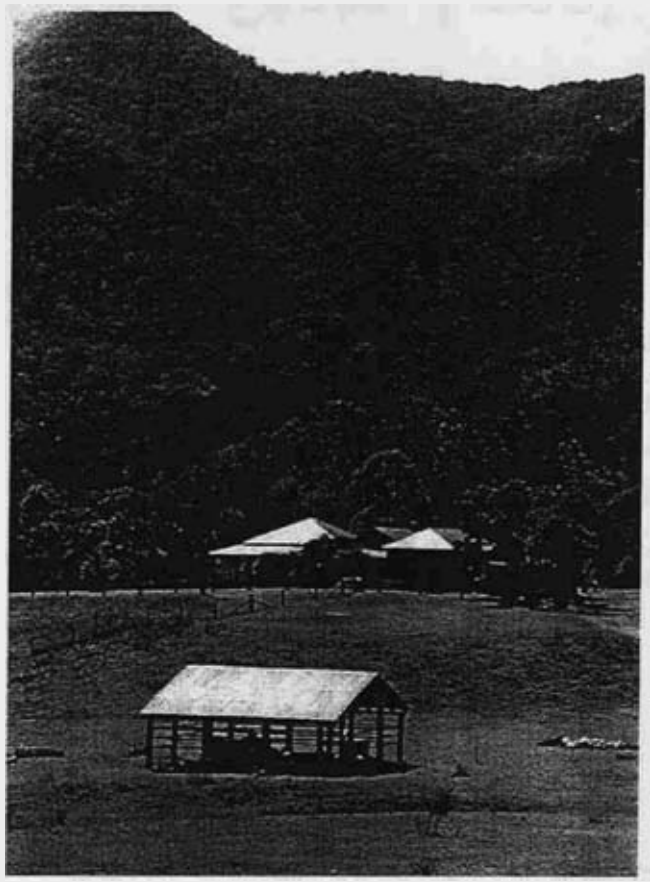
- Action B(4): Community Capacity Building

How will the Blueprint be implemented?

- Management Actions developed into projects
- Projects incorporated into Rolling Three-Year Investment Programs
- Funding bids prepared for projects
  - Natural Heritage Trust
  - Many other Commonwealth, State, Local Government and Industry funding sources.

Catchment Target 1 - Landuse

- Integration of land use planning
- Coastal management
- Urban development and rural settlement
- Natural and cultural heritage
- Aboriginal issues
- Rural land use
- Pest plants, pest animals and fire.



Weed (Pest Plant)Target and Actions

- Management Target 1.8: By 2006 strategies in place for the improved management of pest plants, pest animals and fire to enhance catchment production and biodiversity values
- Action 1.8.1: Prepare, implement and monitor weed strategies and weed management control plans
- Action 1.8.2: Develop, implement and monitor projects for the control of priority environmental weeds, the limitation of the distribution of potential weed species (Weed Alert), and the provision of educational and extension support to landowners and land managers
- There are many other Blueprint Actions incorporating weed issues.

Weed Action Priorities and Projects

- Weed Actions are high priorities (18 & 19 of 79 Actions)
- Weed Actions developed into 3 projects

1. Coastal Riparian environmental weed planning and control - $2.1 m over 3 years including $900 K external investment

2. Tableland planning - $470 K over 3 years including $150 K external investment

3. Environmental weed control around Tableland towns - $235 K over 3 years including $135 K external investment.

How were Weed Actions and Projects developed?

- In consultation with:-
  - Weeds Advisory Committees
  - Rural Lands Protection Boards
  - State agencies
  - Landcare/community groups
- Strongly influenced by submissions on draft Blueprint.

Related Weed Targets .....
Catchment Target 2 - River Health

- Riparian vegetation
- Riverbank and bed erosion
- Water Sharing Plans
- Floodplain wetlands.

Catchment Target 4 - Vegetation

- Maintenance of native woody vegetation
- Increase in native vegetation cover for catchment protection in critical areas
- Farm forestry.

Catchment Target 5 - Biodiversity

- Establishment of major regional habitat links and strategic local habitat links

- Management of high conservation value ecosystems

- Removal of barriers to fish passage.

Take Home Messages

- Blueprints are advisory documents
- Blueprints will influence project funding
- Weeds are a high priority in the MNC Blueprint
- CMB will actively seek external funding
- CMB will actively seek strong partnerships with organisations and communities to deliver projects
- Blueprints and projects will be regularly reviewed and modified as necessary
- The CMB welcomes your involvement.

Brief Biography for Michael Holton

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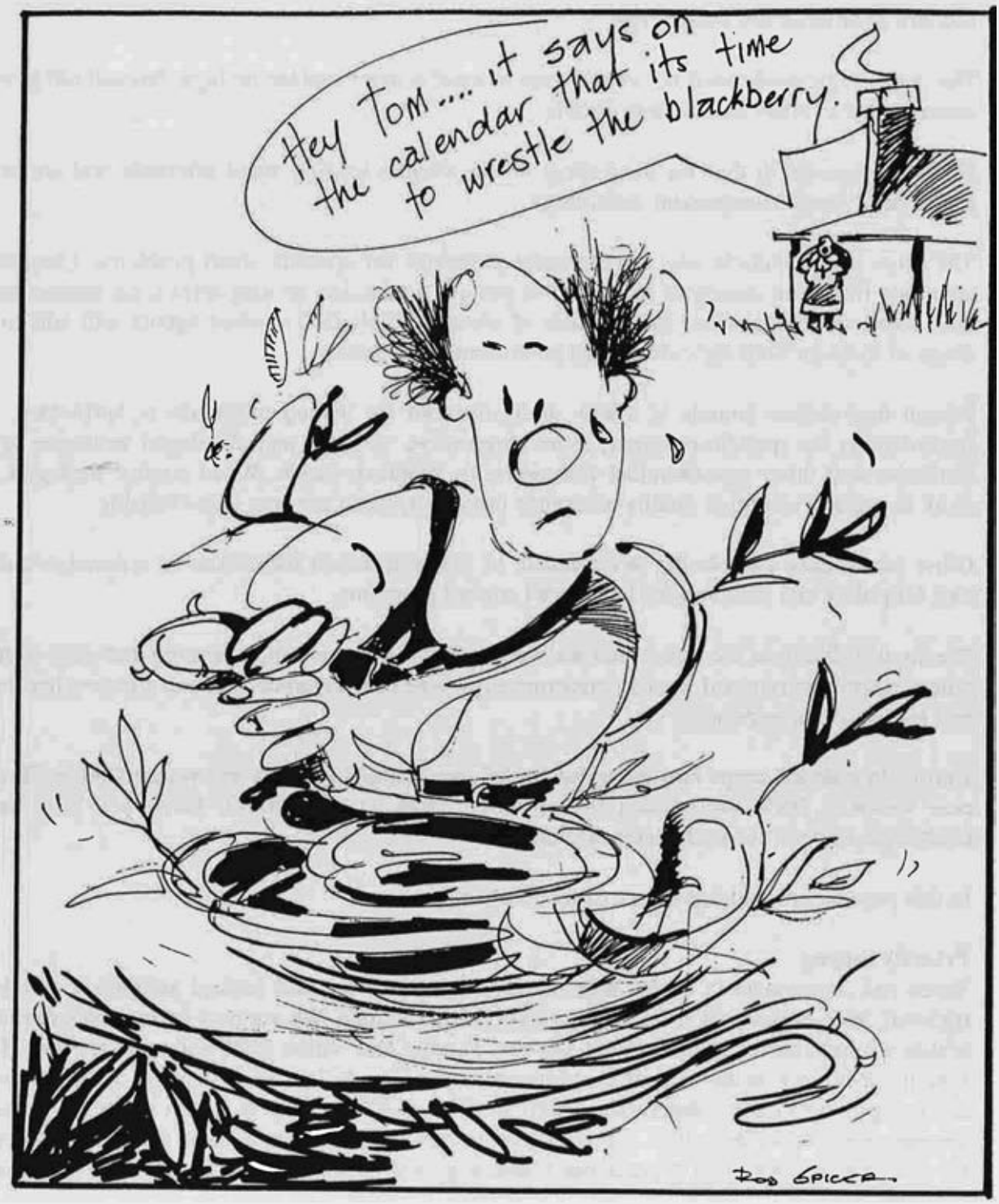
Chairman Mid North Coast Catchment Management Board
Grows beef cattle and plantation timber at Yarranbella, via Macksville
Past Chairman and Past Deputy Chairman of the Nambucca Valley Branch of the NSW Farmers Association
Member of the Nambucca Valley Water Users and Management Group
Past Member of the Regional Plantation Committee
Councillor and Deputy Mayor, Nambucca Shire Council
Member of the Nambucca Estuary and Coastline Management Committee, and Floodplain Management Committee
Member of Regional and State Assessment Panels for NHT (Natural Heritage Trust) funding
Past Chairman of the Nambucca Catchment Management Committee
Previous management and leadership roles in Department of Defence, and the oil and computer industries


Hey Tom.... it says on the calendar that its time to wrestle the blackberry.
ROB SPICER

INNOVATIONS IN WEED SCIENCE AND MANAGEMENT

Richard J Carter, NSW Agriculture

This paper reviews some of the innovations in weed science and technology that will affect weed management in NSW for the next decade.

NSW is fortunate in that we have some of the world's leading weed scientists and are in the forefront of weed management technology.

The innovations include new management strategies for specific weed problems. Changes in approach including strategies to maximise pasture production or long term farm income rather than weed control. Further introduction of classical biological control agents will add to the range of tools for both agricultural and environmental weeds.

Recent innovations include is a new molecular tool for testing resistance to herbicides, new formulations for specific products, more competitive varieties and developed strategies to use fertilisers and other non-chemical techniques to suppress weeds. Weed control strategies that work in organic and other quality assurance farming systems are now also available.

Other innovations include the development of risk assessment techniques as a decision making tool for policy and planning for local weed control programs.

We are also likely to see innovation for weed control in conservation farming and other systems where stubble is retained, and in environmental weed management beyond the two herbicides and lots of labour approach.

Herbicide resistant crops now being integrated into farming systems and we are finding 25 to 30 new weeds in NSW each year (Hosking 2003, Hosking et al 2001). These will pose further challenges that are currently being addressed.

In this paper I will highlight some of the innovations.

Priority setting

Weed risk assessment is a new area of weed science. All weed control authorities at a local, regional, state or national level, attempt to prioritise actions. We are now seeing tools developed which we help us set priorities (see Groves, Panetta and Virtue 2001 for an overview). These systems will allow us to set priorities for treatment. Already in South Australia, local authorities are using these systems determine priorities (Virtue 2001). Also in South Australia a scoring system was used to determine the weed risk to natural ecosystems due to the mass planting of revegetation species. The process has allowed policy responses to reflect the risk (Virtue and Melland 2002).

One challenge facing us all as we start to address weeds in natural ecosystems is which we should target first. Richardson and Rouget (2002, 2003) studied natural experiments. These are where data is collected from exotic tree plantings and subsequent naturalisation. Quasi-mechanistic models are now used in South Africa to determine mechanism for invasion of woody plants such as Eucalyptus and Pinus spp. These models may be useful for determining which invasive species we should target first in natural ecosystems rather then wait to find out- or attempt to remove all exotics just in case.

Weed officers frequently ask the question how frequently do we do surveillance? In New Zealand, a model developed for park managers demonstrates the frequency needed for different weed types and habitats. Depending on the certainty chosen a manager can determine the inspection frequency needed. In New Zealand forest requires 1-2 years, while in short vegetation and wetlands the search frequency is closer 5-10 years (Tirnmins, Harris and Brown 2002).

NSW Agriculture has also contributed to the debate about what to measure (Rew et al 2000).

The CRC for Australian Weed Management, which has NSW Agriculture as a lead partner, is developing strategies to help detect weed incursions, evaluate the risk and to decide which weeds warrant a response, be it eradication, containment or management (CRC 2002).

Different approaches to weed control

Using ants to *harvest* weed *seeds*- In Western Australia the role of ants in seed predation (granivory) is being investigated Borger, Minkey and Spafford-Jacob 2002)
- the trick is to find how to maximise predation by manipulating refuges and interspecies competition (Minkey and Spafford-Jacob 2002).

Nitrogen placement In cropping systems, the use of nitrogen placement and timing so that the crop not the weeds were able to utilise has been demonstrated (Koetz et al 2002). Cultural weed control techniques are proven (Lemerle & Murphy 2000, Walker et al 2002) and similarly selection for crop varieties for competitive ability pays, and is now part of most breeding programs (Lemerle, et al 1996, 2000, 2001Brennan et al 2001).

Accelerated seed-bank decline Seed-banks have always been the Achilles heel of weed management. Work on radish and wild oats has shown the value of seed-banks (Murphy et al 2001, Jones et al 2002).

Seed *placement* Weiner et al. (2001) found that weed suppression was greatest when crop plants were evenly distributed (rather than planted in rows). This needs further evaluation in Australian farming systems.

Mycoherbicides and rhizobacteria For over ten years, mycoherbicides have been studied with little practical application in Australia. Bruce Auld of NSW Agriculture obtained a provisional patent late last year for a new technology that may finally solve the problem. He has developed a water-in-oil-in-water emulsion (WOW). The emulsion holds water on the leaf surface for long enough for the mycoherbicide to infect the weed. This may suddenly open the opportunity for mycoherbicides to work in drier environments.

Rather than using fungi, deleterious rhizobacteria (DRB) offer a promise for weed control (Flores, Vargas and O'Harra, 2002). These, naturally occurring, soil organisms are currently under investigation in Western Australia. Their populations may be manipulated under perennial crops such as vines and natural ecosystems;

Laser cut weeds The idea of using lasers to cut weeds is not new. European work has demonstrated that cutting weed stems close to the soil surface is feasible. In the proof of concept, Hieisel and his colleagues (2002) measured stem diameter with a He-Ne laser then cut the stem with a CO_2 laser with the power adjusted to the stem thickness. The obvious implication of this work is to reduce the power requirement compared to heat based weed control treatments, and to enable selective cutting of stems. This approach may have applications cropping systems as well as environmental weed control. One application could be removing vines and shrubs from rainforests without the need for heavy mechanical equipment.

Herbicide gel A new approach to old technology is gel herbicide formulations for cut-and-swab treatments. Already the technology has been demonstrated on willows with picloram (Ward, Henzel and Prichard 2002).

Improved use of herbicides
Dick Medd and Mui-Keng Tan have characterised the acetolactate synthase (ALS) gene in wild radish. This may lead to molecular assays for rapid ALS resistance (group B herbicide) screening and would also allow diagnosis of resistance patterns, permitting a more informed basis for use of ALS-inhibiting herbicides.

Data from many field studies has demonstrated that doses of herbicides can be adjusted to get high levels of control based on data available at the time of treatment (Medd, Van de Ven 2001, Medd et al 2001, Medd et al 2002, Nordblom et al 2001, 2002,). Factor adjustment of herbicide rates could improve control, reduce herbicide use, environmental impact and reduce risk of failure under extreme conditions.

Integrated weed management
Other research has measured what many have known for a long time. For instance a range of control techniques will reduce populations of thistles and Paterson's curse. Increased pasture production, especially in winter only results where integrated strategies are adopted. In Ruth Huwer's work summer rest, strategic heavy grazing and addition of fertiliser result in increased desirable legume and perennial pasture species in winter well above that of continuous grazing (Huwer et al 2001, Huwer et al 2002). The message is herbicide spraying alone will not increase pasture production in the subsequent winter. Other work has shown that lime and rotations reduce weed seed banks (Kidston et al 2001)

Education
The Weed CRC is taking the Weed Warriors program nationally this year. The aim is to get schools interested in weeds by being involved in the rearing and introduction of biological control agents. Already in Victoria and Western Australia a range of many schools have taken on the program (Kwong, 2002)

Safe grazing of St John's wort
In the past we often promoted grazing of toxic plants without consideration of the animal welfare implications. I have recommended heavy grazing by wethers, on the basis that I knew that ewes and lambs. Work by NSW Agriculture (Bourke 1997, 2001, 2002, Bourke & Southwell 1999) has not only determined the best timing for grazing of St john's wort for weed control purposes, it has also determine the timing for safe grazing for the major St John's wort forms in NSW. Other work has defined selective control of the weed in pastures (Campbell and Nicol 2000a, 2000b), and the information is included in a range of extension publications (eg Campbell, Watson and Bourke 2001, Burton, 2002).

Controlling specific weeds

Weed control in cotton costs about $300/ha, consequently there is a big opportunity to make savings. NSW Agriculture has contributed to the information resources for the cotton (eg Charles 2000, 2002a, 2002b, Johnson et al 2000) and rice industries (eg McCaffery 2000, McCaffery et al 2000, Jahromi et al 2002). Specific problems such as removing lucerne before planting (Davies et al 2001), annual grasses in pastures (Dowling et al 2000, Dowling and Pickering 2000, Freckleton et al 2000), annual pastures (Sandra1 & Dear 2002) perennial weeds (Johnston et al 2000) and aquatic weeds (Ensbey 2000a,b,c) broom (Sheppard et al 2000a,2000b), lippia (Dellow et al 2001, Motely et al 2001, Spenceley & Gooderham 2002), biological control of Bathurst burr (Morin et al 2001) and control in woodlots (George & Brennan 2002), engineering solutions to weed management (Gregor et al 2002), biological control of crops weeds such as wild oats (Hetherington & Auld 2000, Hetherington et al 2001, 2002) and more generally (Mullen et al 2002). In NSW we have developed new approaches to fireweed (Kemp 2002) and serrated tussock (Campbell et al 2001,2002, Leech 2002).

We have also conducted surveys of weeds in atrazine heated crops (Lemerle et al 2001), weed and herbicide resistance management (Alemseged et al 2000, Jones et al 2000b) and economic impact (Jones et al 2000a, Jones & Medd 2000, Jones et al 2002, Vere et al 2001a, 2001b, 2002a, 2002b, Watkinson et al 2000), seed bank studies (Omami et al 2000, Sheppard & Smyth 2002), remote sensing weed surveys (McGowen 2001). Herbicide resistance management (Storrie 2000a, Sutherland 2002) summer crop weeds (Storrie 2000b) and allelopathy (Wu et al 2001a,b, Wu et al 2000) are also current areas of interest.

Communicating the results of research

One of the criticisms directed to researchers is that they fail to communicate results. Communication is however a two-way process. The receiver needs to want to know just as much as the sender wants to send. The innovations in this paper are published. Many of the innovations were reported at the 13th Australian Weeds Conference in Perth last year, and included in the proceedings. The 14th Australian Weeds Conference will be in Wagga Wagga NSW in 6-9 Sept 2004. Regional fora such as the North Coast Weeds Forum, and NSW Weed Society Seminars are also important. The Internet (eg http://weeds.org.au http://www.weeds.crc.org.au and http://www.agric.nsw.gov.au/weeds) and email discussion groups such as Enviroweeds (CRC Weeds 2003) have important roles. Local libraries should be able to obtain all the other published material.

NSW Agriculture is currently looking at better ways to deliver research results to clients such s local councils. One approach we have used is the formal training programs, and developing technical material that may be used in these programs. In response to requests we have for instance recommenced producing written publications. We are currently surveying users to find out what format they want information packaged.

Concluding remarks

The major message is that there is much going on- more than I can outline in this brief paper. The technology ranges from specific solutions to specific problems to new approaches which have long-term implications but little immediately available for adoption by weed officers. Seek out this information, use it and provide feedback.

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Biography

Richard Carter is the Program Leader (Weeds) for NSW Agriculture based at the Head Office in Orange and is also in the Cooperative Research Centre for Australian Weed Management. He leads a team of 24 weed scientists and 30 other weed management professionals located throughout NSW. He is also a participant in the Cooperative Research Centre for Australian Weed Management. He is currently President of the Council of Australian Weed Science Societies, a member of the NSW Noxious Weeds Advisory Committee and has numerous other National and State roles. He is perhaps more familiar in the former role of State Weed Control Coordinator where he lead the push for formal training of local government weed officers in Australia resulting in the Conservation and Land Management Training Package accredited in 2002. Previously he has held leadership positions with the SA Animal and Plant Control Commission and research and extension positions in South Australia. He holds tertiary qualifications in agricultural science, extension and natural resource economics.

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ENGAGING THE COMMUNITY IN WEED CONTROL - THE GIPPSLAND STORY

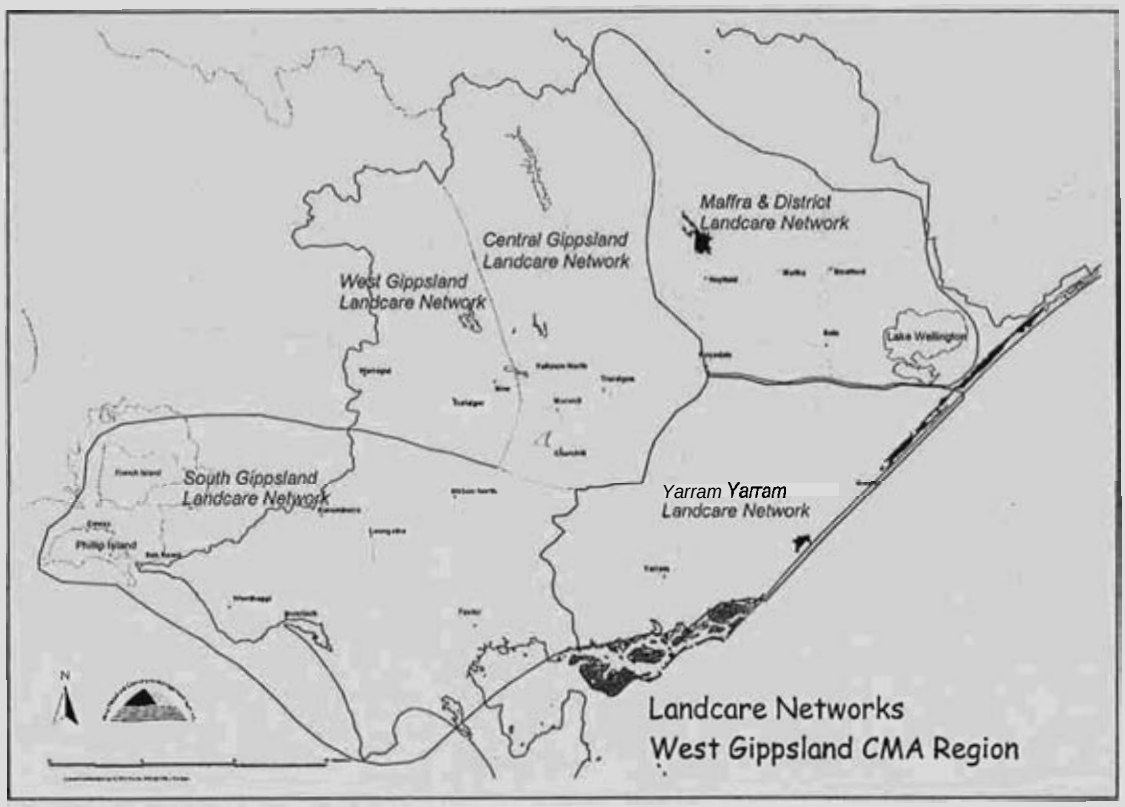
Erlina Compton
Landcare Coordinator
Maffra & Districts Landcare Network
Maffra, Victoria

INTRODUCTION

The Maffra & Districts Landcare Network is an amalgamation of fourteen Landcare groups that operate within the central Gippsland region of Victoria, Australia. The network area is approximately 300, 000 hectares and is made up of around 500 member families. Within the broader Gippsland area, there are eight Landcare networks that range in size from supporting between eight and thirty Landcare groups. Each of these Landcare networks have varying degrees of involvement in weed control programs which reflects their member group's level of interest in weed control, their area's level of weed problems and funding available to implement weed control programs. (Refer to Map below for locations of the Landcare Networks)

This paper will highlight how community engagement in weed control can be achieved through innovative projects that aim to empower the community to take ownership of weed issues within the region. A major example, the Licola Landcare group will be used to demonstrate how successful community engagement is paramount to achieving weed control on both private and public land.

Figure 1: Map showing the location of the Landcare Networks in West Gippsland, note the East Gippsland Landcare Network adjoins the Maffra & Districts Landcare Network to the east.



WEED MANAGEMENT FRAMEWORK IN VICTORIA

Before telling the Gippsland story, it is necessary to briefly context weed management frameworks that operate within Victoria. The Catchment and Land Protection Act 1994 (CALP Act) sets the legislative framework for pest plant and animal control in Victoria. The CALP Act states that all land managers are to prevent the spread and minimise the impact of noxious weeds and vermin on their land. The Department of Primary Industries (previously part of the former Department of Natural Resources and Environment) employ staff to enforce the provisions of the CALP Act. This includes providing extension services to community programs including Landcare and undertaking enforcement actions against landholders who fail to comply. In Victoria, Local Government's have little responsibility for weed control, other than to control noxious weeds and vermin on Council land. This is not to say, that Local Governments in Victoria do not play an important role in weed control programs in Victoria.

The CALP Act also sets out the framework for Catchment Management Authorities (CMA's) which are run by regionally based boards that represent the community on natural resource management issues. CMA's are entrusted to provide leadership and community direction for natural resource management in their particular region.

FUNDING FOR COMMUNITY WEED PROGRAMS IN VICTORIA

Landcare groups usually obtain funding from the State Government through the Second-Generation Landcare Grants program. Groups are able to apply for grants to implement on-ground programs, which provides funds for groups to purchase herbicides and equipment, conduct weed awareness programs and to employ community weed facilitators.

Funding for on-ground programs is also available through the State Government's Good Neighbour Program, which provides funds for pest plant and animal control projects on public and private land boundaries, such as roadsides, or national parks and reserves.

In recent years, the Federal Government has provided funding for Weeds of National Significance, although this has been delivered primarily through the Department of Primary Industries, rather than through community groups.

WEED PROGRAMS OF THE MAFPRA & DISTRICTS LANDCARE NETWORK

Of the fourteen Landcare groups, which make up the Network, five of them have weed control programs as their major focus. The following projects described below will later be used to demonstrate how critical it is to engage the community to achieve weed control success.

Macalister Landcare group roadside weed program

The Macalister Landcare group avidly promotes high standards of weed control in'their local area. Most members of the group are vigilant with weed control on their own properties, and often get frustrated with landholders who fail to maintain their properties to keep weed infestations under control, particularly on roadsides. In Victoria it is the responsibility of the adjoining landholder to control noxious weeds and vermin on roadsides, other than declared main roads, which are the responsibility of VicRoads.

In an effort to lead by example they undertake annual roadside weed spraying expeditions. This involves members taking to the roadsides as a convoy with spray equipment and spraying a series of roadsides in the district. The group usually sprays around 20 kilometres of roads each year. They select a different series of roadsides each year, depending on the level of weed infestation, targeting the heavier infestations first.

This program has resulted in a significant reduction in levels of Blackberry infestations on roadsides in the district. The group have raised awareness of weed control issues, recruited new members and "shamed" many landholders into improving their weed control efforts.

Weeds for Trees program

This program is a grant system that operates within the Wellington Shire and is a partnership between the Shire Council, DPI, Yarram Yarram Catchments Network and the Maffra & Districts Landcare Network. The Shire and DPI each contribute funds to the program, usually $7000 and $15000 respectively. The two Landcare networks provide staff time and community contacts to manage the program. The funds are used to provide herbicides and indigenous plants to landholders who apply to the program. Herbicides are used to control noxious and environmental weeds on Shire managed roadsides and the plants are used to "replace" the weeds with indigenous vegetation. The program aims to increase awareness amongst landholders of the importance of controlling weeds on roadsides and foster community pride in roadside management. In the two years that the program has been running the funding has been oversubscribed, and not all applicants have been able to obtain the subsidised herbicide and plants.

Local Area Weed Plans – the Licola and Maffra Foothills examples.

The Pest Plant and Animal program of the DPI Gippsland region have been developing what is called "Local Area Plans" (LAP) with various communities in Gippsland. These plans have been initiated by DPI staff who have met with local communities and developed a document, which provides a clear policy and standard of weed management for a given local area. These LAP's are documents that are usually around 30 pages in length. The intent of the plan is to provide local communities, government and other land managers with a set of clear and concise policies, actions and priorities for noxious weed management within a designated local area. (Harman, G. 2002) During 2002 it was decided to approach the communities of the Maffra & Districts Landcare Network region and develop LAP's. Land use, catchment boundaries, weed issues and social boundaries usually determine the boundary of a Local Area. Generally the boundaries are determined with minimal community consultation, and to the discretion of the staff of the Pest Plant and Animal Program. It was decided to develop a LAP in the Licola area and another in what was called the Maffra Foothills. The remainder of the area within the Maffra Landcare region was broken up into Macalister Irrigation District Local Area and Red Gum Plains Local Area (See Map below). It is important to note that these Local Areas did not include public land, and only really focused on weed management on private land.

Once the boundaries were established, the consultation process began with a series of public meetings held across the Local Areas.

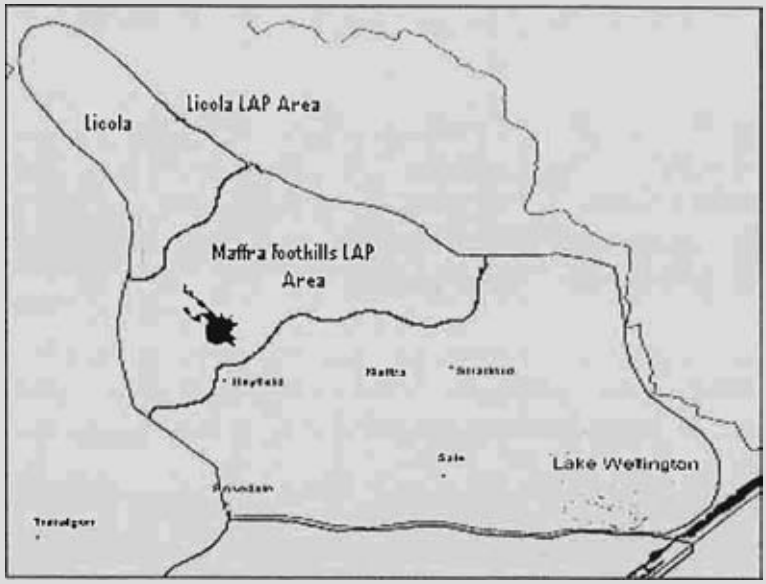


Figure 2: Map of Maffra & Districts Landcare Network area showing the boundaries of the two LAP areas.

Licola LAP

One public meeting was held in Licola, where the community was'informed of the opportunity to develop a LAP, and what it may entail, The meeting agreed to go ahead with the plan, however this was not achieved without a great deal of conflict. The most common issue raised by landholders was that of weed control on public land. National Park and State Forest surround all of the freehold land in Licola and the management of pest plants and animals is a serious, ongoing concern for the community. All the people present at the meeting (Licola is a small, distinct community of around 12 landholders, with the Landcare group being the major community group) became members of a community reference group for the Licola LAP.

One meeting of the reference group was held, where all of the noxious and some environmental weeds that were found in the Local Area were given a priority rating by the reference group. Criteria used to determine the weed's priority was developed by the DPI staff member coordinating the LAP development. The criteria included the potential to eradicate the weed, level of infestation, and its importance to agricultural production.

A draft plan was then written by the LAP Coordinator and sent out to members of the reference group for comment.

The Licola reference group reacted negatively to the draft, and a series of letters were sent to the LAP Coordinator relaying the disappointment of members in the contents of the draft. After another meeting and much telephone negotiations and discussion between the community members, Landcare Coordinator and the LAP Coordinator the community decided to write their own weed plan and rejected the one written for them. The major concerns of the community were that the plan failed to include public land pest management, and that the policies in the plan only applied to the freehold land managers.

Maffra Foothills LAP

Several meetings were held in various locations throughout the Maffra Foothills Area to ensure that community members were given an opportunity to be involved. There are 4 small towns within the Local Area, with hundreds of farms ranging from hobby farms to farms up to 1000 hectares.

The public meetings at all locations concluded that a LAP should be developed. A reference group containing representatives from each of the Maffra Foothills public meetings was formed.

As with Licola, a meeting was held to determine the priority weeds, and then the LAP Coordinator wrote a draft plan, which was identical to the Licola LAP, except for the priority listing of weeds, maps, and a few paragraphs of local information.

The Maffra Foothills LAP reference group held a second meeting, and members had similar concerns to the Licola group, however they accepted the plan and it was publicly launched sometime later. The LAP has not since been used to develop any further weed programs.

LAP's have since been developed in other areas of Gippsland without the conflict of the Licola LAP, however discussions with people involved indicate that similar concerns are still present.

Licola Landcare group weed plan – the aftermath

Following the Licola community's decision to not adopt the LAP, the Licola Landcare group (all the same people who formed the reference group) decided to write their own weed plan. They wished to have a one page plan that listed all of the weeds found in the area, both on private and public land, with a local policy for their control, which would include details on requirements for all land managers for levels of weed control. A draft plan has been written, which is currently awaiting the group's re-inspiration to complete it. The group became severely divided during the LAP process with several community members not speaking to one another. Since all the dust has settled, the group has come together again and is now developing a weed display for the Licola information bay. They have been successful in attracting funds from the Second Generation Landcare program to have the display professionally produced. The group now discuss each priority weed at meetings and share with each other what actions they are undertaking on their land to control them. The group is now ready to engage with the various public land managers to further develop their display and weed program.

CROSS NETWORK PROGRAMS BETWEEN THE MAFFRA & DISTRICTS AND EAST GIPPSLAND LANDCARE NETWORKS

The Maffra & Districts and East Gippsland Landcare Networks jointly manage the African Lovegrass & Serrated Tussock program, which is based on the *"Strategy for the Control of African Lovegrass in the Gippsland region"*. (Aberdeen Consulting, 1998). The program obtains funding from Second Generation Landcare to employ a facilitator to work with private and public land managers who have African Lovegrass or Serrated Tussock infestations.

The facilitator visits infested properties, develops control plans with the landholder, provides herbicides as an incentive to undergo control works and maps infestations. The facilitator also works with local government and VicRoads to improve control and minimising the spread of these weeds on roadsides via slashing and road grading. Community field days and newsletters and media reports are ongoing and raise the profile of these two important weeds.

The ownership of the program rests with the community-based steering committee, which is made up of Landcare representatives from both networks, local government, Vic Roads, DPI and Catchment Management Authorities. The success of the program depends on the partnerships between the various organisations involved, and the enthusiasm of the two Landcare Networks in ensuring its implementation within the community.

COMMUNITY ENGAGEMENT – WHY IS IT SO IMPORTANT?

What does community engagement actually mean? According to Fawcett et al., (1995 in Centers for Disease Control and Prevention (CDC), 1997), community engagement is "the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well being of these people. It is a powerful vehicle for bringing about environmental …. changes that will improve the…community. It often involves partnerships and coalitions that help mobilise resources and influence systems, change relationships and serves as catalysts for changing policies, programs and practices".

Why do we need to engage with the community to achieve success in weed control? Why can't Government departments just manage public land according to their policy of the day, and enforce the relevant Noxious weed legislation when required? Why do we need the community to be involved and empowered? There is a range of literature available on the study of community engagement and all that it entails. This literature provides supporting evidence on the value of community engagement. Chavis et al (1990, pg 56 in CDC, 1997) state that community participation is "a major method for improving the quality of the physical environment". The literature also finds that "the real value of participation stems from the finding that mobilising the entire community rather than engaging people on an individual basis or not engaging them at all, leads to more effective results" (Braithwaite et al., 1994, in CDC, 1997). In addition, when we wish to achieve change in the way things are done, "change is more likely to be successful and permanent when the people it affects are involved in initiating it and promoting it" (Thompson et al, 1990, pg 46 in CDC, 1997). In summary, the literature supports the notion that engaging with the community whether it be in weed control, health improvement or something else is essential to achieving positive and long lasting change and greater benefits for more people and landscapes.

The example given of the Licola Local Area Plan highlights how engaging with the community is necessary to achieve weed control outcomes. By failing to successfully engage, the DPI are now regarded with hostility by the community and they are less likely to be able to successfully implement other departmental programs in the community.

PRINCIPLES OF SUCCESSFUL COMMUNITY ENGAGEMENT

As with the reasons for engaging with the community there is similarly a great deal of literature available to **guide** us on **how** to do it – how to actually engage with the community successfully. The Centre for Disease Control and the Agency for Toxic Substances and Disease Registry's Committee for Community engagement based in Atlanta, USA has developed a set of community engagement principles (CDC, 1997). These principles are based on collection of literature knowledge and practical experience. These are as follows:

1. Be Clear about the purposes or goals of the engagement effort, and the populations and or communities you want to engage.
2. Become knowledgable about the community in terms of its economic conditions, political structures, norms and values, demographic trends, history, and experience with engagement efforts. Learn about the community's perceptions of those initiating the engagement activities.
3. Go into the community, establish relationships, build trust, work with the formal and informal leadership, and seek commitment from community organisations and leaders to create processes for mobilising the community.

4. Remember and accept that community self-determination is the responsibility and right of all people who comprise a community. No external entity should assume it can bestow to a community the power to act in its own self interest.
5. Partnering with the community is necessary to create change and improve the community's well being.
6. All aspects of community engagement must recognise and respect community diversity
7. Community engagement can only be sustained by identifying and mobilising community assets, and by developing capacities and resources for community decisions and action.
8. An engaging organisation or individual change agent must be prepared to release control of actions or interventions to the community, and be flexible enough to meet the changing needs of the community.
9. Community collaboration requires long term commitment by the engaging organisation and its partners.

The Licola and Maffra Foothills LAP is an example of an attempt at community engagement by a government department, in partnership with the Landcare network. The intent of the engagement activity was ethical, honest and genuine. For a range of reasons, some of them direct failures to apply the principles of community engagement, the other reasons being far more complex and long standing historical community cultural issues that are beyond the scope of this paper, the attempt was not highly successful. For example, the engaging organisation (in this case DPI) was not prepared to release control to the community. In this case it was the contents of the plan, which when questioned by the community who were supposed to be the owners of the plan would not be changed or given to the community to control. In the case of the Maffra LAP, which has been completed and left to the community to work with, there is no long term commitment provided by DPI as is required as stated in principle 9. When DPI initiated the engagement process, attempt were made to apply principles 1, 2 and 3, however due to the complex nature of the community, the already high level of mistrust held by the community for the department, this process was only completed to a minimal level. The failure of the Licola LAP was certainly only partly due to the engagement process. It was also due to the community itself, as mentioned above the level of trust that the community had for the department was low, and the culture and complexity of the community and long standing historical factors also played a major role. I do believe though that these issues could have been overcome if all principles had been applied to the process. The department is limited in its ability to apply all these principles. This is because at the end of the day, they are the body enlisted with the responsibility to enforce the provisions of the CALP Act. This is a difficult task, if the same people are also expected to engage with the community according to the ultimate set of principles which involves trusting and harmonious relationships.

What about the other examples of Landcare weed programs given in this paper? How do or don't they apply these principles of community engagement? Unlike the Licola and Maffra Foothills LAP examples these programs are not all the direct result of a community engagement effort by an external organisation.

The Macalister Landcare Group is an example of community engagement being undertaken by the community itself – or rather a part of the community as Landcare can by no means be described as "the community". In this example the Landcare group is the entity undertaking the community engagement. However the principles of successful community engagement can still be applied. Principles 1, 2, 3, 4, 5, 7 and 9 have all been applied by the Macalister Landcare Group in their efforts to engage the community in weed control. The members of the group understand the purposes of the engagement effort – to raise awareness of weed control issues, and improve levels of weed control in the district.

They also have an intimate knowledge of the community, they don't need to go into the community, they are already a member of the community. The group leave it up to their members and the wider community to choose to participate or not, they do not expect all people to become involved. The group certainly mobilises community assets by utilising shared equipment and skills. They also have long-term commitment to the project as the Landcare group is in it for the long haul. The shortcomings of this particular group are that they sometimes do not respect the views of some people who may not believe in controlling noxious weeds, and the group tend to hold onto control of the actions of the program rather than release them to the community. They decide which roads to spray, when to do it, what to use, however they do open up the process to the entire community and undertake the program for the benefit of the community and the environment as a whole.

The Weeds for Trees program is being undertaken by an external organisation, a partnership between two government bodies and two community based organisations. The program provides an incentive to community members to be involved, by providing herbicides and plants. The program defines the community boundaries as the Wellington Shire area, it does not have a detailed knowledge of the community, but then the level of engagement required by the program is minimal, as it only asks people to control noxious weeds on their roadsides. It could be said that the program can afford to not apply the principles, as it relies on incentive funds to gain community support, and does not ask a great deal of the community it engages with. By the same token the program also engages with the community via its partnership with the two Landcare networks. This association has allowed the two government bodies to effectively "skip" applying many of the principles, as they have already been applied for many years by the Landcare Networks.

The final Landcare program, the African Lovegrass and Serrated Tussock project of the Maffra & Districts and East Gippsland Landcare Networks originated from Department of Primary Industries engaging the Landcare networks to be the leader in implementing the program in partnership with other government agencies. The departmental staff worked in partnership with the representatives of the Landcare network to seek funds to employ a consultant to develop the "Strategy for the Control of African *Lovegrass* in the Gippsland *Region"* (Aberdeen Consulting, 1998). The strategy identified the need to employ a facilitator to assist in its implementation. Once again the Department engaged with the Landcare Network to seek funds to employ a facilitator. Over the four years that the program has been in operation, the Landcare networks and Departmental staff have worked closely, whilst the Landcare Network always retained ownership of the project. The result of this effort in community engagement has meant that the Landcare Network has had ongoing support from the engaging organisation. They have been able to mobilise resources within the community, enlisting support from many volunteers. The network has been able to have control of actions, and in turn they have engaged with other organisations and the wider community including Landcare groups and landholders. They have been able to apply the principles of engagement themselves, therefore growing the entire project in both life span and level of success.

PARTNERSHIPS – THE KEY TO SUCCESS

Behind every successful community weed control effort, there is usually a partnership on which it is built. One of the principles of community engagement is partnerships. Partnerships are stated in the literature as helpful in a number of ways, including "maximising the influence of individuals and organisations, exploiting new resources and reducing duplication of effort" (CDC, 1997). Although each of the weed control programs discussed above all exhibit partnerships, the example below illustrates just how forming partnerships with the community and government can achieve success on the ground, this time in pest animal control.

An example of a major partnership for Pest Animal control - The Munro & Longford Landcare Groups Rabbit Control program.

The Munro Landcare Group had been concerned about the rabbit infestations along the road reserve of the Princes Highway for a long time, but had put the problem in the too hard basket. Vic Roads are unable to use 1080 poison on the road reserve as it poses a high public liability risk for accidental poisoning of non target animals such as domestic pets.

In late 2000, the Landcare group decided to approach DPI and Vic Roads for help, which resulted in a joint program between with landholders along this stretch of the Princes Highway.

It was decided to lay 1080 carrot trails on private land adjoining the Princes Highway. This would then avoid the risk of liability, whilst still targeting the rabbits on the road reserve that were frequenting the adjacent private land and causing problems.

Vic Roads agreed to pay for the carrots and poisons, while DPI agreed to lend bait layers, cut and poison the carrots and supervise the bait laying. All the 16 landholders along the section of highway were contacted and all were willing to participate in the program by laying the baits on their property. The program was undertaken over a week long period.

Parks Victoria also joined in and baited the western edges of the Providence Ponds Reserve adjoining private land in the area. **A** total of 18 km of highway frontage and 7 km of reserve were baited during the program.

The program was a great success, landholders reported a huge drop in rabbit activity in the vicinity of the highway. Vic Roads followed up with some warren control works. The program has been repeated now in other areas, over the last 3 years.

CONCLUSION

This paper has attempted to tell the story of the efforts to engage the community in weed control in the Maffra & Districts and East Gippsland Landcare Network areas, both successful and not so successful. In order to achieve success with weed control programs, it is essential to engage with the community successfully, and form mutually beneficial partnerships.

The Landcare Networks in Gippsland will continue to strive for success in weed control and will continue to build partnerships with other organisations and key players, particularly the State Government. We hope to move forward and learn from the mistakes of the past and engage with the community that we so need to be working with by our side.

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Biennial Noxious Weeds Conference, Taree, 2003
Chris Dewhurst, Bushcare Coordinator, Blue Mountains City Council

"Community Groups as the Nucleus for Co-operative Land Management"

This paper presents the outcomes of the Blue Mountains Bushcare Program. A project which has the goal of conserving the natural resources of Blue Mountains urban reserves- by coordinating and facilitating the energy of the local community. These are observations on development of an effective partnership between local government and the community. The Bushcare Program is a true symbiotic relationship that has layers of positive benefits for both sides.

What is Bushcare?

Bushcare is community volunteers working in, learning from and sustaining their local bushland reserves. This is done principally through the control of weeds using the techniques of bush regeneration. Moreover, it is the sharing of responsibility for the management of public land between Council and the Community. Council may resource the group, but it is the community group that becomes the true steward of the reserve.

The Blue Mountains Situation

The Blue Mountains environmental and demographic framework from which to manage is a ribbon development of 82,000 residents within a World Heritage National Park. This creates an urban / bushland interface of 680 km. Hence most weed invasion occurs via stormwater channels and edge effects. The increases in population and bushland impact over the last ten years has spurred on a lot of the energy which feeds into the Bushcare Program.

History of the Bushcare Program

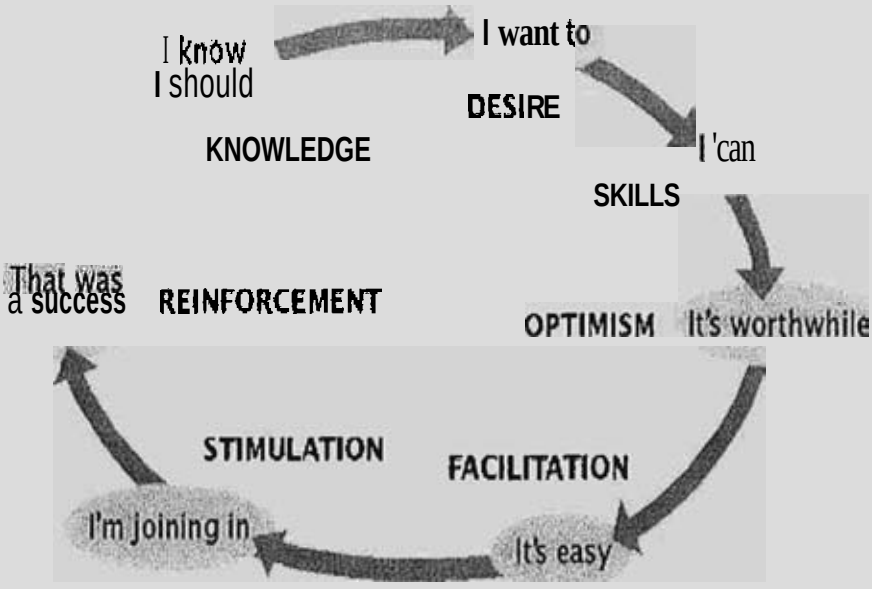
The Bushcare program in the Blue Mountains has its origins in the activities of early groups which commenced activities in 1989. It became evident to these pioneering volunteers that they lacked information, technical guidance and a sense of coordination. They approached local MP's, Council staff and their neighbors to enlist further support. Their lobbying pressure brought them success in 1992 when Council first employed a "Bushland Management Officer". Over the following years the group numbers steadily increased, The success of each one being a stimulus to start another elsewhere. There was a sense of community establishing amongst the volunteers and the "Bushcare Network" was formed. Council could see a need to focus on the direct coordination of this program, and in doing so coordinate its land management. In 1995 a dedicated Bushcare Officer position was created to assist the development of existing groups.

The Bushcare Program very much grew out of the community and Council responded to that energy by providing consistent resources to the program. The Bushcare Groups were beginning to get on top of some major weed explosion issues in their reserves. And this would have taken years by traditional funding means (such as noxious weeds or bush regeneration teams) to achieve otherwise.

Currently the program has 46 groups and 500 active volunteers. These are coordinated by one full time officer and three part-time officers. The total budget for the program is $164,000 annually. This is mostly wages. Projects are often carried out by seeking external grant funds.

Newly emerging in the last 12 months has been our Landcare Program. It is the activity of Bushcare, but on private land. Approximately 15,000 hectares of bushland in the Blue Mountains is on private land, we have around 5,500 hectares in public ownership. Many Bushcare Groups could make the clear link to surrounding private land infested with weeds above their sites, creating a continual source of re-invasion. Numerous landholders seeking to improve their bushland backyard were also contacting council. We began to facilitate this energy and the Landcare Program was born.

The Seven Doors Model – how it works for us.



The 7 Doors Model identifies key factors in a program which build community support and involvement. After becoming aware of Les Robinson's model and applying it to our program, we realised many of the aspects of the Bushcare Program, that developed over its ten year history were being represented by the theory.

The model basically represents a cycle of facilitation. A way of attracting people into the program, training them and retaining them. This is followed up by reinforcement of success and value.

The first step in the cycle is to **Develop Knowledge** within the community. The program seeks to raise awareness about weed issues and the impacts of living near the bush. We achieve this through a combination of many activities but the strongest elements are :

Weeds of Blue Mountains Bushland booklets which are distributed through libraries and Council offices **.** The booklets identify the major weeds in the region with colour photos and descriptions and contain very clear instructions and diagrams on how to control them.

Street Stalls which are held throughout the year in different townships. These displays focus on local bushland issues and weeds . They are always manned by volunteers from the local groups and their Bushcare Officer. Often also with the addition of representatives from other agencies concerned with bushland in that area (eg NPWS). We found that these events stimulate interest and attract people into the program.

Once the seeds of knowledge have been planted in peoples minds, they will begin to see the problems in their area and appreciate the impact weeds can have out natural environment. The next step is create the **Desire** within them to do something.

Through activities like interpretative workshops looking at the bush in their area with a Bushcare officer, or introduction to existing Bushcare / Landcare groups in their area they are taken into the bush and shown the issues first hand.

Working with an established group also introduces individuals to the Bushcare community. This reinforces the message that they are part of an active and committed movement, which the work they do in the bush at the end of their street will be a part of.

New groups do have to fulfill some basic criteria to ensure that valid conservation outcomes will be achieved.

Once people are involved they need to develop **Skills** so that their work will be effective and satisfying.

The main way we do this is through the supervision of a fully trained and experienced Bushcare Officer. All Officers have as a minimum TAFE Bush Regeneration Certificate, a comprehensive understanding of Blue Mountains ecosystems and previous experience working as a professional Bush Regenerator .

Bushcare Officers provide consistent support and training on work days which is the main way volunteers develop their on-ground skills.

The Bushcare Network also runs specific Workshops to develop knowledge in any special area which the Bushcare community has identified they want to know more about.

There is a quarterly newsletter - the Gecko, which goes out to every volunteer. In this there is usually a short article on some pertinent issue. For example our current issue addresses fungi.

The Gecko also keeps people and groups connected with stories on achievements of various groups and upcoming events around Bushcare issues.

So we've got them involved, they're developing some skills now it's important to nurture a sense of **Optimism** to maintain the enthusiasm. Good on ground results builds confidence within the group and reassures them that their work is worthwhile. Well maintained tools, regular supervision and the development of site specific work strategies ensure that volunteer work is as effective as possible. These are really important to achieve good results.

When a group is just starting I often hear initial skepticism "This going to take so long, how will the bush come back by itself'. Just as often a few months later I hear those doubters saying ‘‘ Hey, this really works!!"

As well as building confidence and optimism the other key factor is to make it easy.
It is important to provide a framework groups can rely on so that all the volunteers have to do is turn up. To this end, groups can rely on regular workdays (the same time every month) the same Bushcare Officer to work with them every time and the provision of all tools they will need. BMCC staff also take care of all the paperwork. Insurance is provided and grants are administered through Council. In other words we **Facilitate** Convenient Systems which volunteers can rely on.

To **Stimulate** confident and continuing participation we think it is important to provide support for growing and learning new skills which can be daunting. Good Relationships within groups and with the Bushcare officer create an atmosphere of trust.

This allows people to expand their skills and knowledge. The volunteers can rely on the expertise of the Bushcare Officer to give guidance (and sometimes resolve disputes).

The Bushcare Officers must allow and nurture volunteers to learn from their experiences on their site. This may involve at times allowing volunteers to learn from their mistakes and often from their successes. So we're not too pedantic about exactly how to do things. On the other hand we gently reinforce the basic rules. They know we won't allow any damage to occur either.

And then there's the really fun bit. **Reinforcement,** also crucial for long term success. Apart from congratulatory articles in the Gecko and sometimes in the local paper to celebrate specific successes of individual groups. We have a big Thank-you party every year. The Bushcare Picnic has become a Blue Mountains institution. Council provides all the food and drink (we hardly ever run out of beer). We do all the cooking and work and the volunteers just turn up and have a good time. The Bushcare folk band always plays and there's games for the kids. The Mayor or some such eminent person presents awards for everything from the best morning teas to the hardest working volunteer. This sort of event is really important for bringing people together and making them feel really important and valued.

Outcomes of the Program

Improved Health of Ecosystems

The central goal of the program is to improve the **health of our local ecosystems.** We have restored approximately 600 hectares of land in the past decade. This is achieved primarily as the result of long term commitment to sites. More than any other factor, the success of an environmental project is its perpetuity. This is ensured by an enthusiastic and caring bunch of volunteers more than any other ingredient.

Education

Our **education strategies** are also imperative to the success of our program. They are our primary tool of promotion. It gets people to the sites, and gets them employing group supportive practices in their own garden.

We have so far distributed 30,000 weed booklets and developed an internet site that generates 450 hits a week. Yet all of these initiatives have involved volunteers at every point. From developing the concepts, providing content to actively distributing the material to their neighbors and other residents. A recent survey of an entire sub catchment which had three very active Bushcare Groups revealed that 85% of that community was aware of environmental weed issues and were willing to actively do something. This success is testament to an educational partnership between council and community volunteers.

Improving Social Fabric

Bushcare projects help develop a **sense of connectivity** amongst the community. A network. They inject a sense of positivity into peoples lives as they can see the results for their efforts. And in our increasingly globalised and mass-market culture they help to restore a person's connection to the land

Cooperative Land Management

As public servants working in land management, we tend to see the world as divided up by land boundaries and differing tenures. Bushcare volunteers just see things as bushland. As whole systems. They push for the land to be managed in this way, and as a result get our different authorities working together quite effectively.

They are a knowledgeable and confident community. And they are a recognized key stakeholder because of their long involvement of working on public land. They are also part of a wider conservation network. These factors make them a very powerful lobby force on all land mangers, constantly trying to prod them in the direction of best practice.

The Bushcare Groups are also a proven resource that gives an on-the-ground guarantee that regeneration will be successful in the long term because it will be followed up.

A concrete example of how this all works is the Leura Falls Catchment.

1 = Private Land

2 = Bushcare Group worksites (Council Land)

3 = Small Contract (Council Land)

4 = Large Contract (Council Land)

5 = Council Bush Regeneration Team (Council Land)

6 = Specialised Contract (National Parks Service Estate)

This area is known habitat for three species scheduled as Threatened under NSW and Federal legislation and also has Hanging Swamps. A regionally significant vegetation community.

The top of the catchment is the transport corridor of road and rail. Then private land. The middle is Council managed. The bottom is World Heritage National Park.

Each number on this map represents a different activity and a different funding authority. They have all been prompted in one way or the other by the original Bushcare group. Still working there after seven years.

The conservation outcomes of this example of cooperative land management have included:

- The habitat for three Threatened species and a regionally significant plant community have been protected and restored
- The in-stream habitat has improved with sediment and weed control works
- There is reduced downstream impacts on the national park
- The "protected area" has expanded out of our reserves and into private land via the Landcare group
- And there has been community and social pressure on upstream landowners including state rail, the Roads and Traffic Authority and private landowners to lift their game in relation to land management

Conclusion

In conclusion I would like to make the following points. A successful community program has to be citizen driven but Council supported. But there are a number of "doors" that the management authority can open to make this happen more effectively. Once a good program gets established there will be a very lively core from which cooperative land management can occur.

THE CULTURE UNDERLYING WEED CONTROL

March 2003-04-03

Presented by John Stockard

Preamble: the 'culture' underlying weed control

To the observer making their way around the countryside, weed control appears almost non-existent; roadsides, easements, the visible boundaries and drainage lines of private properties support profuse infestations of both noxious and environmental weeds - with apparent impunity. State legislation appears to reinforce the complacency - as soon as the problem is big enough downgrade it to W4 and it will go away. Meanwhile, our natural heritage is increasingly blanketed out of existence. Control authorities are helpless to amend this situation given the traditional approaches and the budget constraints. How can we change the situation fast ?

Fast, because along the east coast of Australia waterways are threatened by choking, aquatic, vine and woody weeds which destroy canopies and deoxygenate water. Through coastal plains the riparian zone is the principle habitat corridor and reservoir of biodiversity. The complete degradation of this key zone is inevitable without reversing weed smothering. **1.**

Meaningful action needs to address multiple factors - public perception of weed threat, responses from relevant government agencies, limited expertise along riparian zones, logistics of mobilising community resources on the scale required, financing, a maintenance regime that is self sustaining and easily enforceable, community awareness/skill heightened to promote ongoing **action.** The barriers to action in this region are set out below.

The evolution of the present 'culture'

- Weed spread appears to be out of control and beyond scope of individuals and control authorities, resulting in apathy.

  Insufficient funding for trained weed control specialists.

- Volunteer efforts (both landholders and community groups) have been ineffective - on too small a scale, no mechanisms for ensuring ongoing response (volunteers especially), lack of monitoring of maintenance elsewhere. Unless securely placed within the framework of a wider workable strategy, volunteer efforts fail and waste accompanying resources.

- Landholders not undertaking weed control do not face reprisals for non compliance.

- Lack of weed control by some individuals de-motivates others who want to comply.

- A range of situations can prevent landholders from controlling weeds, e.g. unaware, untrained, family breakdown, absentee ownership, sick, elderly and/or poor.

  Lack of experienced, skilled weed controllers with knowledge of integrated systems who can design practical regimes within a property plan framework..

- Weeds considered by many as only an 'aesthetic' problem because the environmental impacts are not widely appreciated.

- Authorities/agencies find enforcement difficult when they lack resources to manage weeds on their own territory: local government typically affords only one weeds inspector, a few contractors.
- Community education programmes are costly and often ineffective, particularly when these are 'passive' programmes, i.e. brochures, posters, TV ads, announcements.

A 'chicken and egg' conundrum: the history of our present situation

Early weeds staff weren't adequately trained to prepare evidence for prosecution. Local government, by close contact with its constituency is often reluctant to take unpopular action. Inadequate funding for weed control compromises weed inspectors. Councils often responsible for spread of weeds via council roads. Inspectors appreciate the dilemma of landholders in (above) - the poor, sick, elderly, or enforced absentee, who can't cope against escalating problem, and/or acquired infestations from others.

These administrative processes have created complacency not only in the control authorities but in the community. Result ? - almost no check on the exponential growth of weeds and bigger infestations beyond the capacity of agency or individual. Weed ratings are thus downgraded while still uncontrolled and prosecution almost impossible because no one can afford to act (comply).

This conundrum situation has worked its way into the culture of planning. Lack of consistent enforcement across natural resource management, generally, has resulted in a climate wherein compliance (action) is frowned upon within the planning process. In regional planning documents currently being developed state-wide, the repetitious terms 'voluntary', 'willing' and 'participating landholders' are indicative of the culture, as if we can afford to take our time over these issues while 'encouraging' people to respond to best practice.

The absence of compliance as a prerequisite for the successful outcome of these plans renders them less valuable, approaching uselessness.

Public Perception: 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 landholders 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 compliancepossible is fundamental. The means by which action can take place, economically and physically, needs to be provided. In the Strategic Perspective for Securing Healthy Coastal Rivers the commissioner states, "In many instances, it is abundantly clear that weed infestations are far beyond the management capacity of local authorities and landholders." He recommends, "Here and elsewhere, the public interest dictates rapid development of a strategic approach that would inevitable involve the application of considerable public resources to supplement those of the local council and landholders." 2.

What's being done to counter the threat posed by environmental weeds to the North Coast ?

Joint agency/community projects: In summary these are not co-ordinated regionally and the majority do not systematically address vine (& other) weeds **at source** on either public or private property. See footnote **3.**

Regional Weeds Advisory Committees: In recent years the N.S.W. North Coast Weeds Advisory Committee established the Environmental, Bitou and Camphor Laurel Weeds Task Forces to address the spread of environmental weeds. Progress was made in the establishment of the Bushland Friendly Nursery Scheme, a Camphor Laurel Control Handbook and regional and draft regional control plans for numerous weeds threatening native vegetation, with view to later declaration.

Relevant regional weeds advisory committees have been attempting to 'get a handle' on the problem, so it's understandable that no action plan exists yet to deal with the threat of environmental weeds generally or riparian zones specifically. To date funds for such a purpose are no -existent.

In weed planning organisations there is still no overriding (regional) strategy for the riparian zone.

North Coast Catchment Blueprints: The management targets, actions and rationales set out in these blueprints for pest species, generally, and environmental weeds, in particular, are analysed in footnote 4.

Although references are sometimes made to sub-catchments, targeted reaches and removal of the threatening process of *ineffective* management of environmental weeds and pest species, no specific integrated programmes are articulated.

With only one exception, the **first three priority actions** of the blueprints are either assessment, reports, research, monitoring or community capacity building in the form of advisory personnel. Despite the escalating destruction of riparian native vegetation, and the narrow window of opportunity for control of these infestations, this issue is not given 'a priori' status.

The north coast catchment blueprints therefore fail to adhere to the precautionary principle (of sustainable development): **if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures** to prevent environmental degradation.

Where blueprints *do acknowledge* the priority nature of weed invasion, their *targets* and *management actions* do not outline **how** control can be achieved. The cultural barrier of acquired community inertia hasn't been acknowledged and the need for an inter-dependence of simultaneous minor strategies within an overall plan hasn't been identified. The scale of the problem and its exponential escalation isn't broached. A common target of the blueprints, *riparian rehabilitation* (with or without reference to *high conservation* or *targeted upper reaches),* isn't strategic if it fails to spell out that an all inclusive, co-ordinated and ongoing programme for control of riparian weeds is the first step required for this rehabilitation.

Without *a clearly articulated strategem,* targets for riparian corridor preservation/restoration and native vegetation conservation are doomed.

Other authorities: The Healthy Rivers Commission consistently notes the urgency and the problematic nature of the weed threat, its likely impact on environmental flows and biodiversity, and recommends a more explicit and strategic approach to the issue. *"Independent Inquiry into the Hawkesbury Nepean River System, Final Report August 1998" Aquatic Weeds and River Health Section 13.*
"Noxious weeds, environmental weeds and some exotic plant species are adversely affecting the river health throughout the catchment. In some locations, the weed infestation is severe enough to negate, to varying degrees the potential river health benefits of improving water quality and/or providing environmental flows."

"Independent Inquiry into the Shoalhaven River System", July 1999 Section 10.3.2: "A new framework for weed management". Recommendation 4.1 Weed management should be explicitly addressed in all vegetation management strategies, on a catchment wide basis."
Recommendation 4.2. "Particular attention should be paid to the development of a more strategic approach to weed management."

When the H.R.C. gets to the North Coast -*"Independent Inquiry into the Clarence River System", November 1999* Section 13.2.3. "Weeds: Application of the recommended framework in the Clarence"

"The diversity and vigorous growth of weeds...is significantly influenced by the warm moist climate that prevails along the NSW North Coast, **making the need to manage weeds an imperative and a significantly more difficult task** than previously encountered in the Commission's inquiries" (Note: A situation prevailing also in the Lower North Coast).

"The Commission has been advised of specific situations in which **the incursion of weed within riverine corridors and instream, could limit the benefit of implementing other measures to improve river health,** including providing environmental flows." (Again a situation existing and exponentially increasing in the Lower North Coast)."

"Securing Healthy Rivers: A Strategic Perspective, April 2000
Summary of *"Weeds", p.13*: "Despite significant current efforts, there is no overall framework for managing weeds as modifying elements of vegetative or water based ecosystems. Weeds continue to encroach on land and enter and infest water systems throughout coastal rivers. As a result, large tracts of catchment land have become significantly modified and will remain so for the foreseeable future.

In many instances it is abundantly clear that weed infestations are beyond the management capacity of local authorities and landholders…Here and elsewhere the public interest dictates rapid development of a strategic approach that would inevitably involve the application of considerable public resources to supplement those of the local council and landholders."

'North Coast Rivers. Independent Inquiry into North Coast Rivers', Draft Report Nov, 2002
During production of this document the Healthy Rivers Commissioner wrote to Dr R. Sheldrake, Dept. Agriculture, about the concerns raised during the enquiry into the impact of both vine weeds and Camphor Laurel on river health. The cornrnissioner made **reference to vine weeds in the riparian zone being regarded as an 'emergency river health issue'** because they are "destroying pristine riparian areas even those with mature canopies" and to the call for "riparian re-vegetation programs to be placed second to managing riparian vine weeds as they may become impossible to eradicate if action to contain them is delayed. Finally the cornrnissioner states, "The Commission is supportive of calls for a wholistic approach based on affected subcatchments to be incorporated into Catchment Blueprints and actively implemented by regional weed management groups."

What then should be our primary objective ?
Full control of priority species at source from commencement along drainage lines extending on a contiguous basis from property to property down the length of any given sub-catchment.

How can community and government resources be mobilised to achieve this ?
Via a 'blueprint' or 'model' implemented by a joint task force for application across the entire North Coast region.

Strategic Weed Control Pilot Programme

1. Top of catchment downwards integrated weed control within sub-catchment units
* Weeds advisory committees use weed maps to pinpoint sources of infestations.

2, Noxious weed declarations at sub-catchment level ensure full participation
* agencies and landowners work together at this sub-catchment level.

3. Skilled contractors and work teams available to assist/train landowners with best practice.
* Revegetation/restoration integrated with weed control.

4. On site training generates a skilled workforce
* Conservation and Land Management Traineeships deliver training in National Competencies for Integrated Weed Management.

5. Initial focus on riparian zone widens to include integrated paddock weed control incorporating sustainable grazing regimes.

This pilot project can be developed in phases.

Stage 1: Urgent on ground weed control with provision for stock exclusion/control within a year, via allocations already nominated in all of the North Coast blueprints.

Stage 2: Medium and longer term parallel actions form the context within which the strategy works. Aspects of these essential components are recommended in other broad strategies; but not as interlocking components of one integrated strategy. They are:

- formal & 'community' education & training (with a participatory component).
- arrangements between participating authoritieslagencies for an efficient equitable compliance/maintenan system
- securing a long term funding base to combat a 'generic' north coast problem so that riparian rehabilitation takes place with ongoing maintenance.

Why is this Strategic Weed Control Pilot Programme likely to succeed? Because it addresses in a systematic fashion the barriers that stand in the way of the primary objective, i.e.
Full control of priority species at source from drainage lines extending on a contiguous basis from property to property down the length of any given sub-catchment.

Problem or barrier	**Solution**
weed spread out of control	massive on ground response
beyond scope of present control structure	increase and pool agency/community resources
volunteer efforts ineffective	remunerate work teams with skills & funds
insufficient funding	remunerate fiscal and vocational training
some can't afford to pay	means tested work teams; formulate equitable regional policy with skilled social scientist
lack of control of weed spread de-motivator for those who otherwise would control weeds	enforce legislative requirements for control by some work teams, 'do it' for reluctant property owner according to ability to pay
unskilled control efforts can 'open up for invasion' by species successors; threatened communities at risk	ecologists assess and monitor site; experts train and supervise
not enough qualified weed controllers	trainee work teams graduate in nationally accredited competencies
authorities find enforcement difficult when can't control own infestation	first to deploy weed teams along lines of spread, pulling in adjacent landholders simultaneously
authorities/agencies lack resources	agencies develop priority catchments, pool to employ 'professional' teams in in priority areas

Ongoing, structurally-embedded joint programmes with other state agencies difficult to develop and administer	Necessary arrangements are made with the Dept. of Education & Training and Board of Studies for curriculum modules with practical components specific to the North Coast to be delivered regionally across schools within Agriculture, Environmental Science, Science, Geography study areas and other vocational re-training pathways; early awareness/training and community expertise ensured.
landholders lack skills to control weed seed spread	landholders receive on site comprehensive training alongside teams instituting primary weed control

The new N.S.W. North Coast Weeds Strategy (Feb.2003) shares an awareness for overcoming some of these barriers at a **North Coast regional level** and articulates, via its objectives, some of the medium -longer term actions that are needed to move toward more strategic action which will assist to form a sound basis for this programme. These include: recognition of the need for 'strategic' declaration of environmental weeds, maximum use of trainees and university students, long term regionally co-ordinated funding base, environmental levies to increase resources, community education via co-ordinated Weed Busters Week, television, more stringent fines for weed dumping, and weeds education/training institutionalized within school curriculum. 5.

Cost ? Below is an approximate estimate of the initial unit cost per annum of the pilot for 'primary' weed control.

The longer term actions e.g. the context with regard to community awareness, education or 'user pay' employment of work teams are either designated via catchment board allocations or rotating trainee teams in the form of Green Corps and/or subsidised work teams using environmental levies, and payment from landowners complying with legislation. None of these are unreasonable funding sources.

IMMEDIATE ON GROUND WORK BUDGET

Weeding the sub-catchment

Site assessment/project planning/monitoring	$5,000
Project Manager/Trainee Supervisor	$60,000
Project vehicle	$15,000
Herbicide/Petrol/perishables (OH & S)	$5,000
Equipment	$5,000
Trainee Wages (assuming rural skills shortage subsidy)	$210,000
	$300,000

Project Action Details	**How/Who**
Select sub-catchment	combined North Coast Task Force pooling interagency data
Declare identified problem plants	temporary declarations target priority infestations
Site Assessment	BPM (Nat.Veg./NPWS data) vegetation assessors, ecologists
Labour force training programme integrated	Conservation & Land Management Traineeship delivers relevant modules for national competencie: weed management on site; skills shortage subsidies apply
Landowner Participation	On site training, working alongside team or teams at discounted rates (as appropriate)

Maintenance: Monitoring by **independent ecologists** with inspections from control authority. Maintenance plan developed with landholder during project; implemented either by landholder 'skilled' through project or follow up 'work teams' brought into area, partially subsidised by environmental levy or other natural resource funds (means test), work done by 'graduate' weed contractors at expense of landowners able/preferring to pay.

Footnotes

1. The commission finds that the draft catchment blueprints "appear to have been constructed additively, based on component parts or 'media' (land, vegetation, water, biodiversity) rather than on a systemic appraisal of river and catchment health. For example, under biodiversity targets, most promote vegetation corridors linking significant remnants; but none mentions that the stream network provides an opportunity to create such corridors and provide river health benefits at the same time."

7.1.2. p. 42, ***"North Coast Rivers. Independent Inquiry into North Coast Rivers", Draft Report November 2002***

2. Securing Healthy Rivers: A Strategic Perspective", April 2000, p. 13

3. Local government works with community groups on Bitou throughout region. Small scale littoral rainforest restoration projects occur intermittently. A project on the Orara River Project focuses on the Camphor Laurel along river banks. The Manning Catchment Management Committee funded Camphor Laurel control, followed by a joint RTA/ Manning Landcare project on the floodplain. Last year a combination of Green Corps, volunteers and landholder tried to prevent Anredera cordifolia (Madeira) and other vine weeds spreading at an even more rapid rate along the Manning. These projects are not co-ordinated regionally and generally do not address vine weeds at source on either public or private property. Some aerial survey work in rivers north of the Manning has shown alarming infestations of Macfadyena unguis-cati (Cat's Claw) and Anredera cordifolia. (The Mid North Coast Weeds Advisory Committee submitted a proposal to the relevant catchment boards to take some action on this.)

4. Lower North Coast Catchment Board: Biodiversity Management Targets:
B4 *- "effective management structure for coordinating and implementing control of pest species and fire are in place by 2004", is supported by the* ***24th priority action*** *'support the development and implementation of management structures and best management programs designed to overcome the impacts of pest species on the extent and diversity of native species'.* ***Funding allocation over ten years*** *?* ***$28,000.***

No identification of, nor specific allocation for, control of imminent weed threats, though the issue might be included in the **2nd priority action** "implement those parts of natural resource management plans that contribute to the achievement of Catchment Targets".

The Mid North Coast Weeds Advisory Committee did recommend that this blueprint include 'prioritise, develop and implement funding projects that eradicate/control priority environmental weeds'. The blueprint reflects this concern.

Mid North Coast Catchment Management Board Management Action Priorities:
Catchment Target **5** *- "appropriate management of pest plants, animals and fire across the Board area through development and implementation of strategies and plans by the specialist organisations dealing with these threatening processes."*

Priority action 1.8.2 includes a call for the control of priority environmental weeds.
This blueprint points to a method in so far as it proclaims the need for greatest emphasis to be placed on work in sub-catchments. Priority action **2.0.1** mentions *a structuredprogram for identification of priority sub-catchments and targeted reaches.*

In general discussion, also, the document observes the need for work to *"start in and greatest emphasis to be placed on sub-catchments, targeted reaches,"* and states that in setting priorities *"actions concerning pest species and fire were elevated in status."*

Northern Rivers blueprint:
Included in this blueprint's definition of **active management** is *"removal of the threatening process of ineffective management of environmental weeds and pest species."* Therefore within its biodiversity targets, weeds are recognised as *a primary threat.''*

*"By 2006: 50% of HCV riparian vegetation under active **management**,50% of HCV remnants in identified corridors under active management…50 % of targeted areas of HCV rainforest, floodplain forest, coastal dune and heathland, mangroves, seagrass beds, saltmarshes, and rare and endangered ecosystems under active management* **…**
*Action **priority 1.1.3** "Develop and broker funding and implementation of projects to reduce the external impacts of fire, weeds, feral animals, pest species and other threats on HCV riparian vegetation, especially those threats that impact on priority project sites. $600,000."*

***1.2.3''**Develop and broker funding and implementation of projects to reduce the external impacts of fire, weeds, feral animals, pest species and other threats on HCV remnants in identified Regional Corridors, especially those threats that impact on priority project sites. - $600,000."*

This blueprint also recognises the role of sub-catchments:
***3.5.1** "Develop and implement with community involvement, streambank rehabilitation plans, for targeted reaches within priority sub-catchments. $6,900,000."*

Upper North Coast Catchment Board:
22. *Priority: environmental weed species (ref B 11 section 10)*
Address priority environmental weeds by:

a) *Developing/supporting Board-wide strategies that eradicate /control priority environmental weeds (terrestrial, aquatic and marine) and fund the implementation of priority actions.*

b) *Implementing initial strategy(s) focusing on species that have been identified as potential major weed problems requiring prompt control action.*

c) Limiting potential distribution of new weed species (weed alert).

d) *Providing educational and extension material to landowners and land managers.*

23. Priority: environmental weed species. Set weed management priorities with NCWAC with regards to trials being conducted in the UNC Board area.

30. Provide funding for local integrated projects that control priority environmental weed species - terrestrial and aquatic (whether those species are the subject of a Board-wide strategy or not).

This blueprint has made a concerted attempt to include specific reference to environmental weeds.

Observations of other agencies about some of the blueprints:
"Prioritise, develop and implement funding projects that eradicate/control priority environmental weeds." (Mid North Coast Weeds Advisory Committee)

National Parks Association:
"Failure to acknowledge the severe ecological condition of many parts of NSW…Failure to address many serious NRM problems which are poorly understood. Weed infestation and its impact on ecological condition is recognised as a threatening process for ecosystems but this is not well enough understood."

5. extracts from **NSW North Coast Weeds Strategy:**

Objective 1.2.1 Assess, prioritise and consolidate the current noxious weeds list

Objective 1.3.1 Establish a funding base for long-term co-ordinated control of environmental weeds

* identify priority locations for bush regeneration and environmental weed management by 6/03
* declare threatening environmental weeds with an isolated distribution as noxious weeds as required

Objective: 1.3.4 Establish an environmental levy in each LGA within the region

Objective 1.3.5 Utilise trainees and student internships where possible

Objective 1.3.2 Educate the community in a range of integrated weed control techniques

Objective 2.2.1 Increase awareness of ways to reduce the deliberate and accidental spread of weeds

* promote awareness of the impacts of weeds…through repeated ongoing campaigns
* promote backyard weeds and alternate species through the Bushland Friendly Nursery Scheme by 4/03
* Investigate use of television advertising to promote the threat from weeds and illegal rubbish dumping by 12/03
* Promote animal quarantine & threat from contaminated produce at cattle saleyards and rural stores by 6/04
* increase penalties for illegal dumping of garden refuse by 12/04

Objective 2.3.1 Promote regionally significant weeds and the need to control them

* co-ordinate weed buster week promotions between stakeholders annually
* produce local and regional brochures for priority weeds by 6/04
* circulate weed id. information to new land owners using rates information by 12/04
* encourage the inclusion of weed awareness in school curriculums by 12/04

Objective 2.3.3 Encourage community involvement in weed management

Bibliography

"Independent Inquiry into the Hawkesbury Nepean River System, Final Report August 1998"
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N.S.W. North Coast Weeds Strategy, Feb 2003
Mid North Coast Regional Weeds Strategy,
New South Wales Weed Strategy, April 1998

Draft Catchment Blueprints (November 2002)
Lower North Coast Catchment Board
Mid North Coast Catchment Management Board
Northern Rivers
Upper North Coast Catchment

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BREAKING DOWN THE BARRIERS

A *cross-border approach to managing Parthenium weed*

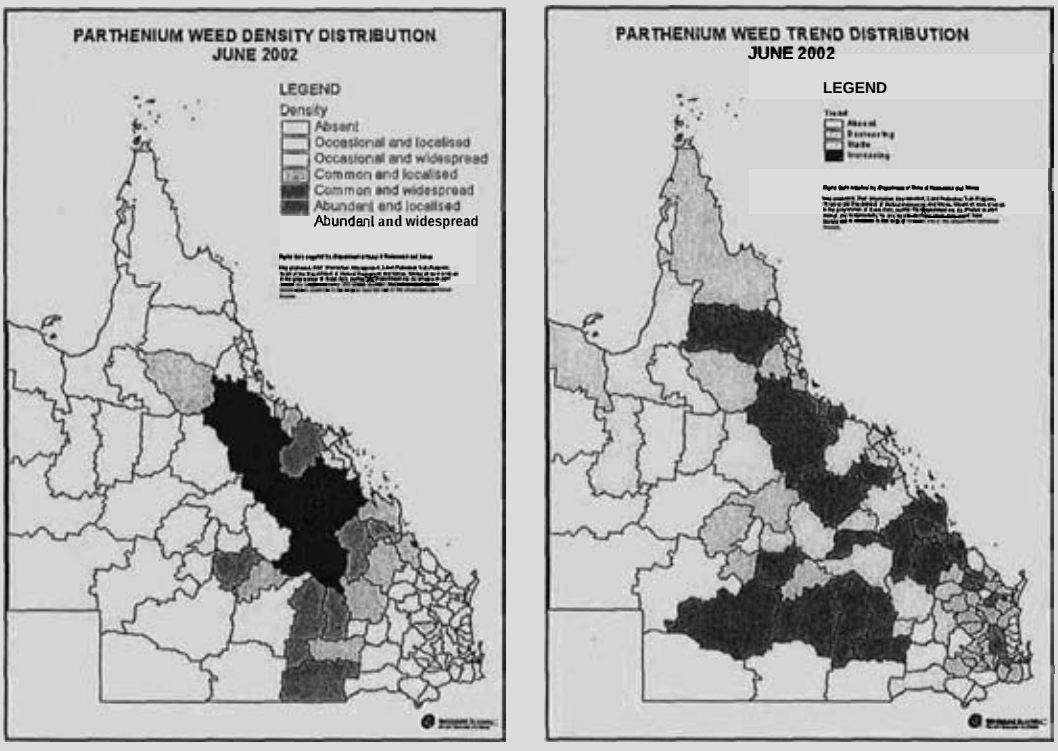
By Janet Barker, Queensland Murray Darling Committee; with contributions from Rebecca Hutchinson, Namoi Gwydir Noxious Weeds Advisory Committee and Darren Moor, Qld Dept of Natural Resources and Mines.

Unlike licence plates, daylight saving and school holidays, weeds do not abide by state borders. Parthenium weed is no exception. This Weed of National Significance (WONS) is spreading from high levels of infestation in Central Queensland, down into southern Queensland and into New South Wales.

Parthenium weed has been present in Queensland since the 1950's, and has been well established in central Queensland for around twenty years. The core infestation area has been estimated at 8.2 million hectares, or around 5% of Queensland.

The following maps show the distribution and trend of Parthenium weed as at June 2002 in Queensland. The data is collected by the Department of Natural Resources and Mines, on a shire by shire basis.

Figure 1: Parthenium weed density and trend distribution in Queensland in June 2002

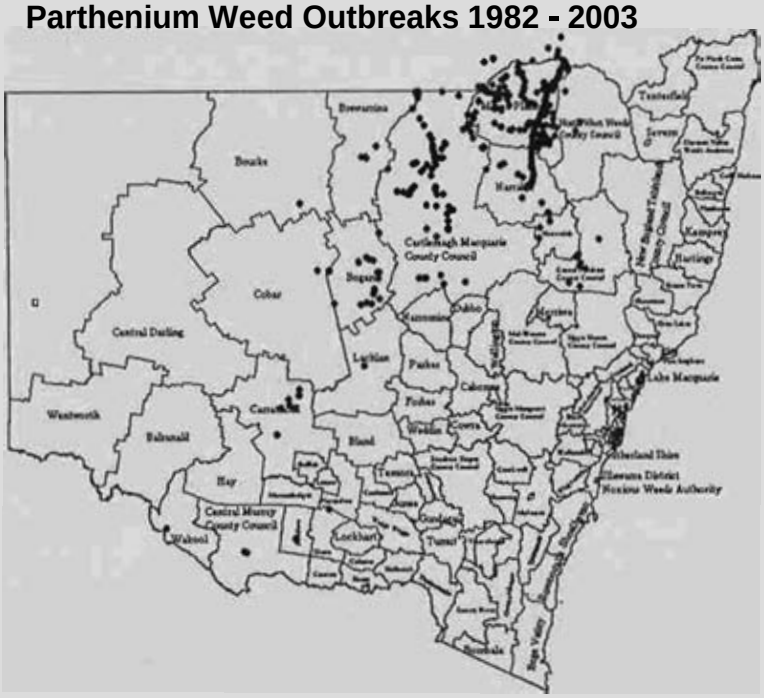


Source: Natural Resources & Mines Queensland,

Figure 1 demonstrates that some shires neighbouring New South Wales have Parthenium populations, of varying densities. While the trend map indicates that in the border shires, Parthenium weed is absent or static; the data was collected during a drought period. It cannot be ignored that there are significant populations one shire north of some of the bordering shires, and the trend in these shires is increasing. With 28 of the southern Queensland shires forming the northern 25% of the Murray Darling Basin, there are serious implications for New South Wales if Parthenium is not contained north of the border.

Figure 2 shows the locations of reported Parthenium weed outbreaks through New South Wales from 1982 to 2003.

Parthenium Weed Outbreaks 1982 - 2003



The aim for control authorities within NSW when dealing with a Parthenium weed outbreak is eradication. Authorities see eradication as the only option to prevent Parthenium from being established in NSW.

Eradication is achieved by quick action, with the main focus of reducing the seed bank.

The majority of Parthenium infestations have been eradicated in NSW. Some of the larger property outbreaks have taken longer to eradicate, with re-germination occurring for many years after the initial outbreak.

Any Parthenium weed outbreak reported in NSW is monitored by the local control authority for at least 10 years.

On a national scale the approach toward Parthenium management varies greatly with differing levels of infestation. Best practice methodologies change, as do attitudes towards the plant as you travel through parts of eastern Australia.

Figure 3 – The Parthenium situation in eastern Australia, a snapshot

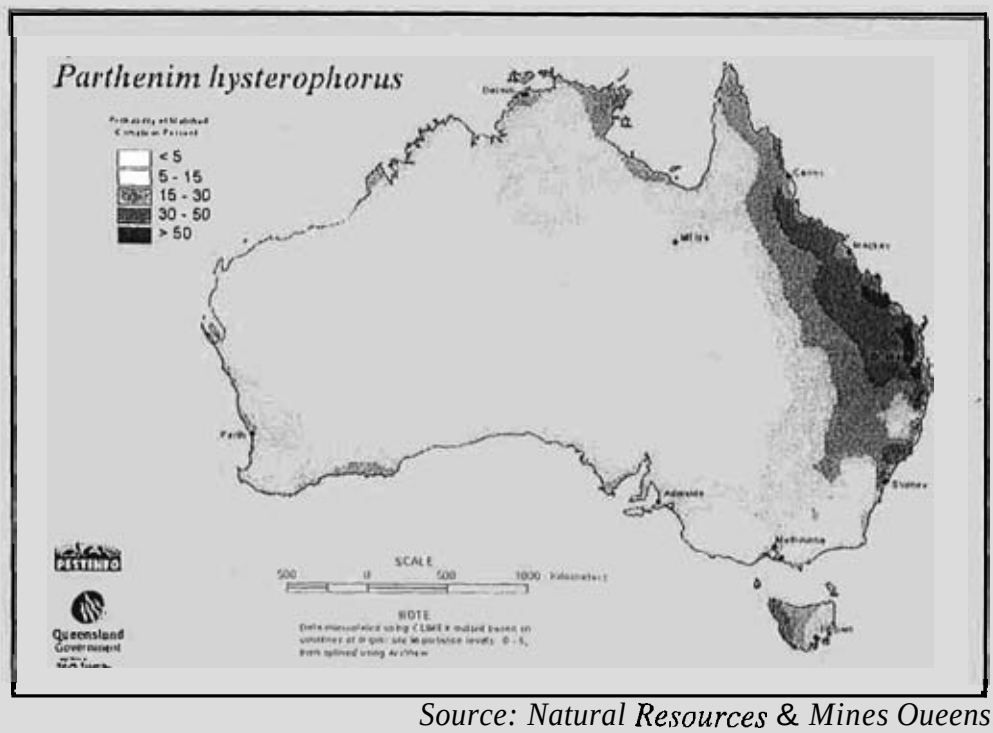
Western Queensland • Isolated to scattered outbreaks common • Good understanding of control mechanisms • Mostly eradication with some containment situations • Monitoring of spread essential due to larger property sizes and reduced populations • Public awareness campaign strong
Central Queensland and Burdekin • Containment and prevention of spread • Learning to live with it • Employing land management strategies, pasture management, shifting watering points • Adjusting stocking rates • Recognised and accepted • Chemical used on roadsides and high traffic areas primarily • Weed seed spread awareness high • Biological controls active • Community ownership high • Moving on from Parthenium as a single issue to broader NRM issues • Emerging broad community understanding of the value to sound pasture management
Southern Queensland • Rates of infestation vary • Starting to differentiate between containment and eradication areas • Stigma attached to having the weed • Stressful issue for landholders with infestations that can't be eradicated • Prevention of spread a priority, particularly along waterways • Chemical still primary means of control • Recognition of the plant still increasing • Weed seed spread awareness medium but increasing • Experimentation with biological controls increasing • Community ownership increasing
NSW • Limited reported outbreaks • Eradication is the only goal • Fear factor present (indicates a good understanding of impacts) • Recognition of the plant increasing • Increased capacity to manage outbreaks • Awareness of weed seed spread increasing
Victoria/SA • Very few reported outbreaks • Limited knowledge of identification, management, impacts and spread mechanisms amongst the general public and agencies

Best practice methodologies and the science behind them continue to improve for Parthenium weed management. However knowing how to manage the plant is only one hurdle. Encouraging landowners to adopt best practice is another challenge as it requires taking on board extra information; changing traditional practice and in most cases, significant economic outlay.

While the spread of parthenium weed is currently limited to the eastern side of Australia, the Department and Natural Resources and Mines in Queensland have mapped the potential distribution. This map is a prediction generated using climate based data.

The potential distribution is mapped in figure 4 based on the Ecoclimatic Index, (EI). If the EI is less than five, the potential for permanent population is low, where the EI is greater than fifty; the potential far permanent population is very high.

Figure 4: The potential distribution of Parthenium weed in Australia



Source: Natural Resources & Mines Queensland.

Figure 4 demonstrates that Parthenium weed has a long way to spread before it reaches the limit of its potential habitat.

What is being done in areas where it is spreading to next?

Southern Queensland and northern New South Wales are the regions of Australia where Parthenium is currently establishing. **A** lot has been achieved in the past five years to prevent these areas from becoming an extension of the core infestation.

In 1998, it was recognised that Parthenium weed was the highest priority pest for southern Queensland. A community based committee was formed, made up of stakeholders representing;

- Graziers
- Grain producers and harvesters
- State and local government
- Service Industry
- Landcare and Catchment Management.

This committee was originally supported by the Dept of Natural Resources and Mines, and consequently the Queensland Murray Darling Committee through provision of a Project Officer and secretariat support.

The mandate of this committee was to develop a strategy for Parthenium weed management in southern Queensland. One of the first realisations of this team was that the strategy would be meaningless without consultation with the neighbouring regions, Central Queensland and New South Wales. Representatives from these two regions were involved in developing the strategy.

The outcome was a strategy document named the Southern Queensland APEC strategy, where APEC stands for:

- Awareness – of the identification, impacts and control of the plant
- Prevention – of new outbreaks, particularly into New South Wales
- Eradication – of outbreaks where realistically and economically feasible
- Containment – of existing outbreaks through updating best practice
- Coordination – of resources like equipment, knowledge and expertise, chemical, networks and funding to improve rapid weed management.

The strategy was endorsed in May 2000.

In a similar time frame, the NSW Parthenium Taskforce was formed, and is also made up of a range of stakeholders from state and local government and relevant industry. The NSW strategy for Parthenium management focuses on establishing a containment line at the Queensland border and establishing a framework for early reporting and eradication of any new outbreaks.

Throughout the process of developing strategies, cross border communication led to clear identification of roles in achieving outcomes. Some of the outcomes achieved have been:

- Incorporation of the southern Queensland and New South Wales strategies and actions into the National Parthenium Management Strategy
- Representation on the National Management Group
- Development of national awareness materials, magnets, stickers, posters, television advertising and display trailers to make the most of funds available to various organisations
- Training opportunities for weed management staff to travel interstate and observe management strategy development in different scales of infestation
- Increased investment in the development of weed seed spread management frameworks, such as wash down facilities, air compressors on the Qld/NSW border, guidelines, vendor declarations and incorporation into new state legislation
- Continued update of new outbreaks in neighbouring regions, potential vectors of spread, and best practice control options
- Expansion of best practice guidelines to incorporate Parthenium management out of the core infestation area.

The declaration of Parthenium weed as a Weed of National Significance, and the consequent NHT funding made available by the Commonwealth government have ensured that many of these outcomes were possible. This funding has provide the means to realise many of the joint strategies developed between Queensland and New South Wales.

Is New South Wales today in a similar situation to Southern Queensland ten years ago?

Ten years ago in southern Queensland, there was a major infestation in the north of the Maranoa Balonne catchment, (Queensland Murray Darling Basin), and little known about infestations elsewhere. The challenges faced by southern Queensland at the time were;

- Lack of control options, as the Queensland government spent around $250 000 in chemical control on this infestation, and the outcome was; it didn't work. Alternative control measures such as pasture management, altering of stocking rates, biological control and establishing containment systems were not yet tested for effectiveness
- The concept of containment was undeveloped, there were no wash-down facilities, guidelines for limiting weed seed spread or recognition of spread vectors by the community
- The wider community was not aware of the impacts of the weed, nor how to identify it.
- There was, and still is no obligation to report outbreaks to local or state authorities.

As a result, there are infestations in southern Queensland that possibly could have been eradicated, however are now permanent in the landscape.

New South Wales currently has a limited number of outbreaks, but has the threat of some larger ones imminent to the north.

The frameworks New South Wales has in place to avoid having permanent infestations are;

- An increased capacity to deal with outbreaks through attending training opportunities in Queensland, or access to improved best management practice information
- A greater awareness of the vectors of spread, and the areas where outbreaks are likely to occur
- A commitment to eradicating new outbreaks, and monitoring the sites for up to ten years
- An active awareness campaign that has been running for at least five years, so the broader community is more likely to identify new outbreaks
- Individuals have an obligation to report new outbreaks to local and state authorities.
- Air compressors to clean down headers on the Queensland/NSW border.

As a result of information sharing, and the development of joint strategies between the two states, there is a much greater chance of containing the spread of Parthenium weed ten years on. While traditionally weeds are an issue managed by state government, the opportunities the commonwealth program has provided have filled the gaps that were preventing the limitation of Parthenium weed spread.

Where to from here?

The joint strategies and initiatives developed between Queensland and New South Wales have only just begun to be implemented. Future goals are;

- Improved development of the containment line on the New South Wales/ Queensland border, ie extending compulsory clean down to earthmoving equipment and other vehicles that may carry weed seed
- Continued opportunities for New South Wales staff and landowners to witness first hand Parthenium management situations in central and southern Queensland

- Increased use and understanding of vendor declarations to protect vendors and consumers from the possibility of new outbreaks going unnoticed
- Establish joint mapping systems between the two states to record outbreaks
- Improved signage on the entrance points to each region
- Provision of resource to ensure follow-up monitoring, eradication and containment of existing outbreaks is possible
- Increased community participation in research
- Improved infrastructure throughout both regions for prevention of weed seed spread, ie wash-down facilities
- Increased incentives for industry to adopt weed seed spread principles
- Streamlining of state legislations regarding pest management.

Cross border coordination regarding Parthenium weed management has demonstrated many positive outcomes. Parthenium is currently the pest that is attracting attention and resources, due to its impacts on the environment and economy. There are other weed species that are present on both sides of the border that have been identified by the Queensland Murray Darling Committee as candidates for more cross-border coordination. These are;

- African boxthorn
- African lovegrass
- Giant Rat's Tail grass
- Lippia
- Blue heliotrope
- Patterson's curse.

Activities undertaken as part of the campaign to improve Parthenium management that would be beneficial to duplicate for other species are;

- Developing joint management strategies for the species
- Pooling research findings
- Pooling awareness resources and budgets
- Providing training activities across the border
- Identifying vectors of spread between the two states
- Establishing containment lines and plans
- Exchanging information on best practice management.

Parthenium Weed Training Kit

Education and awareness is a vital tool in the prevention and management of all weeds in Australia. However, raising the awareness of Parthenium weed in NSW is of particular importance due to the seriousness of the weed and the high risk of infestation from QLD.

Parthenium Weed has made its way down to NSW and was first found in 1982, in Narrabri Shire. To date Parthenium infestations have been reported right across NSW from the north of the state, west out to Bourke and as far south as the Victorian border.

New South Wales authorities are fighting very hard to prevent Parthenium from entering and establishing in our state, however despite this fight some infestations do occur. Therefore a vital tool in this fight is education and awareness.

The objectives of the training kit are to:

- Assist officers to train and educate other staff members of their organisations.
- Enhance Council and Rural Lands Protection Board education and awareness programs.
- Educate Local Government Weeds Officers and Rural Lands Protection Board staff on Parthenium weed.
- Give these officers the information, resources and contacts to conduct activities in their regions to raise Parthenium weed awareness.
- Encourage officers to use Parthenium weed activities to gain skills towards completing nationally endorsed competencies within the Conservation and Land Management Training package.

Due to the uncertainty of infestation locations within NSW, it is important that we have as many pairs of eyes as possible looking for Parthenium. By giving Control Authorities the resources to train staff within their organisation it will increase the number of people keeping an eye out for Parthenium weed. Therefore increasing the likelihood of an early detection of any plants in NSW.

If all weeds officers and rangers of NSW are educated and kept up to date with any Parthenium weed issues, they can pass on the message to their communities and therefore raise the awareness of Parthenium weed.

The Parthenium training kit will be used as a resource tool to enhance Local Government and RLPB awareness progranas. The aim of the kit is to make available information, resources and contacts to local control authorities so they can train other members of their organisations. Everyday, outdoor workers such as road patchers, grader drivers and rangers work in areas of possible Parthenium infestations. This training of extra council and RLPB staff will add to the number of people keeping an eye out for Parthenium weed. Therefore, within a shire area, instead of just the one pair of weeds officer's eyes looking for Parthenium it could be fifty pairs of eyes.

Also with this kit Control Authorities can add Parthenium weed activities into their annual publicity campaigns. By assisting the control authorities with this type of resource it will encourage them to continue their own Parthenium awareness activities, well into the future.

This training kit also aims not only to increase community education, but also to increase the education and qualifications of council and RLPB staff. By linking this Parthenium training kit to the nationally endorsed competencies it will allow weeds officers and rangers to conduct activities which will contribute to completing competencies towards Levels 2 , 3 and 4 of the Conservation and Land Management training package.

The kit will be made up of a folder containing written information, forms and activities and accompanying the folder will be a CD, which will contain pictures, presentations, maps and anything which may need to be printed out from a computer. The Parthenium kit will also be included on the web site of NSW Agriculture, so updated information can easily be accessed by all weeds officers and rangers from anywhere in the state. This will allow weeds officers and rangers to keep up to date with any changes or new information and also allow them to add the updates to their kit folder.

The kit will cover such topics as:

- A list of available resources
- Contact list of where people can find both information and awareness material
- A presentation about Parthenium weed for the purpose of educating community members and other staff members of their organisation
- Some guidelines and benefits of working with neighbouring organisations
- A check list of what procedures to follow when a Parthenium plant is found
- Procedures and available resources for running a field day
- Pictures of various plants and infestations which may be used in publicity work
- Statement from NSW Agriculture – highlighting their point of view on our Parthenium situation, assistance, vision etc
- Parthenium weed plans – Both the National strategy and NSW state plan
- A list of awareness material and suggestions on how they can be used
- Maps – NSW and QLD (infestations, border inspections and washdown facilities)
- General information – plant biology and I.D, prevention, management, community effects (health, cost) etc
- Best Practice Management Manual
- Header information – inspections, cleaning procedures, border inspection process and locations
- Information to update people's knowledge of the Parthenium problem in QLD and letting them know what progress is being made against the weed
- Vehicle washdown procedures
- Information to raise the awareness of Vendor Declarations
- Guidelines to prepare a rapid response plan
- Exercises and suggestions of activities to complete competencies towards the Conservation and Land Management Training package
- Forms to record activities and progress of awareness raising activities
- Examples and suggestions of Parthenium related activities that are already being successfully used by other councils

CURRENT STATUS OF WEED BIOLOGICAL CONTROL IN NEW SOUTH WALES

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INTRODUCTION

Biological control of weeds has been carried out in Australia since early last century commencing with the early projects on lantana and prickly pear. Since then approximately 40 plant species have been the target of biological control programs. Some of these have never progressed beyond the survey stage while others have been highly successful. Holtkamp (1999) and Sullivan (1999) describe the status of New South Wales biological control programs up to that point. This paper provides details on progress in programs from that time only.

TARGET WEEDS

Bitou bush (Chrysanthemoides ***monilifera*** **subspecies** rotundata)
Approval for the release of the bitou leaf roller moth, Tortrix sp., was granted in 2001 and a number of releases have been made in NSW since then. Establishment at these sites has been seriously hindered by the ongoing drought but it now appears that Tortrix sp. is established at a few sites. Releases will continue and NHT have provided funding for a community rearing and redistribution project on Tortrix sp.

Blackberry (*Rubus fruticosus* aggregate)
Further blackberry rust , Phragmidium violaceum, strains are being sought in Europe. The most damaging strain, first released in 1991, has not been found in the field in recent times. The illegal strain first detected in 1984 still appears to be common. Hopefully strains of blackberry rust being introduced are more damaging and more persistent than the strains released to date.

Blue heliotrope (*Heliotropium amplexicaule*)
The blue heliotrope leaf beetle, Deuterocampta quadrijuga, was approved for release in 2001 by AQIS. Since that time a number of releases have been made in NSW. Some of these appear to have established but the ongoing drought has severely impacted on the project. Further releases will form part of a project jointly funded by MLA and AWI. D. quadrijuga will shortly be included in a community and schools rearing and redistribution project called Weed Warriors which is partly funded by the Weeds CRC

Bridal creeper (Asparagus ***asparagoides***)
The bridal creeper leafhopper, Zygina sp., was approved for release in 1999. Since then extremely large numbers of releases of the insect have been made in every state in southern Australia. The majority of these have established and at many sites Zygina sp. is causing severe defoliation. Zygina sp. is also being reared and redistributed as part of the Weed Warriors program. Bridal creeper rust, Puccinia myrsiphylli, was approved for release in 2000. P. myrsiphylli causes considerable damage to bridal creeper in South Africa and appears to have the potential to be an important biological control agent in Australia. A leaf feeding beetle, Crioceris sp., is currently being evaluated by CSIRO in Perth. Its release, if approved, is somewhat further away.

Gorse (Ulex europaeus)
The gorse spider mite, Tetranychus lintearius, was first approved for release in Australia in 1997. Since that time a large number of releases have been made in Victoria and Tasmania. This mite appears to readily establish and is capable of causing significant damage to gorse. A few releases were made in NSW in 2002 but it is too early to know whether establishment has occurred. *T.* lintearius is the first in a suite of agents that could be released for gorse in NSW.

Horehound (***Marrubium*** vulgare)
Horehound plume moth, Wheeleria spilodactylus, has been released in NSW since 1994. Since that time a large number of releases have been made and this insect appears to readily establish at most sites. It is capable of causing significant defoliation at many of these sites. Releases of this insect will continue as part of a project jointly funded by MLA and AWI.

Lantana (Lantana ***camara*****)**
A stem-sucking bug, Aconophora compressa, and a leaf sucking bug, Falconia intermedia were approved for release in 2001 and 2000 respectively. These insects are currently being reared and released in NSW and Queensland. A. compressa has established at some sites but only appears to be causing minimal damage. F. intermedia does not seem to have established at any sites in NSW although it appears to be doing somewhat better in Queensland. Lantana rust, Prospodium tuberculatum, was approved for release in 2001 and a number of releases have been made since then. These have also been severely impacted upon by the drought. In areas where P. tuberculatum has established it appears as if there is a lot of potential for damage to lantana. Recent rains on the NSW coastal strip appear to have increased the likelihood of establishment of this extremely damaging pathogen.

Nodding thistle (Carduus ***nutans*****)**
A now finished project on nodding thistle involved many releases of nodding thistle seed fly, Urophora solstitialis, and nodding thistle rosette weevil, Trichosirocalus mortadelo (previously T. horridus). Both of these insects have established throughout the range of nodding thistle with T. mortadelo being the most damaging.

Paterson's curse (Echium planatagineum)
Paterson's curse is abundant on the central and south-western slopes and eastern Riverina regions and often becomes the dominant plant in winter pastures. All six agents released, the leaf-mining moth, *Dialectica* scalariella, the crown weevil, Mogulones ***larvatus*****,** the root weevil, Mogulones geographicus, the flea beetle, ***Longitarsus*** echii, the stem beetle, Phytoecia coerulescens and the flower-feeding beetle, Meligethes planiusculus, have been established in the field since 1999. Most agents breed slowly so it will take many years for them to breed up and disperse naturally throughout NSW. The weevils and flea beetle are expected to be the most damaging agents with more than 50% of Paterson's curse and viper's bugloss rosettes being killed at ungrazed research sites seven years after release.

Scotch broom (Cytisus scoparius)
The broom twig miner, Leucoptera ***spartifoliella*****,** has built up into damaging numbers in southern NSW but is still in low numbers on the Barrington Tops. Many releases have now been made from insects reared in the field in southern NSW. The broom psyllid, Arytainilla spartiophila, and the broom seed beetle, Bruchidius villosus, appear to have established at a few locations but numbers are still low. **A** gall-forming eriophyid mite, *Aceria* genistae, has been tested and found to be host specific. Permission has been granted for its release and releases will hopefully be made later this year.

Scotch, Illyrian and stemless thistles (Onopordum **spp.)**
A number of insect species have been released for the biological control of Onopordum thistles. The first of these was the seed-head weevil, *Larinus* latus, which is now widely established. Its ability to destroy most of the seed in a flowerhead makes it a good biological control agent. At some NSW sites this insect has reduced seed production by more than 80%.The second agent is the stem-boring weevil, Lixus cardui, which is now widely established. L. cardui is not capable of killing Onopordum thistles, but its activity weakens the plant, makes it less competitive and reduces seed production. This action allows insects such as L. latus to have a greater impact on the plant. Another insect which is established on Onopordum thistles is the crown moth, Eublemma amoena. Larvae can bore into the crown and root of the plant leading to the death of smaller plants. Larvae of subsequent generations feed in the leaves of bolting stems, causing similar leaf shrivelling and death. The rosette weevil, Trichosirocalus briesei, was first released in 1997 but at present there is little evidence of establishment.

Spear thistle (Cirsium vulgare)
Despite several attempts to establish three different agents, spear thistle receptacle weevil, Rhinocyllus *conicus*, spear thistle seed fly, Urophora *stylata* and spear thistle rosette weevil, *Trichosirocalus* horridus, there appears to be no evidence of establishment. No further work is envisaged on this species.

Spiny emex (*Emex* australis)
Several releases of the red apion weevil, Apion miniatum, have been made in both southern and northern NSW since 1999. No evidence of establishment has been found to date. It is too early to tell whether a recent release made just south of Taree has established. If there is no success there will be no further attempts made with this insect.

ACKNOWLEDGEMENTS
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BITOU
3 O'CLOCK
NPWS OPERATION
WEED CULL
Rod Spicer.

Leucaena: A new conflict tree

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ABSTRACT

Leucaena leucocephala is a multiuse leguminous tree planted in over one hundred countries. In Queensland leucaena has become a 'conflict tree'. **A** major component of this conflict is two morphologically and genetically distinct subspecies are found in the state. L. *leucocephala* ssp. *leucocephala*, was deliberately imported in the 19th century as a fodder, fuel wood, shade and green manure, but is now a visible ruderal weedy shrub mostly of roadsides, disturbed sites and creeks. Little action is currently taken on this species although it is a visible and at times problematic environmental weed. L. *leucocephala* ssp. *glabrata* was researched and commercially released in 1962 in Queensland to be used in a tree/grass forage production system for cattle production; over 100,000 hectares is currently planted. Unfortunately, ssp. *glabrata* is also showing a tendency to spread from planted sites. Increased planting of the cultivated varieties, along with the spread of older infestations, is causing community concerns about this species (Walton 2003). This paper summarises the knowledge on the two subspecies, discusses their potential impacts and control. The paper will discuss management options, including the development of codes of practice and state government policy, to limit the spread of this high weed risk but high utility species.

INTRODUCTION

Leucaena (Leucaena leucocephala) is a perennial leguminous non-climbing, non-spiny shrub/tree. Native to tropical America two of the three subspecies now have a pan-tropical distribution facilitated by its use as a fodder, wood source and reclamation species. Described as the "alfalfa of the tropics" it is widely used multi-purpose tree legume in the tropics. It is also considered a weed in over 25 countries around the globe.

Taxonomy

The genus Leucaena is in the tribe Mimoseae of the subfamily Mimosoideae of the family Leguminosae. The genus has 22 species, six intraspecific taxa and two named hybrids (Hughes 1998a). There are no native species of this genus in Australia. Leucaena leucocephala (Lamark) de Wit 1961 is the only member of the genus naturalized in Australia. Synonyms of L. leucocephala include L. glauca, L. glabrata, Mimosa glauca, M. leucocephala and Acacia leucocephala.

Description

The species varies widely from small shrubs to trees (to 20 m and 40 cm dbh). Leaves are 15 to 20 cm long and bipinnately compound. Flowers are white and in compact heads of up to 150 flowers. It is fully self-fertile and rarely outcrosses, making it very seedy with 4-10 pods per head. The brown pods hang vertically, with about 15 seeds per pod. There are approximately 15,000-20,000 seeds per kg (Duke 1983, Hughes 1998b).

Distinguishing characters

Leucaena is distinguished from all other mimosoid legumes by two diagnostic characters, firstly its hairy anthers, which are easily visible with a hand lens and secondly the pollen surface is smooth, finely perforated and lacking ornamentation. A number of other easier to use, but non-diagnostic, features present in all members of the genus are: shoots lacking thorns or spines, leaves always with petiolar glands, flowers in a globose head with more than 30 flowers per head, pendulous and more or less flattened dehiscent pods and seeds with a glossy reddish chestnut brown seed coat (Hughes 1998b).

Subspecies of *L. leucocephala,* although, there is some overlap, are separated by a number of characters:

New growth is glabrous (hairless). Leaves >19 cm long, flower heads with >120 flowers per heads, pods 12-19 cm long and 18-21mm wide. Trees grow to 8-20 m. ssp. ***glabrata***

Young shoots, leaves and pods covered with dense whitish velvety hairs. Leaves <20 cm long, flower heads with <125 flowers per head, pods 9-13 cm long. Trees grow to 3-8 m. ssp. ***leucocephala***

Biology

Leucaena is essentially a tropical species requiring warm temperatures (25-30°C) for optimum growth. It has poor cold tolerance and significantly reduced growth during cool winter months in subtropical areas. It can grow on a wide variety of deep, well-drained fertile soils; ssp. *leucocephala* favours limestone, other alkaline soils and volcanic soils, while alkaline structured clay soils of the brigalow and softwood scrubs, alluvial and open downs country (the cropping soils) are suitable for ssp. *glabrata.*

In Queensland most L. *leucocephala* ssp. *glabrata* is grown at the limits of its climatic tolerances, in areas with low and seasonal rainfall and winter frosts, because the soils are more suitable. It is mostly grown in central Queensland, 100-300 km from the coast, on alkaline clay soils with an annual rainfall of 600-750mm. Planting of leucaena is constrained by the psyllid from areas with high humidity and rainfall over 800mm.

The genus *Leucaena* has a short juvenile phase for a woody species, it can commence flowering within 3-4 months of planting. *Leucaena leucocephala* follows this pattern, with flowering 2-4 months after planting in Botswana (Kaminski *et al.* 2000). Although ssp. *glabrata* generally does not set seed until the second year, time to flowering for variety *Tarramba* was 246 days (range 190 - 289 days) (Anon 1997). Flowering in *Leucaena leucocephala* appears to be independent of environmental factors, as it can be continuous, with flowering and seed production occurring all year

Leucaena leucocephala is a high seeding tree; ssp. *leucocephala* has been recorded to produce 277-388 pods (4000 - 6100 seeds) per plant (Hutton and Gray 1959) while ssp. *glabrata* varieties produced 8 666 and 17 600 seeds/plant in Queensland (Hutton and Gray 1959) and 600 - 5 140 seeds per plant in India (Bhatnagar and Kapoor 1987). Seeds can be spread by a number of vectors but spread is generally slow, most new plants are controlled by grazing animals or grass competition. Seed production may be reduced by the new seed bruchid, but the total impacts of this insect are not known. Breeding of shy seeders or sterile lines would also help reduce the invasive potential of this species in the commercial plantings.

Weed history overseas

Leucaena leucocephala ssp. *leucocephala* has a long history of deliberate transportation and spread and is now one of the most widely naturalized of the non-European crop plants (National Academy of Sciences 1984). It may be naturalized in over 105 countries throughout the world's sub-tropics and tropics. It is possibly growing on up to 5 million hectares (Binggeli 1997). It is known as a weed in over 25 countries, across all continents except Antarctica (Hughes 2002). The World Conservation Union's Invasive Species Specialist Group listed the species L. *leucocephala* in its list of 100 worst invasive organisms (Lowe *et al.* 2000). It is amongst the most prevalent invasive species in the Pacific and is considered a serious problem in several islands, including Tonga and Hawaii (Pacific Islands Ecosystems at Risk 2002).

Leucaena leucocephala ssp. *glabrata* has not specifically been recorded as a weed overseas, but as it has been planted for less than thirty years it is likely that it is in the early phases of invasion (Hughes and Jones 1998). Cultivars of ssp. *glabrata* were widely introduced and planted across the tropics in the 1970-80s, mostly promoted for use in reforestation programs by international agencies (National Academy of Sciences 1984). It is now very widely cultivated throughout the tropics and subtropics. Its worldwide distribution may now equal that of ssp. *leucocephala.*

Current distribution and weediness

Leucaena leucocephala ssp. *leucocephala* has a long history of occurrence in riparian areas and disturbed sites along coastal northern Australia, from Cockatoo Island in Western Australia (Hussey *et al.* 1997) to Windsor (near Sydney) in New South Wales (Cowan 1998). In the Northern Territory, ssp. *leucocephala* is probably the most widespread exotic woody weed, as it can be found in many coastal communities including Darwin, Nhulunbuy, Yirrkala and Howard Island, and in many catchments (Smith 1995, 2002). It is recorded in New South Wales on Norfolk Island (Swarbrick and Skarratt 1994), but residents state it is not invasive there. Small infestations of L. *leucocephala* ssp. *leucocephala,* generally between 0.5 - 5 ha in size, are scattered throughout coastal and sub-coastal areas of Queensland; often on roadsides and in riparian areas in the Fitzroy Basin, Torres Strait, Townsville, Mackay and southeastern Queensland (Shelton *et al.* 2001). A prioritisation of the weeds in Queensland's Wet Tropics listed *Annona glabra* (Pond apple) and L. *leucocephala* as the two highest ranked weed species in this bioregion (Werren 2001).

Leucaena leucocephala ssp. *glabrata* varieties have been planted in both coastal and inland areas of Australia, since released commercially as a fodder species in 1962 (Shelton *et al.* 2001). This species is planted in the Ord Irrigation Area in Western Australia, in the north of the Northern Territory and on over 200 properties in Queensland (north of Charters Towers, throughout the Fitzroy Basin and in south-eastern Queensland). Spread from these planted paddocks, outside the reach of grazing animals, has been noted onto roadsides and in riparian areas in Queensland (Jones and Jones 1996, Shelton *et al.* 2001), in northern New South Wales e.g. the Clarence River in Grafton (R. Ensby personal communication July 2002) and along 50 kilometres of the Ord River in Western Australia (N. Wilson personal communication September 2002). The majority of naturalised stands of ssp. *glabrata* originate from nearby grazing properties and have occurred over the past twenty years. Infestations of leucaena across the state, including Brisbane, Townsville, Mackay and Rockhampton, have been shown to include ssp. *glabrata* (Shelton *et al.* 2001). Higher weed risk posed by ssp. *glabrata* arises from the taller stature of the trees, increasing the risk of seeds beyond the reach of browsers. Moreover its wider soil and climate tolerances extend its habitat range in Australia.

Potential distribution

Based on climate modelling, leucaena has the potential to grow within suitable habitats in coastal and inland parts of Queensland, extending into northeast New South Wales and across the tropical Australian north (figure 1). Increased planting of leucaena, if not managed by graziers, may mean the species has the potential to colonise much larger areas than currently exist. The majority of problematic infestations are expected to be associated with riverbanks, waste areas and/or roadsides. Although leucaena does not readily invade undisturbed forests or woodlands it invades riparian areas, both undisturbed and disturbed. Given the high rate of disturbance of water bodies this species poses a threat to most coastal wetlands and in inland areas as well.

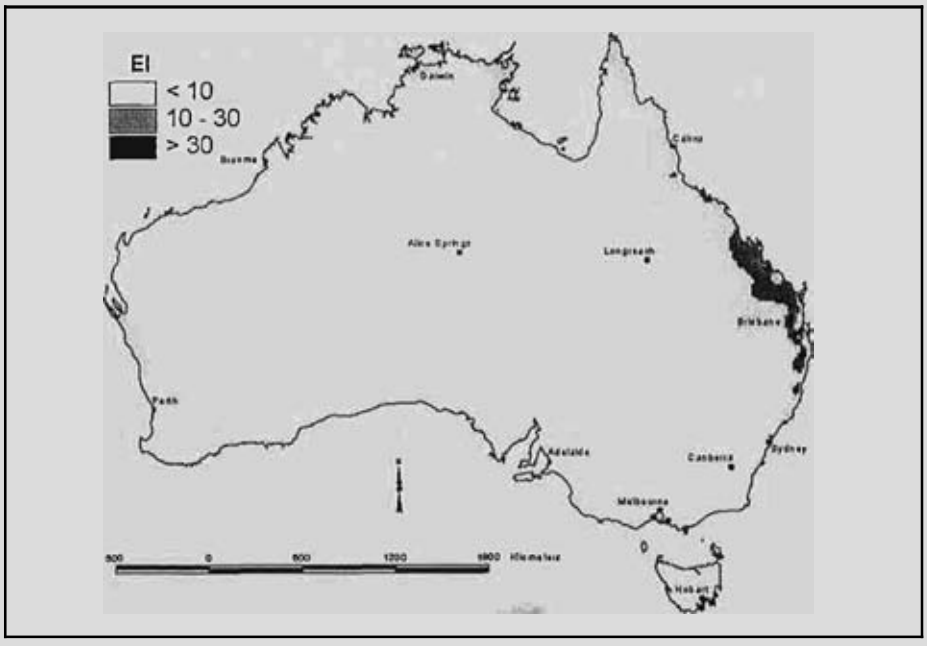

***Fig. 1**. Potential distribution of* Leucaena leucocephala *ssp.* glabrata.

Data is splined from a CLIMEX prediction. EI = Ecoclimatic index: EI<10 potential for permanent population low, EI>30 potential very high

Current uses

Leucaena leucocephala ssp. *glabrata* offers an economic benefit to the Queensland cattle industry. Live weight gains of 0.7-1.70 kg/head/day have been achieved in leucaena/grass pastures. This growth is comparable to or higher than grazing on buffel grass alone (0.47-1.30 kg/head/day) and to grain-fed lot feeding (1.41 kg/day). In Queensland live weight gains equal to >250 kg live weight gain/ha/year (Esdale and Middleton 1997) have been recorded on this forage. The pastures are long lived (over 40 years), drought tolerant and productive. Annual benefits to Queensland from the current leucaena production area are estimated at $14 M per annum (Middleton et al. 2002).

Both subspecies of *L. leucocephala* were promoted in the 1960-80s by development agencies worldwide as a "miracle plant" (National Academy of Sciences 1984). However, most of the potential uses are not employed in Australia. These uses include: shade for crops, firebreaks, timber production and firewood, pods as a human food source, concoctions of barks and root are taken for various medicinal purposes, planting for mine rehabilitation and sand binding, production of a gum very similar to gum Arabic from seeds, planting in rotation with maize to restore soil fertility and planting in parks and gardens as a shade tree (National Academy of Sciences 1984, Brewbaker 1987).

Control

Control methods are available for leucaena and control of infested sites is possible. The expenditure required to control the plant in areas where it is not wanted is currently minor but will increase with more spread. Using a registered herbicide, control costs for treatment of dense leucaena infestations are estimated to be about $1000 per hectare, although most infestations are made up of scattered plants and small stands and much of the cost relates to the time taken to find and treat the scattered plants. Immediate control of all infested sites in Queensland would be between $5.9-14.7 million and would need to include on-going, but cheaper, seedling control.

A number of non-native insect pests have been accidentally imported into Australia. These agents are now widespread in Queensland and reduce both seed set and plant growth. Although they reduce seed production it is not yet clear if these agents are sufficient to reduce the weediness of the two subspecies. Specific studies of the impacts of the insects on weediness or seed production have not been carried out. The two major pests of leucaena are the bruchid beetle, *Acanthoscelides macrophthalmus,* a seed predator native to Central and South America, was first found in Townsville in May 1996 and the psyllid, *Heteropsylla cubana,* a sap-feeder native to Cuba, was first noted in Queensland in Bowen 1986, and it is now widespread.

Future management

Leucaena leucocephala is not currently declared as a weed by any State in Australia. It is not a declared plant in Queensland under the *Rural Lands Protection Act* 1985. A number of local governments in Queensland e.g. Rockhampton City have, however, declared L. *leucocephala* a weed within towns under local laws where it is creating a problem in town wastelands, roadsides and on unused land. Cook Shire has specifically declared ssp. *leucocephala,* requiring control action, and it also requires ssp. *glabrata* to be grown in accordance with a code of practice. In Longreach spread of ssp. *glabrata* originally planted in the town into drainage lines of the Thomson River led to the Shire locally declaring this subspecies a weed. Several other local governments are considering similar measures on either one or both subspecies of leucaena.

The increased occurrence of infestations of leucaena in riparian areas across Queensland, both near planted paddocks and in built-up areas (Anon 2002a), and concern over approval of tree clearing permits in river catchments for fodder crops, including leucaena (Dickie 2000), has resulted in increasing demands for enforced control of this species. At the same time grazier groups and researchers have expressed concern at the "bad publicity" directed at L. *leucocephala* ssp. *glabrata* in Queensland media in recent years and are quick to defend the plant's value as a forage crop for finishing steers without feed lotting. (Middleton 2000, Partridge 2002). Enforced control on grazing lands in the state would be opposed by most graziers. Rather than declaration, planning and management guidelines to limit spread from plantings of high weed risk but high utility species may be the future for this and other species.

At this time two major activities are being put in place in Queensland to set parameters for the use of this species in the state. For land holders responsible management of leucaena pastures is being promoted under a "Code of good management practice for livestock" developed by farmers who cultivate leucaena. This should reduce spread from planted areas substantially. As part of the code material found outside cultivation regardless of the subspecies should be removed if it is impacting on the environmental values of the site.

At a state level a cross-department policy has been developed by the three government agencies with major land management and pest management responsibilities in the state. This document addresses the need for land use management recommendations over the location, planting and management of the shrub legume, leucaena. This document has the following policy principles:

1. The precautionary principle of Ecologically Sustainable Development should be observed in the planting and management of *Leucaena leucocephala.*
2. That L. *leucocephala* ssp. *leucocephala* should not be planted.
3. That planting of L. *leucocephala* ssp. *glabrata* should only occur under intensive management for animal production.
4. Due to the potential impact of L. *leucocephala* ssp. *glabrata* on the environment, further planting as a fodder crop should only occur:
    - In areas isolated from creeks, waterways and other drainage lines so that seeds will not be carried into the watercourse, and
    - Within fenced areas and at least 20m away from boundary fence lines.

5. Responsibility for the control of 'escaped' Leucaena leucocephala, ssp. leucocephala or *glabrata*, lies with the person or agency owning or managing the source stand.
6. All Queensland Government extension material relevant to leucaena should highlight the ecological risks, as well as the production and other benefits, associated with managing leucaena and the recommended control and mitigation techniques.
7. The development of sterile commercial cultivars will be encouraged.

Compliance with voluntary codes and this policy will be will be reviewed in 3 years with a view to considering if a regulatory regime is needed.

Conclusion

Early action to contain or prevent the entry of new weeds will minimise the long-term costs of impact and control. Some tree crops have become weeds, e.g. pines in New Zealand and olives in South Australia. Unlike annual weeds trees may take a long time to become a problem, lag phases of 20 to 50 years are not uncommon. Trees are rarely widely planted but a recent review of cultivated forage trees (Lefroy 2002) found 200,000 ha planted in Australia; mostly Tagasaste (Chamaecystis proliferus), leucaena and saltbush (Atriplex spp.). The area planted to these shrubs/trees had increased six-fold in the past decade. While the review found a further 101 tree species from 33 genera as identified in the literature as having potential for forage production in Australia, over the last ten years no new species achieved commercial levels of adoption. Exotic trees in general are known to present a risk given that the key selection criteria for a successful forage plant are rapid early growth and adaptation to a wide variety of environments. A number of genera with species which are used both in forestry and are the focus of eradication efforts; Acacia, Acer, Ailanthus, Albizia, Melia, Parkinsonia, *Pinus*, Pittosporum, Prosopis, Prunus, Psidium, Robinia, Schinus, Tamarix and Toona. (Hughes 1994, Hughes and Styles 1989).

Concern from the community over the promotion of new species, that may be weeds, may see increasing government involvement in the screening of these plants in the future (Melland & Virtue 2002) and codes of practice are a likely outcome for some industries. Leucaena is not to be declared in Queensland but government will be monitoring the implementation of the producer code of practice to ensure that landholders are taking on the responsibility of preventing spread of this species from their property and if these actions are not take then legislative actions may be required. At the same time local government is declaring locally where the species is a problem, which is showing a growing acceptance of the role local government in Queensland has in weed management.

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The Bushland Friendly Nursery Scheme

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Abstract

The Bushland Friendly Nursery Scheme (BFNS) is an initiative of the NSW North Coast Weeds Advisory Committee, with generous funding assistance from the New South Wales Government through its Environmental Trust, designed to reduce the impact of weeds on native ecosystems through raising awareness and voluntary restraint.

The Committee, through its Environmental Weeds sub-committee and other stakeholders, had identified 83 serious environmental weeds on the North Coast. A total of 59 weed species / genus were selected for inclusion in the Bushland Friendly Nursery Scheme, although some of these species may be later declared noxious in some areas.

The Scheme is aimed at three sections of the community: plant nurseries, their customers and local government. All have a role to play in reducing the spread of environmental weeds and the BFNS provides an integrated approach that allows each to have a sense of ownership and responsibility that will help ensure that the scheme's objectives are met and will be sustained into the future.

The Scheme is discussed in this paper through background information, its success and difficulties as well as what future implications it could provide.

Introduction

As we all know, a weed is a plant growing where it is not wanted. Environmental weeds are plants growing where they are not wanted, amongst native vegetation and impacting on habitats of native plants and animals. This may be on roadsides, on streambanks, in bushland, in wetlands, or in National Parks or Nature reserves. The degree of impact depends on the nature of the native vegetation and the characteristics of the weed.

Around 67% of the environmental weeds are garden escapes, which were legally and legitimately introduced to Australia as ornamental species. A number of pasture species, particularly sub-tropical legumes, are also significant environmental weeds.

Background

This project is part of a major project, the 'Regional Weed Action Project- Camphor Laurel, Bitou Bush and Environmental Weeds', initiated by the NSW North Coast Weed Advisory Committee (NCWAC) in 1999. The Bitou Bush and Camphor Laurel aspects of that project are completed. The Bushland Friendly Nursery Scheme (BFNS) is the major focus of the 'other environmental weeds' section of the project.

This Environmental Weed sub-committee comprising key stakeholders from Local Government, NPWS, DLWC, Landcare, TAFE, bush regeneration practitioners and others formed as the Environmental Weed Taskforce. Following initial surveys of members, over 130 species of weeds of current or future concern were identified. From this a priority list of 83 environmental weed species was derived that required immediate action for the NSW North Coast region.

The weeds were assessed using a methodology similar to that used to produce the Weeds of National Significance (WONS). The method involved use of decision matrix computer software and input from 16 leading environmental weeds experts from Taree to South East Queensland and beyond.

The decision matrix program allowed the team to assess the importance and adjust the weighting of 22 important questions based on the weed's invasiveness, impacts, potential distribution and controllability before looking at the individual plant species.

The most serious potential weeds were then assessed for possible declaration as noxious weeds. The most serious weeds that currently have an isolated distribution have been nominated for declaration as W2 noxious weeds. Serious weeds currently being widely sold in the region are now being declared as W4g noxious weeds in order to restrict their further sale. A total of 59 weed species / genus were selected for inclusion in the Bushland Friendly Nursery Scheme, although some of these species may be later declared noxious in some areas.

What's it all about?

Logan City Council initially introduced the scheme, with support from Greening Australia in Queensland. The NCWAC Environmental Weeds Taskforce adopted the project in principle. Local Government and the NCWAC with the provision of posters and promotions would encourage the community to purchase their plants from BFNS. Under this scheme, participating Nurseries would agree not to sell any of the 59 species.

The scheme seeks to build better links between the nursery industry and Local Government. It is anticipated that participating nurseries would receive preferred supplier status to Local Government, State and Federal Departments and local groups including Landcare and Coast care. Council's profile in environmental management within the community would therefore be heightened by participation.

Participating nurseries are invited to voluntarily agree not to sell any plants from the list of species identified as having the greatest potential for causing environmental damage. The nurseries may then promote themselves as 'Bushland Friendly' and benefit from the publicity generated by the scheme.

Benefits of the Bushland Friendly Nursery scheme are:

- Special signage to identify the nursery as a Bushland Friendly Nursery.
- Special promotions, including press, radio and TV advertising
- Vehicle stickers, aligned with radio competitions etc
- Preferred supplier status for Councils and Government Departments
- Lists of alternative native and exotic species widely distributed
- Promotions through the annual Weedbuster Week promotions
- On-going support and promotion
- Better communication between the Nursery Industry and Government.
- A uniform list of undesirable species, for the whole of the North Coast

Some of the community benefits include having fewer environmentally hazardous weeds being planted, and better community awareness of the problems caused by waste dumping, seed spread by birds and water. Those this it is hoped that the community is more discerning in their selection of plants for landscaping.

Project development

The NCWAC applied for a Grant through the Environmental Trust in June 2001 to fund the appointment of a project officer and production of promotional material. The project was funded in March 2002 and applications sought for the Project Officer role. The Island Quarry of Byron Bay was successful in obtaining the role, and started work in August 2002.

The Project Officers have been employed for six months to begin implementing the scheme. The Project Officers' duties involved securing the participation of councils and nurseries, developing alternative species lists, developing educational and promotional materials, beginning the promotion of the scheme in the media and establishing a network of stakeholders to take over the running of the scheme at the completion of their contract.

The seventeen local councils involved in the scheme participate by adopting the list of BFNS environmental weeds into their local planning controls as species that they will not use themselves or allow to be used in future developments. Each council has designated a member of staff to liaise with nurseries and the public and pledged either a financial or in-kind contribution toward the future maintenance of the scheme.

Councils will also promote the scheme in their regular advertising and help in the production and distribution of educational materials and lists of participating nurseries.

Project success so far...

Through ongoing consultation, the securing of the involvement of local councils from Taree to the Qld border has been a major coup. To involve the councils in the BFNS planning process provides a cornerstone to the program.

The development of lists of species to be promoted as alternatives to the identified environmental weeds is also a key part. **A** literature review was conducted to develop a list of plants that are native to the north coast area. The alternative species were then categorised by the form of the plants (vines, groundcovers etc.) to **correspond** with the equivalent categories of weeds. The alternative plant lists were then widely distributed to people with experience/expertise in vegetation management to provide feedback. The final lists were of plants that are native to the entire North Coast area and, to the best current knowledge, not likely to become weeds themselves.

Securing nurseries to participate in the scheme was a time consuming process. In addition to the efforts of the nursery industry body, the Nursery and Garden Industry Association NSW, the Project Officers made approaches to as many of the nurseries in the area as possible, in person or by telephone. The project officers approached approximately 285 nurseries and sent 175 formal invitations to participate.

The educational materials produced by the project officers were expanded considerably to include full-colour booklets with descriptions and photographs of all the listed environmental weeds and the lists of alternative species. These booklets in addition to posters and less detailed brochures will provide a valuable resource in raising the community's awareness of the issue of environmental weeds in general and the BFNS species not to be sold in particular.

Organising the continuation of the scheme after the term of the Project Officers' employment involved a staff member from each local council being delegated the responsibility of administering the scheme for their area. The scheme will be overseen by the NCWAC that includes members of the nursery industry, environment groups, local government and other government agencies.

Difficulties and delays

Through the development of the project, a number of difficulties and delays were determined in order to promote an understanding of the lessons learnt. These included:

- Loss of the original Project Coordinator of the scheme.
- Obtaining images of the weeds for the educational materials.
- Convincing nursery owners that some of the plants on the weed list are actually potentially bad environmental weeds.
- Convincing nursery owners that it would be worthwhile for them to stop selling some of the popular species.
- Convincing some wholesale nursery owners to participate in the scheme when the main incentive offered is free publicity and they actively do not want publicity.
- Convincing same local Councils that the scheme is worth the investment of staff time and on-going financial contribution.

Project effectiveness and value

The overall effectiveness of the project cannot be accurately assessed at such an early stage of the scheme's development. However, the agreed involvement of the participating nurseries and councils and the commitment of the NCWAC to maintaining the scheme all suggest positive outcomes for the project in future.

The educational materials produced are a positive contribution to the North Coast community. The scientific evaluation used to select the species listed as BFNS environmental weeds means that the public is being informed of the weeds that are most likely to cause problems in the area. The colour posters and booklets provide the most extensive resource relevant to the region for identifying environmental weeds and understanding their significance. These materials will be invaluable for home gardeners, environmental groups and others wishing to make a positive contribution to the local ecosystem.

It should be noted that the Project Officers have worked beyond the term of their contract in order to deal with the difficulties outlined above and achieve the objectives of the project.

The future...

On-going promotion of the scheme will be necessary to consolidate and expand its influence. Without additional funding this will be largely the responsibility of participating councils, the nursery industry and individual nurseries.

Local government could **take a leadership role by** actively **removing** the listed **weeds** from the areas they are responsible for maintaining. This **would** also **add** to their, and the scheme's, credibility with nurseries **and** the public in relation to environmental protection. This may also be covered by councils' in-kind contributions.

Links **with groups such** as Greening **Australia,** Flora for Fauna and the Society for Growing Australian Plants could **be** strengthened in order to promote the virtues and use of native species. This would provide balance to the essentially negative nature of the scheme to date. The scheme may be **perceived as overly** focussed an negative aspects of the nursery industry because it is directed **mainly** at not selling the **weeds,** Greater emphasis on promoting the benefits to the environment **of** native plants in home gardens would give the scheme a more positive impression to nurseries and **their** customers.

Conclusions

The NSW NCWAC's work on the environmental weed risk assessment process and the BFNS is an initiative that can be readily implemented in other regions throughout the country. The assessment process can also be used when considering potential noxious weeds or prioritising control of existing declared weeds. The BFNS is an excellent way to reduce the spread of known weed species without the lengthy process and some of the negative aspects of noxious weed declaration.

The scheme should have a positive impact on the natural environment in the long term. The increase in public awareness of the issue of environmental weeds and the regulatory changes made by local governments will contribute to a reduction in the number of weeds making their way into areas of native vegetation. This reduction will limit the need for dealing with new incursions in the future and free up resources for controlling existing weed populations and other environmental issues.

Further information on the Bushland Friendly Nursery Scheme is through the NCWAC website : www.northcoastweeds.org.au

Acknowledgements

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BFNS Project Officers
North Coast Weeds Advisory Committee members
Project Development and Planning
Weed Risk Assessment members
Local Council BFNS Officers
Participating Nurseries
and those involved in assistance with locating, or contributors of, photos for publicity materials

Thank you.


Believe me Mrs Simpkins..... its not an invasive plant!
NURSERY
OPEN MON. FRI
PALMS
5 for $1
Pots..

NURSERY & GARDEN INDUSTRY NSW & ACT (NGINA)

NOXIOUS WEEDS CONFERENCE

Recently the internet search engine "google" listed almost 77,000 Australian entries for a search on the word "weed".

There were almost 1,500 entries for Australian weed websites ranging from sites such as NSW Agriculture to those dedicated to specific plants.

There were over 25,000 entries for a search on environmental weeds.

This I'm sure is not exhaustive with many other sites, organisations and weed lists available through other search engines or not listed on the web.

What does all this mean? There is a plethora of information available on the subject of weeds but at the same time it is improbable that anyone could absorb and fully understand the volume of information that is available.

The question from the nursery and garden industry is how does one try to keep up with the volume of information that is available? How much of this information is relevant? More importantly though is how much of it is accurate?

It would be simple to say that all the information is relevant – which may indeed be the case, but I am sure there is information available that may not necessarily give an accurate and realistic representation of the true situation.

By way of example – when we hear of an "outbreak" of a weed plant in specific locations – there are occasions where we in the industry suspect that the outbreak may be localised because evidence of widespread invasive activity is generally not supported by factual material.

Rarely is "in situ" photographic evidence provided to support these claims, quite the opposite in fact, the evidence is anecdotal, emotional and one could argue tinged with a certain amount of bias. Many bush regenerators though dedicated are quite often ignorant of species and can label a good plant with a bad name in ignorance.

Our industry is somewhat concerned about the abundance of organisations that currently exist and those that are likely to come into existence in the future, all intent on tackling the weeds problem.

Whilst each of these does now and will continue to have the sincerest of intentions, there does not appear to be a consolidated and co-ordinated approach to tackling the problem nationally.

The problem is further exacerbated by the variation between councils at a local level, states at a broader level, and Australia generally each having differing declared lists and there appears to be no consensus as to what is a weed and what is not.

D. Ainsworth
Nursery & Garden Industry NSW & ACT

In Senator Bartlett's Environment Protection and Biodiversity Conservation Amendment (Invasive Species) Bill 2002, an invasive species is defined as

> (a) "A non-indigenous species and has been, or may be, introduced into Australia and, either directly or indirectly, threatens, will threaten or is likely to threaten, the survival, abundance, or evolutionary development of a native species ecological community, ecosystem or agricultural commodity"

Or

- (b) "It is a genetically modified species".

One could determine from this definition that all imported plants are virtually labelled weeds but there is no mention of natives that have gone feral.

In Tim Low's book "the New Nature", he states:

"Australian weeds are sometimes worse than anything imported from abroad. They elbow aside local vegetation, change fire regimes, create monocultures and shade smaller plants".

"These kinds of problems are also global in nature. Australian garden plants are misbehaving all over the place. Umbrella trees are taking over hills in Hawaii, wattles are infiltrating Africa, and sweet pittosporum poses problems on four continents".

The Nursery and Garden Industry's position in regard to the Democrat's Bill is that it fully supports the rigorous "Weed Risk Assessment" process that is currently in place and legally enforceable by Bio-Security Australia in conjunction with the Australian Quarantine Inspection Service. Much time and effort has already been dedicated by industry personnel and various government agencies to this effective process.

To reduce the threat of ***importing*** invasive species, our industry believes more attention and resources should be put into the current Weeds Assessment process and improved interception (including by mail) of illegal and undeclared imports.

To reduce the threat of invasive plant species ***already in*** Australia, our industry is actively involved in projects with local councils and government departments to identify and promote more environment-friendly alternative plants.

Our industry believes the most effective approach to reducing the threat of invasive plants is a combination of continued rigorous application of the existing Weed Risk Assessment Process; matched with effective education and promotion activity. Both require a co-operative effort involving the nursery and garden industry, government departments and organisation and the wider community.

Although our industry supports the existing Weeds Risk Assessment Process another issue the industry finds difficult is that there does not appear to be any real agreement on how to go about deciding what makes a plant a weed? The internet once again provides a vast resource of information, yet the volume of information is overwhelming to say the least and once you work your way through the maze of information the next question is which matrix to use?

Did you know that there are over 9,000 Australian internet entries for "weed risk assessment"?

What's more interesting though is the general public's perception of what constitutes a weed and my colleague Elwyn Swane will explain more of that later today.

The nursery and garden industry is more often than not accused of being the major perpetrator of weeds because a number of plants grown and sold by production nurseries and garden centres have, over the years, come to be regarded as problems both in our bushland and elsewhere.

Our industry looks upon these accusations with some degree of cynicism. We see a somewhat unfair emphasis placed on the hundreds of plants that have become a problem, rather than on the tens of thousands that have not.

Generally speaking, growers and retailers recognise their responsibility not to promote invasive plants, but rather to encourage customers to purchase non-invasive alternatives.

That's where the answer really lies – in educating the buying public – keep clearly in mind that if a customer wants something, then come hell or high water, he or she will find a way to get it,

I want you all to know that the industry wants to be, and is being, proactive and involved in addressing the problem of garden escapes as environmental weeds. But we all need to work together if we're going to get anywhere.
Discord amongst ourselves and unfairly laying the blame is not the answer.

We really do need to be realistic about the entire situation – it's not the nursery and garden industry that bears the primary responsibility – it's ourselves, every one of us.

Maybe some of those local provenance plants that we now see as the answer to our problem may in years ahead create the same problems that we're seeing now with introduced species – and I certainly include our Australian plants in that remark.

It's community education that provides us with the best opportunity of stopping the spread of invasive plants – no matter where they originated.

The Nursery & Garden Industry NSW & ACT (NGINA), the peak body of the nursery and garden industry in NSW & ACT, and related bodies in other states actively encourage our members to cease producing plants where there is indisputable evidence of widespread invasion.

NGINA recognises the role it is has to play in educating not only plant producers and garden centre operators, but also the public.

This is achieved through a number of forums including displays at garden shows, talks at garden clubs, our national accreditation schemes and more so the industry sponsored DAGE (Discovering Alternatives to Garden Escapes) project about which the project co-ordinator Elwyn Swane will provide more detail.

Through our industry's national accreditation programs -- Nursery Industry Accreditation Scheme, Australia (NIASA), the Australian Garden Centre Accreditation Scheme (AGCAS) and the Nursery & Garden Industry Professional Program (NGIPP), nursery operators and their employees are continuously encouraged to adopt best practice methods within their businesses.

Participants in each of these schemes are reviewed regularly to ensure they meet the national standards.

Whilst the schemes themselves do not identify specific plants, they do provide a strong basis to encourage operators to embrace changes to the varieties of plants grown and sold within **NSW** and the **ACT.**

NGINA takes seriously the role it has to play in educating and changing the public's attitude to invasive plants.

Our industry is keen to continue to work with local government as well as state and federal government utilities, towards a fair and achievable solution to the problems of invasive plants.

What's important is that we are able to demonstrably justify our reasons for wanting to remove certain plants from cultivation.

However, I must reiterate that it is not to each other that we need to justify, but to the gardening public – for it is they who will make or break anything that we may decide to do.

I would like to expand some of these points from our, the nursery and garden industry perspective. Before I commence however, it is important for us to distinguish between what we regard as a weed and what is a garden escape.

Most nursery and garden centre customers do not need to make this distinction – to them weeds are thistles, bindii, clover, dandelions, onion grass and so on; unsightly infiltrations into the garden and lawn that should be removed or sprayed but no matter what, eliminated from the garden or lawn.

Our industry's preference is to forget the word "weeds" and talk instead about garden escapes – those horticulturally significant plants that have invaded and naturalised themselves in areas other than those in which they were originally planted.

Referring to these garden escapes as "weeds" – as is usually done by many individuals and organisations – tends to cloud the issue and cause confusion in the minds of the general public.

The nursery and garden industry is an easy target at which to point the finger and lay blame for many of the garden escapes. Federal, state and local governments all do it – as do bush friendly and weed organisations.

It is true that in past years some plants sold at nurseries and garden centres have escaped from home gardens and have by any one of a number of means naturalised themselves elsewhere to create environmental problems.

Forgotten though is the fact that many escapes and invaders simply "walk" into a new environment and establish themselves because the climate is right for them or a natural event occurs that enables them to shed seed and invade the area around them.

There are many ways by which invaders may be transported from one area to another, birds and the wind are two obvious ways as is the carrying by individuals who visit the bush and innocently carry seed out in the soles of their footwear or in their clothes.

Again, this emphasises the need for educating the public so they become aware of how their actions can impact on the environment and what precautions they can and should take so that invaders are not moved from location to location.

Earlier I mentioned the industry accreditation schemes - AGCAS and NIASA. The industry offers a selection of accreditation and professional recognition programs to industry participants and is promoting them to the community.

I will outline the aims of two of the schemes briefly highlighting the role they have within industry to educate growers and retailers of the need for professionalism and further being able to assist in educating the gardening public.

Garden centres and production nurseries can all benefit from meeting a minimum standard, being independently assessed, demonstrating professionalism and regularly getting help with business improvements.

The concept of professional independent assessment of businesses and business practices is not new and is one that is used in many different industries. For example, plumbers, car repairers, accountants, even doctors all have schemes of best management practice available to them that enable demonstration of professionalism and provide a mechanism for continual improvement.

Within our nursery and garden industry, NIASA and AGCAS have already attracted 300 businesses to become accredited and benefit from the accreditation process. This number has steadily increased over the past few years.

While the technical focus of AGCAS and NIASA differ, the concept of a helpful independent assessment that encourages business improvement and a professional attitude is common to both schemes. In addition, AGCAS and NIASA provide industry benchmarks for minimum professional standards.

To help these schemes develop and add value for participating businesses and individuals, they will be more widely promoted throughout the industry and to consumers. This will be achieved through the implementation of the new industry strategic plan 'The Nursery and Garden Industry, 2002 and Beyond' which has accreditation and professional recognition as a major focus – as is environmental responsibility.

In a recent survey of all NIASA businesses, participants claimed that NIASA has enabled them to maintain a high level of professionalism they also indicated that time is right for significantly increased NIASA marketing to greenlife buyers and end customers, the gardening public.

The focus of NIASA is the best management practice guidelines that were originally published in 1997 and over 3400 have since been sold. Recently updated, and soon to be republished, these guidelines provide a template of best management practices for production nurseries and growing media suppliers. The guidelines were developed through extensive consultation with industry and are regularly reviewed by state and national NIASA committees.

AGCAS enables retail nurseries to benchmark their performance and provides information and advice on how to build their customer reputation. Designed as marketing based and customer focused tool, the AGCAS process measures the way garden centres serve their customers and provides understanding on what and how improvements can be made.

D. Ainsworth
Nursery & Garden Industry NSW & ACT

Professionalism is needed to be successful in our industry. Demonstrating our professionalism will also enable our products and services to be more highly valued by the community.
I think you will agree that the industry is demonstrably pro-active in its efforts to educate production and retail nurseries, and the general public not to promote or plant garden escapes. However as I indicated earlier there are a number of obstacles that must be overcome at a local, state and federal level before the industry can be confident of moving forward in unison with other statutory and community based groups.

Subsequent to the repealing in 2001 of the Horticultural Stock and Nursery Act, our industry no longer has access to funding for research & development purposes. The replacement Act, Agricultural Industry Services Act provides the mechanism for a committee to be established that could levy industry members be they members of NGINA or not.

During 2002 the NSW Nursery Industry Services Committee was established in accordance with the legislation. The Committee recommended that all production nurseries with a turnover in excess of $50,000 have a levy of $200 per annum placed upon them to fund research and development for the nursery and garden industry. Previously our industry has benefited from programs such as:

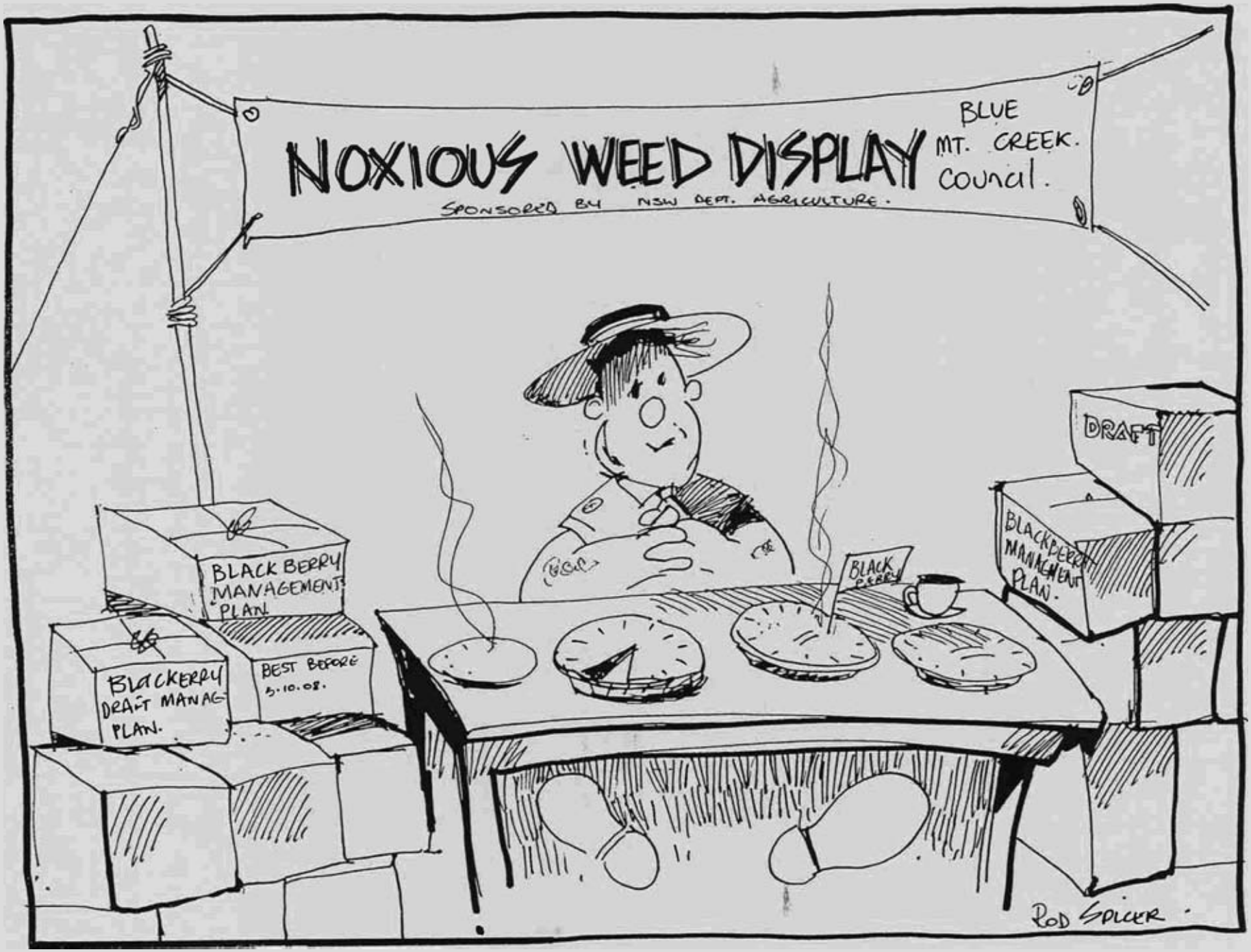
- the development of integrated pest management for mites in ornamentals;
- fertiliser strategies for reducing nutrient leaching and improving growth rates; and
- improved nursery irrigation, drainage and recycling.

Two polls have now been conducted and unfortunately the proposal was defeated on both occasions. This now leaves the NSW industry vulnerable as there are no other immediate sources of funds available for the industry to use solely for research and development. The industry is aware that the weed control movement gets federal funding in excess of $150 million per annum - how then can the nursery & garden access some of these funds so as to ensure the arguments are balanced and the right weeds get targeted?

In the future it will be necessary for our industry to work even more closely with government bodies and other organisations to develop programs such as the Discovering Alternatives to Garden Escapes.

I have attempted to highlight some of the issues the nursery and garden industry has relative to weeds and their control, hopefully I have put into some perspective the concerns we have in relation to the gardening public being made aware of the issue of garden escapes and more importantly receiving accurate and balanced information so they can make informed and intelligent decisions when purchasing plants.

In conclusion, the Nursery and Garden Industry is committed to promoting gardening and the benefits associated with it, at the same time taking a responsible approach to the issue of garden escapes and invasive plants by demonstrating initiatives within the industry and working with government and community groups to halt the progress of plants that have now or will in the future become garden escapes in areas other than those in which they were originally planted and to discourage the public from dumping plants in the bush and further from purchasing'plants that have undeniably become true invaders.


NOXIOUS WEED DISPLAY
BLUE MT. CREEK. Council.
SPONSORED BY NSW DEPT. AGRICULTURE.
BLACK BERRY MANAGEMENT PLAN
BLACKBERRY DRAFT MANAG PLAN.
BEST BEFORE 5.10.08.
BLACK BERRY
DRAFT
BLACKBERRY MANAGEMENT PLAN.
ROD SPICER.

PAPER FOR DISCUSSION – by Elwyn Swane for

12th NSW AGRICULTURE BIENNIAL WEEDS CONFERENCE

As some of you may know, I grew up in my father's nursery. As children, my brothers and sister and I spent school holidays helping in the nursery and after our school years we variously became fully involved in the nursery. Our 82 year old family company was sold in 2000 and after a lifetime working in the nursery, I retired for a few short months, then joined the staff at NGINA in a part time capacity as the project officer for D.A.G.E. (Discovering Alternatives to Garden Escapes).

As a nursery person and avid gardener, I regard the subject of garden plant escapes with some scepticism, Why I ask myself, shouldn't they all have a place in this land? Perhaps, after only two hundred or so years of white settlement, we are witnessing an evolutionary change on this continent, whereby some imported species might suit it better than the originals. Is the fact that they have taken advantage merely "survival of the fittest", if that is so, what is wrong with it?

I'm a horticulturist, not a botanist, with no further scientific qualifications, so from what I've read about climate change and global warming it is my understanding that our planet is changing and perhaps foreign plants might one day replace indigenous in this part of it.

It is interesting fact, that after the last ice age some 8,000 years ago, Britain was a waterlogged landscape of sedges and ferns with barely 200 species of plants to re-emerge in the post glacial period, none of which would have created a posy of flowers or made a meal. Yet, many plants that today we credit as being British, in fact are not!

What do any of us really know?

For myself, I know that several plants have become a problem, but not just the imported kind, there are native plants behaving badly too.

I also know that there are numerous groups of people frenetically brandishing banners trying to "save" our environment and not getting very far and other ecologists who diligently educate lesser mortals to rational thought without hot-headedly advocating total annihilation of every non-native plant, because they recognise that native plants can be guilty too.

Then, there are 'plant bashers' who would have us remove all imported species with or without any factual evidence of invasiveness.
A nationalistic pride in Australian plants is to be applauded but, often the 'goody two shoes' enthusiasts know little about any other species!

There must be a middle road but how do we find it?

My first altercation with a 'plant basher' was with an employee, years ago in our Dural nursery who wrote an article for the local paper denigrating exotic plant gardens of the Hills Shire as a drain on water resources, saying that all should be removed and replaced with native species. I explained that 90% of her pay packet came from the sale of roses, azaleas and camellias, only a few of the exotics that made a high percentage of our trade at that time.
If her opinion was that only native plants were good, I suggested she seek work in a native plant nursery. This she did but, was replaced by another native plant enthusiast, who wasted no time in telling me we should be growing more native plants.

I do appreciate a preference for Australian species but, at that time, natives were not popular, sold slowly and rapidly outgrew pots. Wasted plants mean loss of profit and poor management.
This new employee invited me to a talk by an ecologist, I went prepared to argue, presuming it to be a one-sided argument against non-native plants.
But, there was no contest! I agreed with everything the lady said about plant choices, native or otherwise and applauded her unhesitant commitment to the eradication of free-radical, garden plant escapes. I am very pleased to add that Judie Rawling from Urban Bushland Management Consultancy is now a member of the DAGE steering committee.

In an Australia Day address in January 2002, futurist Tim Flannery offered a radical approach to those of us who like to garden among imported plant species. He stated that 'roses, lawns and plane trees are a blot on our landscape', implying that all gardeners should and must 'go Australian'.
(Yet, recent DNA research shows that the North American plane tree is the closest living relative of our Australian rich family Proteaceae).
Tim's argument worried me since my garden of non-native plants, developed under a grove of native turpentine trees abounds with numerous wonderful native parrots, tawny frog-mouths, kookaburras, currawongs and magpies as well as possums, sugar gliders, frogs and water dragons, blue tongue lizards and little skinks, all in suburban Beecroft!

In my pursuit of gardening I do nothing harmful to discourage these creatures, providing a pond, bird baths, large rocks and plenty of flowering plants for nectar and seed. Plants requiring chemicals to stay healthy are swiftly removed and I don't use snail pellets.

In the suburbia that surrounds me, these creatures are happy to co-habit with humans at close quarters in gardens of imported species! There is plenty of recorded evidence, from Aboriginal times through to white settlement, by early pioneers, that proves much of our fauna has indeed adapted to human intervention.

Of course, there is every good argument to plant indigenous flora in our gardens in preference to imported species.

If you happen to like Australian plants, they are more natural for our Australian wildlife and require less water than most, tho' not all, imported species. What concerns me however, is that most are hybrids, not species, and not really indigenous to any one region.

Propagating the yarn that native species alone are less water consumptive gives the impression that the only way to conserve water is not to sell imported species and to remove existing gardens of imported species in the hope of reducing the use of water or preventing plant escapes!

We should be propagating the education of gardeners to make more considered selection of plants, Australian or non Australian, NOW and in future.

Removal of rampant classified noxious plants like privet and lantana is an almost impossible ask, certainly it's economically challenging and were it possible, might even create an environmental catastrophe none of us could ever envisage. Removal of all exotic garden plants not proven invasive, could mean more of the same.

Retirees enjoying their gardens would be forced to remove all exotics and begin again but, are they economically or physically capable?
Do we remove choice from the home gardener or the income of growers who have specialised in the propagation of imported species, in some instances for several generations?
What happens to the environment?

According to the Australian Bureau of Statistics the nursery industry is worth billions of dollars annually but it is doubtful at this stage that native plant sales constitute the higher percentage of that figure.

Perhaps native species should take preference over imported, if gardeners are happy to choose that way but only if **they** are local to the area and not imports or **hybrids** from other states.

This is difficult to ensure since as I've said, so many hybrids of species of various origin are now available.

In new housing developments, Australian native plants (or others for that matter) cannot replace the previous environment. It is impossible to re-create a natural landscape after shifting and replacing soils, altering topography and erecting houses on concrete slabs. These are now artificial landscapes and nothing, including the micro-climate, is as it was before. It is foolishness to assume the previous environment can in any way re-establish.

An article by Tim Entwistle published in the RBG's Sydney winter magazine 2002 was a gentle rebuttal of Tim Flannery's Australia Day edict.

Enwistle highlighted the fact that gardens have 'other values' and says:
"They are part of our heritage, just like our artificial construct, the house. Most people enjoy their gardens, no matter where the plants once grew. Many appreciate having plants from other countries. This is to be encouraged, perhaps under the banner of the multi-cultural garden."

He goes on to say:
A simplistic call for gardens to be all-Australian risks alienating people who, for whatever reason, chose the multicultural garden, but [who] also support genuine environmental initiatives.

Having said all that, **there are plants no one should grow in their garden;** ones that have a high chance of spreading into nearby bush and becoming weeds, any plant that discourages indigenous wildlife, or demands an unreasonable supply of reticulated water, or needs toxic chemicals to survive"

Summing up he said:

"We should all think about the impact of our garden on the environment that exists on the other side of the fence. Aim for a garden that is neutral to positive, but one that you like."

What then **can** we do to **make** gardeners more environmentally **aware** of the greater backyard? How do **we** encourage homeowners and not necessarily those with gardening **expertise** to strive for this neutral to positive garden planting?

The D.A.G.E. initiative begun by the Nursery and Garden Industry, Australia with support from the Natural Heritage Trust, is now managed by the Nursery and Garden Industry, NSW & ACT. It is an attempt to educate growers or nurserymen who propagate and grow plants, garden centres and hardware chains that sell them and most definitely gardeners, in regard to the garden escapes identified on our focus list.
Here I stress that our list refers only to the Sydney Basin at this stage and not to the entire state!

The focus of the DAGE list is on plants still propagated and sold and it is derived from the experiences of representatives from all areas of environmental protection, including officers from councils, noxious weeds committees, NSW Agriculture, Department of Land and Water Conservation, Australian Assoc. of Bush Regenerators, an ecologist and members of the garden industry.

To qualify, the plant had to be seen by **all** committee members as a wide spread invasive escape that is grown and sold in nurseries, garden centres and other garden outlets, eg., Buddleia davidii.
While hybrids of Lantana x camara do not readily set berries to attract birds to aid their spread, it is believed they cross-pollinate other forms of lantana to more freely set berry, so these hybrids have been included on our list.

The number of plants targeted seems small but, it will grow and should be viewed in conjunction with numerous other ornamentals, already declared as noxious on municipal or other agency lists.

Publication of the D.A.G.E. booklet is intended for distribution throughout nurseries and other gardening outlets within the Hawkesbury-Nepean and Southern Highlands regions and includes alternative plant listings for each of the garden escape plants.
It is hoped that this will encourage gardeners to question each purchase they make.

The hot issue is whether or not the alternatives won't also become invasive given time.

To the best of the committee's ability we have evaluated each alternative selection through a weed risk assessment test to ensure this does not happen but then as I asked earlier "what do any of us really know"?

Today, backyards are much smaller than a decade or two ago, subsequently nurseries and garden centres find a diminishing market in return sales. Previously, gardens were larger and developed over years but, today are installed as part of the house package on small blocks with more 'hard' than 'green' landscape.
A direct result is a need for impulse sales of new, exotic plant imports or the development of new hybrids, some of which are barely classified! What testing do these new plants undergo in the wider environment, outside the importer's or hybridist's patch? And if they are tested satisfactorily in one region, does it mean they won't be a problem in another?
Both growers and garden centre operators need to question the potential of any new plant to become an invasive environmental weed.

Some years ago our firm imported Diascias and Gauras from British breeders, believing that Diascia required a specific English bee for pollination but, we later found that Gaura set seed freely, I hope not yet in the bush. Illegally imported crop-pollinating bees may yet help Diascia to do likewise. Both these plants have now been further developed by hybridists here in Australia.

Sound trial grounds are needed across the country where new hybrids and imported plants can be fully evaluated across a variety of climates or regions before being commercially released. Trials would indicate the extent of a plant's climate range and what climates cause a plant to behave differently.
There are trial grounds for roses, are there such trial grounds for perennials, trees or shrubs?
And which authority has the ability to monitor the progress of such trials?

The nursery industry cannot attempt control in a situation where we are busy on the one hand trying to eliminate an invasive plant, if behind us wide scale hybridisation, propagation or importation of another is taking place.

What criteria does NSW Agriculture use in the assessment of plant imports?
Do rulings change with popular ecological theory or assumption and are changes to assessment criteria always made on sound judgement with substantial scientific support?
How often have rulings lapsed only to be re-instated?

It is not difficult for nurseries to obtain permits to import plant material. Our own nursery did it for years in regard to bud 'eyes' of new rose varieties. Sometimes parcels even came direct from FedEx to the nursery without going to quarantine, which we responsibly surrendered unopened to Aqis.

After inspection our rose bud-wood was grafted onto rootstock at Narromine, held in a quarantine area and inspected regularly by Aqis until approval for release was given. But, what of imported perennials like Gaura and Diascia, released after initial inspection and an all too limited isolation period within the metropolis.

And what of unscrupulous persons who bring in plant material illegally, subsequently propagating quantities for sale without Agriculture inspection?

It is pointless to lay blame for those that are already garden plant escapes because it's specifically a case of **'how little we knew in the past'? (***In the early 19th century plants, birds and animals were transposed between states because 'nature' groups then thought it would be nice to have certain species common to all states without ever dreaming what detriment might ensue as a result).* **Aborigines too** transposed ... plant material between regions so the door was unbolted a long time ago!

In future, more plant escapes, exotic and native are likely. Perhaps even those growing for generations without problem, or maybe new imports or new hybrids. When the opportunity arises which will and which won't escape? Are we able to predict?

Human intervention has contributed to global warming, altering conditions so that some plants thrive better than they should outside their natural range.
For example, there are numbers of tropical plants now thriving further south of the Queensland border than say twenty five years ago and gardeners take credit for the success.
We know the more probable cause **is** climate change by other examples of plants and weeds once only known north of the NSW border, that now extend below it as environmental weeds.

The nursery industry like many others contributes to that change in its need for fuels for heating and the manufacture of plastics like pots, ties, labels etc.,

BUT, as an industry we have to ensure that we do not continue to carry responsibility for an ever increasing list of plant names that are appearing on a multitude of weed lists created by more and more weed organisations cropping up like mushrooms across the nation.

At least, not without scientific and visual proof of invasiveness. Most importantly unification of groups is necessary if there is to be qualified criteria to classify a plant **escape** and to more evenly spread **what** little available funding there is!

Are there **valid scientific statistics** to prove that more plants become feral than those that remain well behaved?
Generally speaking, when left to themselves, plants are slow to colonise but **they are very good at adapting.**

Naturalist Tim Low says that the key question **is** NOT 'Why do some plants become weeds?' but 'Why do most cultivated plants remain well behaved?''
He explains the reasons and goes on to say that there is no way we can predict which plants will escape to naturalise in future but, lists his reasons why so many plants have not yet naturalised, most of which we know or can fathom.
He says conditions under which escapes are more likely are; when 'new stock is imported, the arrival of **new** pollinators and **when** plants or their seeds reach localities that suit them best.'
He vigorously opposes importation of new crop-pollinating bees yet, there is evidence to suggest that illegal importation of these has already occurred.

I am very recently alerted to the problem of garden plant escapes. Still, I feel there is sometimes **a lack of evidence** to support some inclusions, such as visual evidence of infestations out of control, or **scientific proof** of cross pollination from hybrids to species forms, or perhaps I've not yet found it.

In the plethora of weed lists now published I truly hope that a plant is not condemned because half a dozen seedlings bobbed up on the edge of bush somewhere or because a few people have a 'fixation to remove ' certain plants on the assumption of possible invasiveness. I also deplore the fact that some genera are condemned by plant profilers on the basis of one species gone feral!

The Nursery and Garden Industry Australia commissioned a survey of gardeners in the Hawkesbury-Nepean Catchment that includes 26 local government areas. Interviews were conducted over weekends and weekdays, only with the main gardener in the household. Of the sample most were women (64%) males 36%, implying the main gardener is more often female.

When asked what is a weed? 2/3rds when prompted, agreed that it is a plant that may be invasive. Many saw weeds as something they did not plant, did not want or that don't look nice.
Onion **weed, clover,** bindii. **oxalis** and **grass weeds** rather **than garden** plants were named as having a **major** environmentally bad effect.
A minority were conscious of the fact that garden plants in their own gardens might become environmental weeds, some thought about it, some didn't care or think about it at all.
There was however, high awareness of weeds in parks and bushland (2/3rds) and half **accepted** that **invasive weeds** are a major environmental problem.

Despite this awareness, most blamed natural means like birds, animals and insects (63%), wind (47%) or natural propagation (15%).
Only a minority noted that humans are a causal factor.

Only half believed introduced species account for most invasive plants, only 9% said native plants could be invasive, which shows an acute lack of knowledge of **native** plants as invasive weeds.

When buying plants, very few thought nurseries would sell invasive plants but 64% agreed that they would not buy a plant if advised it could be, 33% thought they probably would and **3%** disagreed outright.

When prompted with a list of ten major plant escapes it was found that only Phoenix (date palm) (68%), lantana (75%) black eyed Susan (55%), Cootamundra wattle (51%), Cocos Island palm(48%) were well known. Lantana was considered by more than half as a potentially invasive weed and most said all these plants were present in their gardens. That is very unlikely as most hadn't mentioned them until prompted, nor would they be able to identify them.

It was interesting that most thought education above legislation a better way to control environmental weeds, 23% said plant nurseries shouldn't propagate invasive plants. Most thought killing weeds was the best method of control but had little idea of how it could be achieved.

Despite numerous suggestions in regard to public education through mass media advertising and signage at nurseries, most felt that staff advice at nurseries was vital to make customers aware of potential plant invasiveness.

This survey is more expansive than intimated here and showed acceptance of weeds or plant escapes as a problem in bushland but, most do not take much notice of them at home.
Respondents rationalised that the causes are "natural" and not from the impact of people and their backyards.

There is noticeable lack of awareness and recognition of major environmental plant escapes, and few regard the potential impact of them - **concluding that education, information and communication at point of sale is vitally necessary.**

There was very little acceptance of the need for regulatory legislation. This is supported by demand for information, advice and the opinion that advice will be taken if provided.

The problem the DAGE committee faces is in getting the message across. There must be clear definition for the gardening public on this issue but the angst is guaranteeing that the message reaches ALL of them.

The present influx of migrants to Australia from very different parts of the world means that recognition of weeds or invasive plants is difficult for them.

Last year during WeedBusters Week, Hornsby Council displayed signs in Chinese and Korean that attracted huge attention. Many Asian people confirmed with council personnel that they had certain plants or weeds in their gardens but didn't know these were a problem. They were glad to have the information and said that they would act on it.

But, will they?

From my experience in nursery retail, the gardening public have preconceived ideas of what they want from a garden. It's difficult to alter their choices to something more suitable.

have often advised against a plant's unsuitability for a site, only to have the customer take the plant anyway. What they can't buy in their local area they will buy from another area or use mail order. For instance, huge numbers of Paulownia trees, highly promoted some years ago and sold by mail order now tower over houses, out-growing backyards all over Sydney.

It is inherent in our psyche to receive, digest, accept or reject information as we see fit. If we can't control mail order or plant swapping between friends in different areas, can we control interstate movement of plants that might become disastrous environmental hazards in another?

Even Australian plants transported from one state to another present the same potential, so let's not specifically condemn only non-Australian plants.

The nursery industry has raised its standards considerably over the past ten years mainly through an accreditation scheme and professional programs in which it encourages members to participate.

While the mission statement of the industry encourages best practice and professional conduct, some may choose to ignore it or non-members may never receive it. The **'bully boy" approach** of 'black-banning' or harassing nurseries into signing agreements is not one which our industry condones.

Another alternative **is legislative control of invasive plant material.**

But, **this is a dangerous path.** There is controversy in definition. There can be too much haste when 'drawing the line' of classification. Too much information from too many agencies can be more dangerous than too little. Who can tell which will and which won't become invasive given time? Or where?

Often well meaning advocates for a purer environment become over enthusiastic in their 'defence of nature'. And that raises the question "what is nature?"

Nobody disputes the fact that some garden plants are an invasive problem in bushland. There has to be a solution but it has to be one with which the horticultural industry and the gardening public can work amicably in achieving together.

When I came to this committee I found it hard to know where to begin and now it's hard to know where to stop. I want to remain rational but, critical too. We need both to curb the spread of invasive plants but to also make the goal achievable.
And we need education for gardeners – I'd like to believe there are no bad plants, only poor choices!

Predictions of a plant's potential invasiveness made from a laboratory or weed risk assessment test may not be relevant at all, because the opportunity for the plant to 'naturalise' may not occur, predators may intervene, or the particular climate change may not be conducive. Condemnation **may be unjust!** Let us not be accused of 'blanket' decisions based only on probability!

More garden plants will escape in future but, we must work with **what we have** and **what we now know.**
There are many issues in trying to control the spread of invasive plants into the future.

As I see it, most remedies will require **funding** first, scientific assessment, co-operation between agencies and the man in the street, education of plant propagators and control of new hybrids, control of imports and or pollinators, and restriction of the movement of plant material inter as well as intra state.
These are just some of the obstacles to overcome and given the hundreds of plants already on the 'Weeds of National Significance' list it seems an overwhelming task.

How do we succeed?

Well, given this past summer we might be entering a 'fire age'.

Or the climate may go into reverse – what do any of us really know?

PLANTS TOXIC TO LIVESTOCK ON THE MID NORTH COAST OF N.S.W.

Allan Glassop
District Veterinarian
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This paper aims to provide a brief summary of some of the potentially toxic plants found in the Mid North Coast area of NSW.

In its most basic sense, the term "weed" simply describes a plant which is growing in a situation where it is not wanted. Not all potentially toxic plants are always regarded as weeds - many very useful pasture species can cause toxicity problems under certain conditions.

Similarly we need to differentiate between toxic plants and noxious plants - not all toxic plants are classed as noxious, and conversely not all noxious plants are toxic.

A discussion on toxic plants becomes more complex when some of the variable factors are taken into account e.g. some weeds are only toxic to certain species of animals, some weeds are more toxic at certain stages of growth, some cause sudden death with few prior symptoms, some cause sudden animal production losses but few deaths, while others result in long term (chronic) ill-thrift and lowered production (production = milk yield, carcase growth rate, fertility effects etc.)

Plant toxicology is often an inexact science and there are still many plants on the "toxic plants lists" which are largely there due to anecdotal evidence and a suspicion of toxic effects under some circumstances. Definite proof of toxicity is often lacking as research by feeding trials, chemical analyses and other techniques is costly and time consuming.

While poisoning by many of the major toxic plants is well-researched and can sometimes be diagnosed on blood samples and/or microscopic examination of autopsy tissue samples, there are numerous other toxic plants for which there is no definitive diagnostic test.

One must always remember that the mere presence of a toxic plant in a paddock does not mean that it is causing problems.

In my opinion many anecdotal reports (= farmer diagnoses) of plant poisoning are possibly incorrect - animals can't talk and describe symptoms, so veterinary diagnosis is often a complex mix of history, clinical signs, paddock observation, animal behaviour, owner observations, elimination of other possible causes, sometimes blood test results, and often post mortem findings.

Over the years I can recall visiting dozens and dozens of farms with animal mortality problems, and diagnosing a range of infectious disease problems, where the owner's presumed diagnosis had been plant poisoning.

In some circles plant poisoning is regarded as a convenient diagnosis for the "diagnostically destitute" – in other words, if a definite cause of death is not obvious, then it is easy to blame a toxic plant.

Anyway, enough of these generalisations, and I should hasten to point out that I am not trying to downplay the importance of toxic plants in livestock illness and deaths.

So what are the main toxic plants in this area?

It is impossible in a short presentation such as this to provide an exhaustive list (and neither am I qualified to do so), so I'll discuss what I regard as the district's potentially toxic plants, under 3 categories :-

(A) Plants common in the district which cause significant and repeated mortalities in livestock.
(B) Other district weeds which may cause problems
(C) "Good" plants which can cause problems.

As common names of plants can be confusing, I have shown botanical names as well. However not being a botanist I can't guarantee the correctness of these names, as often taxonomists have a habit of changing scientific names of species from time to time, thus causing more confusion.

With the limited time available I will merely provide a brief description of the toxic effects of each plant - not being a veterinary toxicologist I don't intend to provide detailed biochemistry etc, even where there is detailed knowledge of some specific toxins - in many other cases detailed knowledge of toxic effects is simply not available.

(A) THE MAIN CULPRITS

BRACKEN FERN (Pteridium esculentum).

Arguably the most widespread weed on the Mid North Coast. While it can be controlled to a degree by slashing, mulching, pasture competition and chemicals, it is virtually impossible to eradicate from the more inaccessible areas, so it will continue to remain an "occupational hazard" for livestock producers.

The main toxic effect of bracken fern is on the bone marrow resulting in a very low blood platelet count (thrombocytopaenia), and a low white blood cell count (leucopaenia) - the end result being failure of the blood-clotting process (resulting in internal haemorrhage and severe anaemia), and a greatly increased susceptibility to secondary infections.

There is no effective treatment, and once an animal starts to show clinical symptoms (usually anaemia, tarry faeces (melaena), and haemorrhages on mucous membranes such as the gums, conjunctiva or vaginal/vulval mucosa), death is inevitable.

A less-commonly seen effect occurs in older cattle which have been exposed to non-fatal levels of toxin over a longer period of time - these animals develop tumors in the bladder which bleed intermittently - this is one of the causes of the condition called "coastal redwater" or "enzootic haematuria".

Problems have apparently also occurred in humans in some overseas countries where bracken tea infusions are used as a herbal tonics.

FIREWEED – (Senecio madagascariensis)
(Senecio lautus is the main species in Qld)

Arguably as ubiquitous as bracken fern in this area. Fireweed can be controlled by pasture competition and chemicals, but is virtually impossible to totally eradicate.

The toxic compounds are pyrrolizidine alkaloids (also found in weeds such as Pattersons Curse, Heliotrope and Rattlepods, which can also be toxic to livestock).

These toxins cause liver damage resulting in death of liver cells and replacement by fibrous tissue (scar tissue). Symptoms are **extremely** variable, ranging from sudden death in apparently healthy animals, through to chronic ill thrift, weight loss and emaciation.

There is a lot we don't understand about fireweed poisoning. It is extremely rare to see cattle ever eat mature fireweed plants, even under severe drought conditions - presumably a palatability effect, yet we still see cases of fireweed poisoning. The most **likely** theory is that cattle unknowingly eat the small fireweed seedlings (which are probably not as unpalateable) while grazing, with the toxin building up in the liver and causing liver fibrosis over a period of time.

The toxins can also remain active in hay made from fireweed-infested pasture.

Again there is no specific treatment, but not all affected animals will die.

With both Bracken Fern and Fireweed, it is fair to say that considering the large plant populations in this area, we don't diagnose as many cases of toxicity as one might expect.

While many cases are only single animals in a mob, in other cases mortalities can be quite high. Some examples that are on our records are :-

- 16 steers from a mob of 40, which died from Fireweed toxicity over a **3** week period on one farm
- 7 heifers from a mob of 14 which died from Bracken Fern poisoning on one farm
- 5 heifers from a mob of 5 which died from Bracken Fern on another farm.

GREEN CESTRUM (Cestrum parqui)

While not as prevalent as Bracken Fern or Fireweed, Green Cestrum is found predominantly along watercourses and gullies, and the berries are widely spread by birds – Green Cestrum poisoning has been diagnosed in almost all parts of the Gloucester RLPB district.

It is highly toxic, usually resulting in sudden death from acute liver necrosis.

Again there is no effective treatment, with most affected animals dying quite quickly after a short period of recumbency with marked convulsions.

RED-FLOWERED LANTANA (Lantana camara)

The general observation is that the Red-flowered form is toxic, while the Pink-flowered form is relatively non-toxic. (Note there are many forms of Lantana, and many regional variations e.g. the Pink flowered form found in North Qld is considered highly toxic).

While not a problem in the Manning Valley (Red flowered lantana is quite rare here), it is a significant problem in coastal areas from Kempsey north.

The toxin in Lantana causes severe liver damage which also results in the secondary effect of photosensitization, due to the inability of the damaged liver to break down and excrete light-sensitive pigments found in green plant material - these build up in the bloodstream and react with UV light to cause what is effectively an "internal sunburn" of non-pigmented skin. Again there is no specific treatment, and many affected animals die from liver failure.
(NOTE: There are several other plant species which contain light-sensitive chemicals which can cause a primary photosensitization when eaten by livestock - in these cases there is no liver damage, and the affected animals usually recover).

(B) THE MINOR OFFENDERS (not in any order of importance):-

These plants are recognised or suspected as having potential toxic effects, but on the Mid North Coast, diagnosed or confirmed cases are sporadic and relatively rare.

OLEANDER - (Nerium oleander) - Contains a cardiac toxin which can cause sudden death.

PEACHLEAF POISON BUSH or POISON PEACH (Trema aspera) - contains a liver toxin, causing liver lesions similar to Green Cestrum.

WANDERING JEW (Tradescantia albiflora) - When consumed in quantity by hungry cattle can cause death from nitrate poisoning with symptoms of panting, staggering, collapse and convulsions. Often found along creek banks and in neglected gardens.

RED SALVIA (Salvia coccinea) - Can cause severe enteritis, scouring and death - found in roadside cuttings and steep creek banks.

CASTOR OIL PLANT (Ricinus communis) - Contains a very potent toxin called ricin (purportedly used by injection in some "spy versus spy" assassinations). Usually found on creek and river banks.

THORNAPPLE sometimes called False Castor Oil plant (Datura species)- contains a central nervous system toxin - rarely eaten by animals, but supposedly used more by humans for its hallucinatory CNS effects. Often found in recently cleared pasture land and in cattle camps.

SMARTWEED (Polygonum spp) - suspected of causing primary photosensitization - common is roadside drains, floodways, irrigation channels and drainage ditches.

WHITE CEDAR (Melia azedarach) - the berries can be toxic - suspected cases have occurred where birds have dropped white cedar berries into water troughs. Symptoms are ataxia, muscle weakness, trembling and collapse.

MILKY COTTON BUSHES – Red-flowered cotton bush (Asclepias curassavica) and Balloon cotton bush (Gomphocarpus physocarpus) - Balloon cotton is more common particularly on cleared pasture land where follow-up weed control has not occurred. Both contain a cardiac glycoside which can cause heart failure.

MOTHER OF MILLIONS (Bryophyllum tubiflorum) - This plant has two potential toxic effect - (i) sudden death from a cardiac toxin (ii) severe scouring from enteric effects. Rate of consumption may explain the varying symptoms.

STAGGER WEED (Stachys arvensis) - Can invade improved pasture and can cause CNS symptoms of ataxia and staggery gait - not fatal and stock return to normal when they have no further access to the plant.

ROCK FERN (Cheilanthes sieberi) - can cause death, with symptoms similar to Bracken Fern poisoning. Often found in roadside cuttings and banks, and sometimes in hilly pastured areas.

WATER PRIMROSE (Ludwigia peploides) - Sometimes invades dams and waterways and can cause symptoms of listlessness, ataxia and scouring if stock have access to it during droughts.

WILD TOBACCO BUSH (Solanium mauritianum) - Sometimes eaten by stock (particularly in drought) with no apparent toxic effects, but has been suspected of causing deaths with symptoms of muscle weakness and paralysis, when consumed in large quantities. Common along creeks and gullies and will readily colonize recently cleared areas.

WILD PASSIONFRUIT (Passiflora subpeltata) - Can cause ataxia, convulsions and muscle tremors, and sometimes diarrhoea.

BLACK BEAN TREE (Castanospernum australe) - The seeds contain a toxin which causes severe scouring, debility, laboured breathing and general depression. The toxin can also cause false positive results in cattle which are being tested for the genetic disease known as Pompe's Disease.

BURRAWANG or Zamia palms (Macrozamia spp) - These contain a range of toxins causing symptoms ranging from scouring, liver damage and weight loss, through to nervous system damage resulting in hind limb ataxia, stumbling and falling over. Usually found in hilly areas in this district.

GRASSTREES (or BLACKBOYS) (Xanthorrhoea spp). These contain a toxin which effects the nervous system. Symptoms are weight loss, continued dribbling of urine and a staggering swaying hind limb gait.

CROFTON WEED (Eupatorium adenophorum) – Only apparently toxic to horses, resulting in severe lung damage and death. Non-fatal cases suffer from permanent lung fibrosis and respiratory problems. Very common along creeks and gullies, and will invade pasture land particularly semi-shaded slopes. Has spread rapidly in this district over the last 10 years or so.
A related plant MISTFLOWER (E. riparium) is also suspected of causing similar symptoms in horses.

WINTER CHERRY or JERUSALEM CHERRY (Solanum pseudocapsicum) - Can cause abdominal pain and scouring. Commonly found in "cattle camps".

ST JOHNS WORT (Hypericum perforatum) - An increasingly common weed in the district - causes severe photosensitization.

INKWEED (Phytolacca octandra) - Suspected of causing enteritis. Often found in cattle camps, around stock yards and in recently cleared areas.

NATIVE INDIGO (Indigophora australis) - has been anecdotally reported as affecting cattle in this district, causing muscle stiffness and scouring, but there is little solid evidence. Usually found in hilly timbered areas.

NOOGOORA BURR (Xanthium pungens) – can cause liver damage in cattle, but only when in the very young seedling stage. Usually found along creeks and floodways

(C) THE (normally) GOOD GUYS:-

This group includes many of the region's major improved-pasture species which can, under certain conditions, cause livestock deaths. (Again not in any order of importance).

(i) KIKUYU POISONING (Pennisetum clandestinum) - a major pasture species for both beef and dairy cattle in this area, but very occasionally can be responsible for significant livestock deaths. The most recent example was a few weeks ago, when a dairy herd in the Hastings Valley lost approximately 50% (54 cows) of the herd over a 7 - 10 day period. The actual cause is unknown, but one possiblity is that under very well-defined conditions of growth, the plant can contain a toxin which causes gut stasis, severe dehydration, renal failure and death. Only usually seen late in the kikuyu growing season e.g. autumn, when the kikuyu is the only available feed, often after good rainfall at the end of a long dry or drought spell. Some cases may recover without treatment.

(ii) SETARIA TOXICITY (Setaria sphacelata) - Arguably the most widely-used improved pasture grass species in this region over the last few years. The plant contains oxalate, which in ruminants, can occasionally result in deaths from oxalate crystals causing damage to kidneys.

Monogastric species (e.g. horses) can suffer from a calcium deficiency condition commonly known as "Big Head". This is due to a chronic calcium deficiency, bacause calcium in the animals diet is unable to be absorbed because the calcium in the diet reacts with the oxalate in setaria to form insoluble calcium oxalate, which the horse cannot absorb from its gut. The end result is weak bones, with the typical symptoms of an enlarged head ("big head") and spontaneous fractures of bones.

This condition is only likely to be seen in horses which are continuously grazing Setaria pastures. (Occasionally seen in horses which are run continually on pure kikuyu pastures, as Kikuyu can also contain lower levels of oxalate).

Toxic effects of oxalate from Setaria are relatively rare in ruminants such as cattle, as rumen microbes usually break down the oxalate, preventing it from binding to calcium. When there is significant oxalate absorption, the oxalate crystals can precipitate in the kidneys causing kidney failure.

(iii) PASPALUM (Paspalum dilatatum) - Under some seasonal conditions, paspalum (an common improved pasture grass) is often parasitized by a fungus which grows on the seed heads. This fungus produces a mycotoxin which can cause nervous system symptoms such as ataxia, staggering, and hyperexcitability when ingested by cattle. Removal of stock from the affected seed-heads usually results in complete recovery, but occasionally stock die from misadventure while affected by the toxin.

(iv) SORGHUM species - Many of the early forage sorghums contained a high level of prussic acid, which caused Cyanide poisoning in livestock which grazed these plants. Most of todays forage sorghums are low in prussic acid content, but under some conditions (particularly drought- affected or frosted regrowth) toxicity problems can occur. Johnson grass (a weed variety of sorghum) is particularly high in prussic acid, and remains a problem in some areas. Symptoms are staggering, convulsions, gasping respiration, collapse and death. Treatment may be successful if instituted early enough.

(v) NITRATE/NITRITE POISONING - Occasionally caused by weeds such as Wandering Jew, Pigweed, and Variegated thistle. A more common cause is due to heavily nitrogen-fertilized pastures of rye, oats etc. These plants/pastures can accumulate high nitrate/nitrite levels, which can cause deaths, particularly when grazed by hungry stock. Symptoms are staggering, dyspnoea, muscle trembling collapse, convulsions and death.
Treatment can be successful if instituted early enough, as the toxicity prevents the blood from carrying sufficient oxygen to tissues. - veterinary treatments can reverse this - but stockowners may only have minutes in which to act.

GENERAL COMMENTS

Many other plant-related animal health problems can occur, such as milk fever (Hypocalcaemia), grass tetany (Hypomagnesaemia), bloat (ruminal tympany), Rye-grass staggers, and various fungal toxicities, but are beyond the scope of this paper.

In many cases of plant poisoning, treatments are rarely available, practical or useful. Most toxicities have no specific antidotes, and any treatments administered are usually supportive - such as W fluids, antibiotic cover and intestinal absorbents to try to prevent further toxin absorption.

So this is a brief field outline of some of the potentially toxic plants in this part of the world. Those of you from different geographic and climatic regions may have a totally different list of plants to contend with, but one closing comment is probably true for all regions - **the majority of livestock plant poisonings in a district, are caused by a small minority of plant species.**

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Gained a Queensland Diploma in Agriculture from Qld Agric College 1963. After several years in agricultural advisory and technical positions in Qld & N.T., then completed a B.V.Sc. degree at Queensland University 1974. Worked in mixed rural veterinary practice in various locations until 1990 - main interest cattle medicine and production. Since 1990 employed as District Veterinarian with the Gloucester Rural Lands Protection Board based in Wingham. Responsibilities include animal health advisory and regulatory duties, and on-farm investigation and surveillance of livestock production problems and mortalities. Also a beef cattle producer.

GIANT PARRAMATTA GRASS

AN EMERGING WEED ON THE SOUTH COAST

Good afternoon Ladies and Gentlemen, my name is Ian Borrowdale, I'm the Chief Weeds Officer for Shoalhaven City Council which is a large local government area situated about 160km south of Sydney on the south coast.

This afternoon I'd like to tell you a little about a weed that is already widespread on the north coast and is an emerging weed on the south coast. This weed has the potential to spread throughout the entire south coast and onto the Southern Tablelands. This weed, of course, is Giant Parramatta Grass. I feel a little like I'm preaching to the converted because many people in this room have had considerable experience with Giant Parramatta Grass. It was in Taree that I was first alerted to the potential invasiveness of Giant Parramatta Grass, this was when I took a tour whilst attending the Biennial Weeds Conference at Port Macquarie. We were shown around by District Agronomist, Terry Launders who was cautioning all concerned about the dangers of Giant Parramatta Grass. Since working with this weed I can fully appreciate and support all his advice.

The small growing Parramatta Grass (Sporobolus africanus) has been around the south coast for many years and is not considered to be problem weeds in this area. My first recollection of Giant Parramatta Grass on the South Coast was seeing a tall spiked grass growing under power transmission lines. I conclude now that this is how Giant Parramatta Grass was introduced to the Shoalhaven area, probably from a contractors vehicle who was doing maintenance work on the power lines or pylons. Since then, in a period of no more than 6 years Giant Parramatta Grass has spread to several areas in the northern part of the city where in some cases, it is now quite dense on a few farms.

The Plant

Giant Parramatta Grass is a native of South Africa and is found in many other countries of the world. The name Sporobolus, come from the Greek, sporos, meaning seed, and bolos, meaning throwing. In America its common name is "dropseed grass", which alludes to how mature seed easily falls from the seed head.

The species of Parramatta Grass, Sporobolus africanus has been in **Australia** for a very long time, being first recorded by Robert Brown during his visit to Sydney in 180211805, it was named shortly after this time, after the township of Parramatta, where it was first identified. To identify between africanus species and the taller **growing** Giant Parramatta Grass, GPG **now** has the Botanical name of Sporobolus fertilis.

Identification between the two varieties is quite often difficult, as apart from height, they are very similar. Generally, Giant Parrarnatta Grass is a corse, tussocky grass that usually grows to the height of 70cm to 2 meters, The seed heads **are up to** 40cm long and resemble a rat's tail with the branches at the bottom of the seed head often drooping away from the central stem. The seeds are small and at **maturity** are a characteristic dull, leaden, green colour. Tussocks grow up to 40cm in diameter and can produce up to 200 seed heads per year with plants seeding in the frost-free period of the year. On the south coast GPG usually seeds from late December **until** the end of February, however, due to the drought there was very few GPG plants in seed in February this year however, after reasonable rains fell in late March GPG has grown and seeded through until the end of May.

GPG is quite often mistaken for Giant Rats Tail Grass and visa versa and for some reason in the Shoalhaven area, GPG is often confused with Vasey Grass, which is a member of the Paspalum family and with the exception of its height doesn't look anything like Giant Parramatta Grass. During the winter months on the south coast GPG infestations are easily identified due to the long yellow / white stalks of dried off seed heads which usually remain standing over the winter period.

The Problem

Giant Parramatta Grass is a threat to grazing industries for the following reasons:

- It is a vigorous and aggressive weed that quickly spreads and invades pastureland.

- Once established it can quickly multiply, thus reducing pasture production due to its aggressive nature and ability to overshadow other desirable grass species.

- It is well adapted to a wide range of climatic conditions and is capable of growing in most summer rainfall areas. It has demonstrated an ability to adapt across a wide climatic range. GPG is now found from latitude 0 to 35 degrees and at altitudes from 0 to 2,700mtr. It is anticipated that it will continue to adapt to differing climatic conditions, with its spread only limited by deficient summer rainfall.

- GPG is drought resistant and recovers quickly outstripping the recovery growth of most desirable species after drought.

- GPG is generally unpalatable to stock and has low nutritional value, however, graziers have found that continuous slashing in spring will encourage new growth that is slightly more palatable to stock. This have been helpful in milder drought conditions, however, in the drought recently experienced on the south coast, even GPG did not grow appreciably.

- GPG produces a large amount of seeds that can remain viable in the soil for several years.

- The seed is mucilaginous; this means it produces a gelatmous substance that aids the seed to stick to surfaces. Whilst the seed does not feel sticky it readily adheres to even shiny surfaces such as car duco and if wet with dew the seed will adhere to almost anything. The seed is not spread by the wind, however, it is easily spread by the movement of vehicles, machinery, livestock and also floods. Cattle can also spread GPG seed due to it adhering to fur and also mud in their hooves. Drainage run off and floods can also spread seed over a large distance.

- Slashing and mulching is a popular method of managing pastures on the south coast, if this operation is carried out early in the growing season, this practice is quite acceptable, however, many farmers decide to slash or mulch after GPG has set seed and this is one of the best or worst ways of spreading GPG from paddock to paddock and from farm to farm.

- GPG has high silica content and mature plants are unpalatable and very difficult for animals to graze. There have been stories of farmers finding cattle teeth in paddocks that were pulled out when animals tried to graze on GPG. Similarly young cattle being sold in very poor condition because their teeth have been worn away by grazing on predominantly, GPG dominated pastures.
  In many areas cattle reaching sale yards from known GPG areas will fetch a lower price because of worn teeth and poor condition due to grazing GPG.

- Properties badly infested with GPG usually sell for lower prices. This is because the carrying capacity of the property is reduced; there is considerable expense in effectively managing pastures infested with GPG. Many Councils have GPG declared a noxious weed, hence there is a legal liability for a new owner or occupier to control.

- Slashing and mulching of GPG requires considerable energy (horsepower) and causes considerable wear on machinery parts such as slasher blades, due to the high silica content.

Control

As with most weeds an integrated weed management control plan is the secret to successfully controlling GPG. A control program consists of various elements and will depend upon:

- The degree of infestation.
- The land's capability to return control costs invested.
- The type of livestock enterprise and its cash flow.
- The type of pasture present or optimum for further region.

Chemical

Selective chemical control using Flupropanate products such as Task Force at 2ltr/ha gives good control, usually spraying from September through to March providing growing conditions are good.

The long withholding period of four months for blanket treatments is quite often difficult to manage, particularly for dairy farmers who are rotationally gazing. The need to have at least 100mm of rain since spraying before resowing pastures of Clover and Perennial grasses is also a disadvantage. Despite these disadvantages, using this type of chemical, which is sold under Trade names such as Task Force, Kenock or Tussock is still the most popular method of controlling GPG on the south coast.

Selectivity can also be gained using Glyphosate type herbicides. Trials have shown that pressurised wick wipers are best; GPG should be wiped in both directions to achieve rates between 3 and 6ltr/ha.

Blanket spraying with Glyphosate products at rates up to 6 ltr/ ha or with 212 DPA products such as Propon will kill Parramatta Grass (and most other species) without a withholding period. On the south coast these products are used to achieve control of GPG prior to sowing improved pasture. In established pasture, control is usually carried out by spot spraying using Flupropanate products, as the withholding period far grazing animals is only 14 days for spot spraying.

"Chemical slashing" using wick wiping to prevent GPG sending up mature stalks and seed heads have been used on the north coast. This practice is not popular on the south coast, as most farmers prefer mechanical slashing to hold this growth at bay.

Pasture Improvement

This is a successful option where the farm enterprise and soil types will create a viable return to offset the high costs of control. The most popular pastures on the south coast usually include Perennial Rye Grass (Kangaroo Valley) Haifa White Clover with the addition of Pawera Red Clover and Maku Lotus optional. A popular method of establishing pastures on the south coast is to undersow, this pasture mixture, with a crop of autumn sown oats.

Control Innovations

- One farmer in the Shoalhaven area, who was desperate to remove GPG, in seed from his pasture, Mowed the paddock and made round bale silage of the material. Six months later a test for viable GPG seed resulted in a very low viability. Apparently the heat of the ensiling process had destroyed the viability of the seed. This process was to be tested this year in February, however, due to the drought there was insufficient GPG plants setting seed to make this trial worthwhile. Perhaps a good drought is another innovative way to control Giant Parramatta Grass.

- To prevent the spread of GPG on roadsides Shoalhaven Council has adopted a roadside hygiene program. Weeds staff map the presence of Giant Parramatta Grass. Infestations map are supplied to Council's maintenance section, so slasher operators carrying out roadside slashing will know when they are entering into a GPG infested area.

  Brush down areas are provided in strategic locations. When machinery is passing out of an infested area the slasher and tractor can be thoroughly brushed down by the operator. These areas are clearly sign posted, indicating to the slasher operators that they should stop and brush down in this location. Spray operators from the Noxious Weeds Section of Council are aware that there will be a concentration of GPG seedlings in the brush down area needing to be sprayed on a regular basis. The signage shows members of the public that Council is activity implementing a program on roadsides to prevent the spread of GPG.

  Council's Weeds Officer has used the success of this program to point out the benefits to farmers of adopting a similar program on their farms.

Farm Hygiene

Every farmer should be encouraged to prevent the spread of GPG seed from one paddock to another or from one property to another. Some simple way of doing this include:

- If vehicles or equipment from public utilities such as electricity, Telstra, Pipe line authority etc. wish to enter the property question where the vehicles have been working previously and insist that all equipment including vehicles be cleaned prior to entering the property.

- Insist that stock carriers wash down trucks before delivering or picking up livestock. It is preferable that carrier's vehicles are washed down on the infested property rather than on a clean property. However, if this is not possible, vehicles should be washed down in a central location with the surrounds and drainage run off area of this location, monitored regularly to ensure that GPG does not establish in this area.

- Avoid, wherever possible putting vehicles, machinery or stock into paddocks where GPG plants are in head. If this is unavoidable, make sure that all vehicles are brushed down prior to leaving the infested paddock and are thoroughly washed down upon return to a wash down point.

- Make sure the grass is dry before mustering stock in paddocks infested with GPG. GPG seeds have the ability to adhere to moist surfaces such as animal's coats or vehicle's tyres that are made damp by rain or dew in the paddock.

- When rotating stock from infested to clean paddocks, hold stock in a small holding paddock for a minimum of five days to allow seed to pass through the animal's digestive system. Be prepared to inspect and control any GPG growing in this holding paddock. It is unclear at this time if GPG seed is destroyed whilst passing through the digestive system of animals.

- Establish a central wash down area preferably close to the area of the farm infested with GPG or avoid travelling across areas not infested to the wash down point.

- The old rule of always using certified seed is particularly important in preventing the spread of GPG. The last thing you want to do is be sowing GPG into an ideal seedbed with your preferred pasture mixture.

Conclusion

As with most emerging weed problems the sooner control is implemented for Giant Parramatta Grass the better. Time needed to carry out control and control costs are less if infestations are light. Council Weeds Officers need to reinforce this message to the community and to Council Managers. Community awareness and the ability for farmers to identify Giant Parramatta Grass and take appropriate early control action is critical to the successful control of this weed. After seeing extensive heavily infested areas on the north coast, I believe that we, on the south coast, are well placed to successfully contain and control GPG infestations. I trust that this presentation has been useful to Managers who are still in the happy position of having only light and emerging infestations of Giant Parramatta Grass in their areas.

BIOGRAPHY

Ian Borrowdale was born and raised in the Shoalhaven area, growing up on local dairy farm. He attended Nowra High School and graduated from Hawkesbury Agricultural College in 1969 with a Diploma of Agriculture. After this he was engaged in dairy farming, earth moving and transport industries. He has held the position of Chief Weeds Officer with Shoalhaven City Council for 20 years and has been instrumental in implementing successful control programs for the control of Aquatic Weeds, Bitou Bush, Fireweed and Giant Parramatta Grass as part of his duties with Council.

He won the Dupont travel award and toured New Zealand to study weed management.

This year he was awarded the National Medal and the Centenary Medal for his contribution to the community, through his involvement as Local Controller for the Shoalhaven State Emergency Service.


Parramatta Grass!...
an' I tell you somethin' else
I got..... white ants...
a useless dog...lazy kids...
a broken down shed....
Flat tractor battery.....
a worthless dairy Farm
arthritis... tinea
leaking roof... flies
...Fleas...
PROPERTY REPORTS
INSPECTOR NOXIOUS WEEDS
Rod Spicer.

An Integrated Approach to Weeds Management on Travelling Stock Reserves Kernpsey Rural Lands Protection Board

Description of Kempsey Rural Lands Protection Board District

Kempsey Rural Lands Protection Board is located on the Mid North Coast of New South Wales mid way between Sydney and Brisbane.

The Local Government areas of Kempsey, Hastings, Nambucca and parts of the Greater Taree, Coffs Harbour and Bellingen Shires are located within the Board's District. The valleys and rivers of the Macleay (11,450 sq km catchment), Hastings (4,484 sq km catchment), Nambucca (1,427 sq km catchment), and Bellinger (1,100 sq km catchment) provide a topographical variety which ranges from coastal swamps to alluvial river flats, through rolling ridge country and steep mountainous eastern fall escarpment country.

Significant tracts of land are gazetted Wilderness, National Park, State Forest, Environmental Protection Zone, Nature Reserve or vacant Crown land.

Definition of Travelling Stock Reserves:

Travelling Stock Reserves are parcels of Crown Land which have been "resewed" for use by travelling stock under legislation. As the name implies, their main purpose is to provide pasture reserves for travelling or agisted stock. This pasture reserve can be especially beneficial in times of drought, bushfire or flood. Over the years, the use of reserves has developed to include public recreation, native flora and fauna conservation and apiary sites.

The development of these routes over history was purely practical. Even today, most Travelling Stock Routes can be found on the more productive land to supply feed for travelling stock, following watercourses for ease of watering stock, and on higher ground so they are passable even in the wet.

Since the boom times of the early 1800s to mid 1900s, the development of the road and rail network and access to larger and more efficient stock transport vehicles led to a reduction in the traditional usage of TSRs. Despite these faster methods of transporting stock, many TSRs are still being used to provide pasture reserves for travelling and agisted stock and are particularly useful in emergency situations. In addition the other less traditional values of TSRs are becoming increasingly recognised with a growing interest in the role that they play in conserving the natural environment and providing sties for recreation. (The Long Paddock a Directory of Travelling Stock Routes and Reserves in New South Wales).

Kempsey Rural Lands Protection Board Network of Travelling Stock Reserves

Kempsey Rural Lands Protection Board has a unique network of Reserves which include trusteeship of some Flood Refuges, other Flood Refuges are under licence and an extensive network of Travelling Stock Reserves and Routes gazetted under the Board's care and control.

Routes and Reserves are divided into:

(1) **Flood Refuge:** Reserves for refuge in time of flood. The Board being responsible to keep fences stock proof. Area not fully under the control of the Board.

(2) **Reserves:** All actual Reserves or Watering or Camping Reserves under Board control and listed by number and common name.

(3) **Stock Routes:** All Stock Routes or parts of Stock Routes excluding Reserves on Stock Routes under the control of the Board.

The network has become fragmented over the years as a result of:

(a) Urban sprawl;
(b) Road and Highway construction;
(c) Withdrawal from Board Control as surplus to requirements; and
(d) Conversion to National Parks or State Forests.

The importance of the network has changed over the years with the reduction in carrying capacity of many properties and the conversion of large tracts of agricultural land to National Parks or State Forests. An improved road network has seen the reliance on stock routes for the movement of stock diminish, however, the Board must still maintain an effective network which allows the movement of stock within the Board boundaries and to/from adjoining Board areas.

The network comprises:

- 2,255 ha Reserves and Routes;
- 546 ha Flood Refuge under licence from National Parks & Wildlife located within Hat Head National Park;
- 648 ha Flood Refuge under Trusteeship

Highlights of this network are:

- 6 Flood refuges;
- 85 Travelling Stock reserves;
- 11 Travelling Stock Routes

The main use of this network is for stock movement in times of emergency such as Flood or Bushfire. Major flood events which impact on the Lower Macleay flood plain (the Macleay River has an 11,500 sq km catchment) sees large numbers of livestock move onto the flood refuge network within a very short period of time. Other parts of the network are utilized for relief grazing and apiary sites.

The location of the Reserves and Routes varies from remote unfenced bush blocks and routes to cleared fenced paddocks within townships to holding paddocks located within the Hat Head National Park.

The movement of livestock by a variety of owners from many localities in adverse conditions creates its' own unique management challenges. These are the:

- control of noxious and environmental weeds;
- control of disease;
- animal health issues associated with plant poisoning;
- ownership of livestock;
- accurate assessment of losses

Weeds are introduced via livestock movement, importation of fodder, inundation by water and vehicular movement.

Like many public land managers the Board has limited resources to control weed infestations and has to develop priorities in accordance with the five (5) year TSR Management Plan (October 2002) and the NSW North Coast Weeds Strategy (February 2003).

Weeds being addressed and the Strategies being used:

The Board adopts an integrated approach to weeds management via:

- permits being issued to landholders to graze the reserve or route while assuming responsibility for pest animal, weed control and hazard reduction work;
- the engagement of contractors to undertake one off control programs;
- the employment of a Field Assistant to undertake seasonal control of noxious and environmental weeds;
- engaging in partnerships with Landcare Groups and local Councils to undertake specific control programs at specific locations

Privet narrow leaf (Ligustrum sinese)

Heavy infestation along the creek bank in the Mungay Creek Reserve on the Armidale Rd west of Kempsey. The Board in conjunction with the Mungay Creek Landcare Group and Department of Land and Water Conservation (DLAWC) has been working on controlling the spread of privet.

Large stands of the privet have created dense canopy cover from the centre of the creek to the high water mark with smaller seedlings spreading to the pasture within the reserve. With the assistance of Natural Heritage Trust Funding a Bulldozer was used to clear the large and dense infestations in the reserve to the edge of the creek and adjoining paddocks.

Due to erosion concerns removal from the creek (Mungay Creek has rapid flow in times of high rainfall events) bank has been undertaken manually using the cut and trunk paste method using 2:1 application of Glyphosate. Good results have been achieved with this method, with very little re-growth apparent and the gradual spread into the pasture has been halted.

This is a long term project with small amounts of work being undertaken as time and resources permit. The ultimate goal is to plant native trees along the riverbank to help stabilize the bank.

Camphor Laurel (Cinnamomum camphora)

The Sea Street Reserve is located within the urban area of Kempsey on the flood plain adjacent to the local show ground. **A** network of over head power lines created problems with regard to control options.

Contractors (with Workcover accreditation) were engaged in conjunction with Kempsey Shire Council to fell and remove the large camphor laurels that were growing on the boundary fences. Some re-growth is occurring and this is being contained as required.

Giant Parramatta Grass (Sporobolus indicus var. maj) Cat 3

The drought conditions that have prevailed since November 2001 across the Board District have created an ideal breeding environment for all sorts of noxious and environmental weeds.

Giant Parramatta Grass has thrived and despite previous action taken to control this invasive weed it is now abundant on many reserves and routes throughout the Board District.

Control methods used have included wick wiping (Glyphosate) and boom spray (Flupropanate) by contractor, spot spraying by field staff using Glyphosate. Unfortunately the reserves and routes that are affected with this weed do not have improved pasture and resources do not permit the planting of pasture to create competition.

Options being explored to prevent the spread of seed is the development of clean out paddocks where stock will be held with a view to emptying out prior to movement from one location to another. Vehicular movement restrictions are very hard to implement as many people see the reserves and routes as a place of recreation where trail bikes and motor cars can used for recreation.

Red Lantana (Lantana camara) Cat 3

Immature plants are removed by a combination of slashing and burning. Mature plants are removed via chemical application using Glyphosate and a wetting agent (Synertrol oil) on the smooth leaf variety. Like GPG pasture improvement to create competition is not possible due to budget constraints.

Smart Weed (Polygonum hydropiper) and Burrs (Bathurst and Noogoora) (Xanthium spp) Cat 2

Prolific in the Gladstone Reserve located within the small village of Gladstone on the lower Macleay floodplain. The grazing permit holder for the Reserve has undertaken control work on this reserve with very good results.

Other Weeds of Concern

Fireweed	-	causing ill thrift in cattle;
Thistle	-	invading bare patches of ground in pastures;
Mother of Millions		seed set has occurred and will cause problems in the flowering season;
Mexican Poppy		has become abundant on flood plains as a result of the widespread flooding of March 2001;
Bracken Fern		again a sign of the dry seasons with cattle looking for anything that is remotely green and suffering the ill effects;
Groundsel Bush		thriving in the dry conditions in the Collombatti area;
White Cedar		deaths in cattle have been attributed to the eating of the seeds and on post mortem examination large amounts of the seed have been found in the rumen and intestines. Previous reports of death had only occurred in pigs and this was sometime ago.

Formosa Lily
(Lilium Formosanum)

Abundant on roadways and now becoming abundant in the very little pasture that is evident and is a major source of concern to livestock owners.

Volunteer Corps

The Board has been successful in obtaining assistance from the Catchment Management Board to have a Volunteer Corps Team undertake a survey of flora and fauna on a number of Reserves. This will provide a map of vegetation types (including weeds), locations and densities and will prove valuable in the management of these reserves in the future.

The team is scheduled to undertake the work in June 2003.

Peter James
Ranger Reserves
Kempsey Rural Lands Protection Board

Biography: Peter James Ranger Reserves Kempsey Rural Lands Protection Board

Peter has worked with the Kempsey Rural Lands Protection Board since June 2000 and holds qualifications as an Authorised Control Officer (Vertebrate Pest Control), Chemical Application **AQF3** and Managing Chemical Use AQF4 and is an Inspector under the Stock Diseases Act.

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12th Biennial Noxious Weeds Conference, Taree, NSW, 1" – 3rd July 2003

Threat Abatement Plans: weeds and plant conservation

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Key words: Threat Abatement Plan, Key Threatening Process, Weeds, Plant Conservation, Bitou bush, *Chrysanthemoides monilifera*

Introduction

Weeds and other biological invasions are acknowledged as one of the major contributors to the loss of native biological diversity, globally (IUCN 2000). Historically, weed problems and plant conservation issues in Australia have been treated separately, despite the acknowledgement of a direct cause and effect link.

The independent way we approach weed and plant conservation issues is part of the problem. For example, we generally tend to address weed problems from an eradication perspective, often combined with the assumption that removal alone will have positive conservation outcomes. However, weed control alone does not always lead to conservation outcomes. Often, other weed species invade following control or the initial weed re-infests the site, especially if follow-up control is not undertaken. The assumption that weed removal will result in conservation outcomes does not consider the reasons for the weed problem in the first place (e.g. some systems are more prone to invasion than others: see Lonsdale 1999). In addition, this assumption does not account for the recovery of native species, which is extremely important, especially when the weed has been dominant and/or present for long periods of time.

Weed problems are not acknowledged in the early stages, when the chances of eradication are high and impacts to native species low. The acknowledgment that a weed is a problem also influences the legislation that can be used to control it. The legislation used to control weeds can greatly influence the control of individual weed species and the management options for plant conservation (Downey 2003). However, the best option for holistic management of invaded ecosystems is to combine weed management and plant conservation. This can be achieved by listing weeds as key threatening processes under the various Commonwealth, state and territory threatened species legislations. In this way, weed management will have outcomes for plant conservation. This paper outlines this new approach of linking weed management and plant conservation and provides a case study on *Chrysanthemoides monilifera* in *NSW*.

Biodiversity conservation legislation

The Commonwealth, states and territories have separate but similar threatened species legislation which aims to protect Australia's biodiversity. This is achieved through the identification and listing of species, populations and ecological communities that are threatened (threatened entities) and through the identification and listing of Key Threatening Processes (KTP). The legislation also provides for planning and regulation to promote the recovery and conservation of threatened entities and the abatement of KTPs. The categories and classifications used are not consistent amoung the various jurisdictions (e.g. threatened populations can be listed in NSW, but not nationally), therefore for the purposes of this paper they will be referred to hereafter as threatened entities.

The listing process for threatened entities and KTPs under the various legislations involves four stages:

Nomination - proposal for listing presented to the relevant Scientific Committee or equivalent

- **Assessment** - an evaluation by the Scientific Committee or equivalent of the merits of the nomination
- **Determination** - the decision by the Scientific Committee or equivalent to list or recommend for listing the threatened entity or KTP, or to reject the nomination
- **Action** - a plan for the recovery of the threatened entity, or a threat abatement plan for the KTP

Key threatening processes and threat abatement plans

The **basis** for nominating a threatening process under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999 (EPBC* Act), and/or under the equivalent state/territory acts (e.g. *NSW Threatened* Species *Conservation* **Act** *1995:* TSC Act), is that it meets requirements such as being a threat to at least two listed threatened entities (see http://ea.gov.au/biodiversity/threatenedktp/ for more details or relevant state/territory web sites).

Threatening processes listed as a KTPs may have a Threat Abatement Plan (TAP) developed depending on the respective legislation. For example, under the TSC Act a TAP must be written within three years of the listing date. Whereas under the EPBC Act, the Minister has the power to make the decision to write a TAP, based on whether it is a feasible, effective and efficient way to abate the process (KTP).

Entities listed as threatened must have a recovery **plan** or similar (hereafter referred to as a recovery plan) written/developed, the timeframe for which depends on the respective legislation and listing (i.e. vulnerable or endangered). It must be noted that a TAP is not a recovery plan. The key distinction between a TAP and recovery plan is that the aim of **TAP** *is* to reduce a specific threat to many threatened entities, whereas a recovery plan aims to reduce the threats to a single threatened entity, although some recovery plans have been developed for multiple **species** (e.g. a suite if species which occur in the same area). A TAP may therefore reduce the threat but not recover the entity, which is why recovery plans and TAPs need to be integrated.

Many of our major pest animals have been listed as KTPs (e.g. foxes, feral goats, rabbits, feral cats and feral pigs: under the TSC Act - http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Threat+abatement+planning or the EBPC Act – http://www.ea.gov.au/cgi-bin/sprat/public/ publicgetkeythreats.pl). However, to date, *Chrysanthemoides monilifera* (bitou bush/boneseed) is the only weed to be listed as a KTP under any threatened species legislation (Commonwealth, State or Territory), despite these Acts being in place for many years.

Currently, several other weeds have been nominated to the relevant Scientific Committees for consideration as KTPs:

- *"Camphor Laurel* (Cinnamomum camphora*) Most Toxic Chemotypes"* under the EPBC Act. Environment Australia publishes all nomination (including unsuccessful ones) under the EPBC Act on its website (see http://ea.gov.au/biodiversity/ threatened/nominations/index.html).
- *"Invasion of native plant communities by exotic perennial grasses"* under the TSC Act. NSW National Parks and Wildlife Service (NPWS) publishes preliminary determinations by the Scientific Committee i.e. nominations under the TSC Act on its website (see http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Key+threatening +processes+by+doctype).

Weed strategies and legislation

The management of major weed problems is achieved best though an integrated multidisciplinary approach across all levels of government, industry and the community. In 1997, the Commonwealth Government established the National Weeds Strategy (NWS: ARMCANZ *et al.* 1997) to target the management of weeds of national significance. The NWS aims to reduce the impact of existing weed problems of national significance provide, cost efficient and effective means for harnessing national action on weed management and prevent new weed problems. Twenty Weeds Of National Significance (WONS) were determined by the NWS Executive Committee (Thorp and Lynch 2000). The WONS comprise some of the major agricultural and environmental weeds in each state and territory. Several aquatic weeds are also listed as WONS. The Commonwealth favours the WONS initiative to combat weed problems, however, this initiative does not specifically address threatened entities.

At present, there are several thousand weed species in Australia, many of which pose similar problems to the WONS or will pose similar problems in the future. In addition, the list of weed species is growing, with many new weeds recorded each year.

Many species are considered to be 'sleeper weeds' because they currently are scarce or are in relatively low levels or isolated patches (see Grice and Ainsworth 2003). As a result, Environment Australia has produced an alert list of weed species, which targets new weed problems or sleeper weeds. The long-term economic cost of controlling weeds is greatly reduced if small infestations are treated, rather than leaving them to become large ones (See ARMCANZ *et al.* 1997). It is important that we identify and control such weeds.

Each state/territory has legislation that identifies and lists weed species as noxious/pest plants. In addition to identifying the weed species, such legislation places restrictions on movement and sale of plants, specific responsibilities for control and establish the framework for coordinated control (Carter 2000). The objectives of the noxious weed legislation are to reduce the impacts of weeds on agriculture, the environment or human health through a coordinated approach supported by legislation and to direct government expenditure. However, such legislation is not a plant conservation instrument.

These strategies and legislations aim to manage, control or reduce weed populations in Australia. The strategies and legislation that encompass each weed species can aid other outcomes like plant conservation (see Downey 2003). In order to obtain conservation outcomes in weed management, we need to merge weed and plant conservation initiatives, for example, through the listing of weeds as KTPs.

Case Study: *Chrysanthemoides monilifera*

Chrysanthemoides monilifera is a perennial semi-succulent woody shrub of South African origin, which grows in a wide range of coastal environments including fore dune, grasslands, dune scrub, dune forests/woodland, open and closed heaths and littoral rainforests (Weiss *et al.* 1998). *Chrysanthemoides monilifera* was listed as a KTP in NSW because of its impacts on coastal plant communities. It now occupies 90% of the NSW coastline, an expansion of 36% in the last 20 years (Thomas and Leys 2002).

Weed strategies and legislation for *Chrysanthemoides monilifera*

In 2000, *C. monilifera* was listed as one of the 20 WONS. Following this listing, a national strategy was developed (see ARMCANZ *et al.* 2000) to manage *C. monilifera* invasions. Subsequently, a NSW State strategy (NPWS 2001) was developed for *C. monilifera* subsp. *rotundata* (bitou bush), which aims to deliver a coordinated and strategic approach to bitou bush management in NSW by:

- Preventing the further introduction and spread of bitou bush
- Minimising the adverse impacts of bitou bush on biodiversity
- Expanding the commitment to the management of bitou bush

A key action of this Strategy is the preparation of a TAP for C. *monilifera* in NSW.

Chrysanthemoides monilifera has been declared a noxious weed in all coastal councils/control areas of NSW (including metropolitan Sydney) under the NSW *Noxious Weeds Act 1993* (NW Act). As such, it must be fully and continuously suppressed and destroyed, and/or prevented from spreading and its numbers and distribution reduced.

These strategies and the NW Act principally focus on the control and management of weeds, in this case C. *monilifera.* While this is a necessity for weed control, it is not the best way to address weed problems and plant conservation. However, weed management and plant conservation can be merged through KTPs and TAPs.

Chrysanthemoides monilifera as a key threatening process

"Invasion of native plant communities by bitou bush/boneseed (Chrysanthemoides monilifera)" was listed as a KTP in 1999 under the TSC Act.

Under the TSC Act, a TAP must be written within three years for each KTP. At present, NPWS is developing a draft TAP for *C.* monilifera in NSW, which will abate, ameliorate or eliminate the threat to threatened entities. One of the main hurdles in the development of this TAP has been the identification and prioritisation of the threatened entities at risk from invasion. A model has been developed to rank threatened entities, using a range of attributes, including the entities ability to persist, its distribution and its threatened status (i.e. vulnerable or endangered). A preliminary ranking, prioritised eleven threatened species, two endangered populations and six ecological communities. Sites, across all land tenures, have been selected for each priority entity where the actions of the TAP can be undertaken. The main action is the control of C. monilifera at priority sites using best practice management guidelines (see Vranjic 2000) in combination with site-specific conditions like topography and access. Subsequent actions involve the monitoring of these control programs in order to determine the success of the TAP. Monitoring will include measuring the response of both *C.* monilifera and the threatened entities to the control programs. Additional actions are designed to foster local community participation in the TAP and *C.* monilifera control and awareness in general, through training, participation and education. The draft TAP also identifies knowledge gaps and ways to collect this information. For example, very little is known about the impacts on fauna from C. monilij'era invasion, or its control. It is anticipated that the draft TAP will be released for public comment within the next year.

Through the *C.* monilifera TAP measures can be allocated to sites where the biodiversity benefits will be greatest.

Future directions

The causes of rarity to native plants, of which weeds are a contributing factor, need to be addressed in plant conservation (Downey 2003). On the other hand weed management needs to focus on plant conservation outcomes as illustrated here. One way to address this issue is to nominate/list the causes of rarity as KTPs. Chrysanthemoides monilifera is at present a unique case in Australia because it has been listed as a KTP and therefore control under the TAP will be focused on plant conservation outcomes.

It is anticipated that the listing of weeds as KTPs will lead to a more holistic approach to weed management and plant conservation in Australia. How this will be applied to on-ground management will contain uncertainties until TAPs are released and implemented. In the next few years, it will be important for land managers to become familiar with KTPs and TAPs and their role in weed management. A range of options is available for nominating weeds as KTPs under the TSC Act. The nomination of environmental weeds as a whole; subgroups such as woody legumes, exotic vines, invasive trees; transformer species (see Richardson et al. 2000), and; the single species approach as used for Chrysanthemoides monilifera.

There will be a continued need to undertake weed management and biodiversity conservation independently as weed management still needs to occur in areas where biodiversity conservation is a low priority, and biodiversity conservation must occur where weed control is a low priority.

Acknowledgements

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Hastings Environmental & Community Infrastructure Levy

Background

In formulating the 1996197 budget and Management Plan, Council's inability to fund a number of programs including footpaths, cycleways, stormwater controls, bushland rehabilitation and weed control, was identified.

That year, the Local Government Department issued a Circular specifying grounds upon which an application for an extra-ordinary rate increase could be based. There were two criteria which applied to the Hastings case:

[3] Population growth creating demand for additional facilities and services not met from additional income generated by the growth; and

[10] New initiatives or enhanced programs in environmental protection and management.

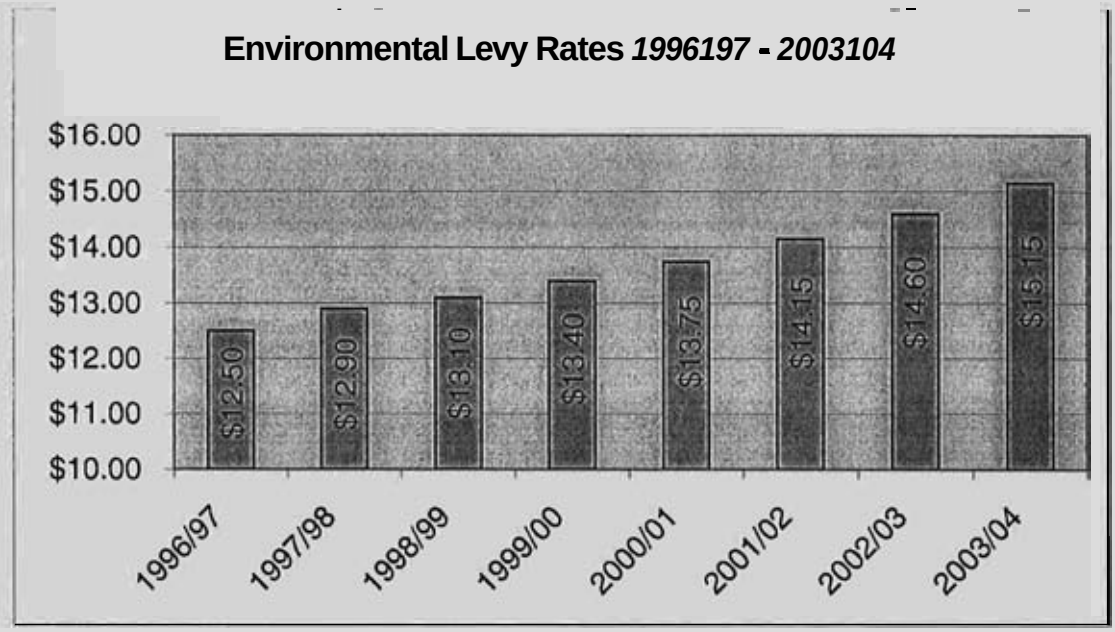
The Council resolved to make application for an extra ordinary rate increase of $25 per assessment to fund a separate program with the following objectives:

a) Rehabilitation of existing green belt areas
b) Implementation of stormwater control management measures including pollution traps, erosion control and general water quality improvement
c) Development of pedestrian/cycleway networks which provide access to, and through, green belt areas
d) Coastal environment improvement works ie. access, weed removal and vegetation rehabilitation
e) General support for Urban Landcare, Cleanup Australia, and school based Streamwatch Programs
f) Development of a drainage strategy to allow a better assessment of environmental pollution issues

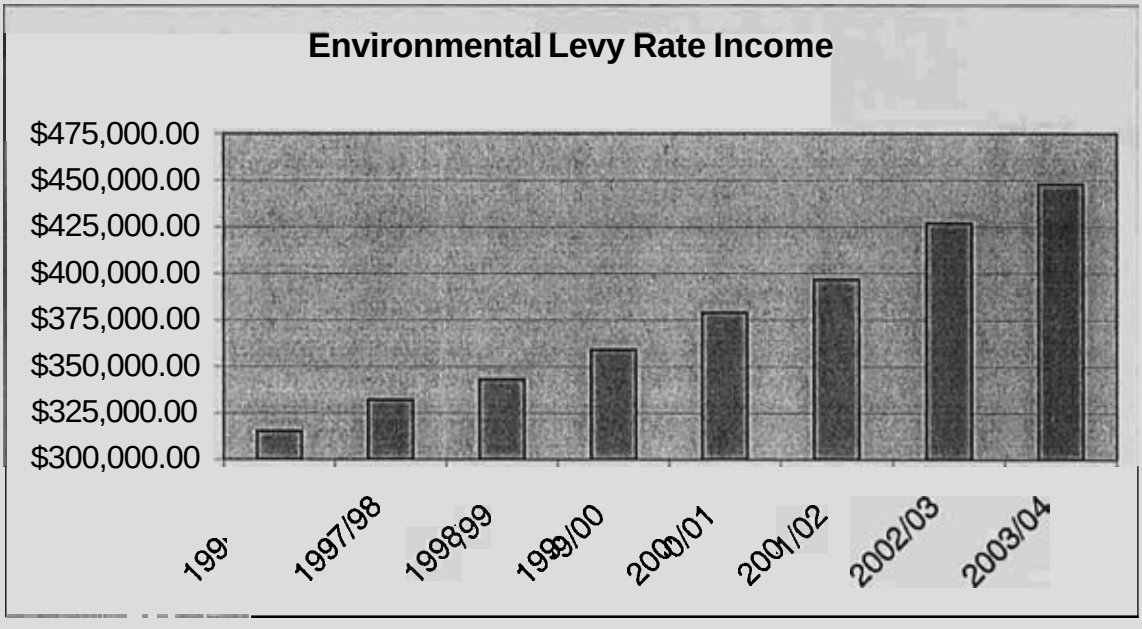
The Minister approved an increase in Council's notional general income of 5.7%, which equated to $12.50 per assessment, to raise an additional $316,266 on condition that the funds be identified and used on the proposed Environmental and Community Infrastructure Program. Since its introduction the program has been operated as a separate entity, with any funds not expended in a given year placed in reserve and used for programs in the following year.

Rating

One of the benefits of establishing such a rate is, it is then subject to allowable rate pegging increases. The effects of which are shown in the following graph.



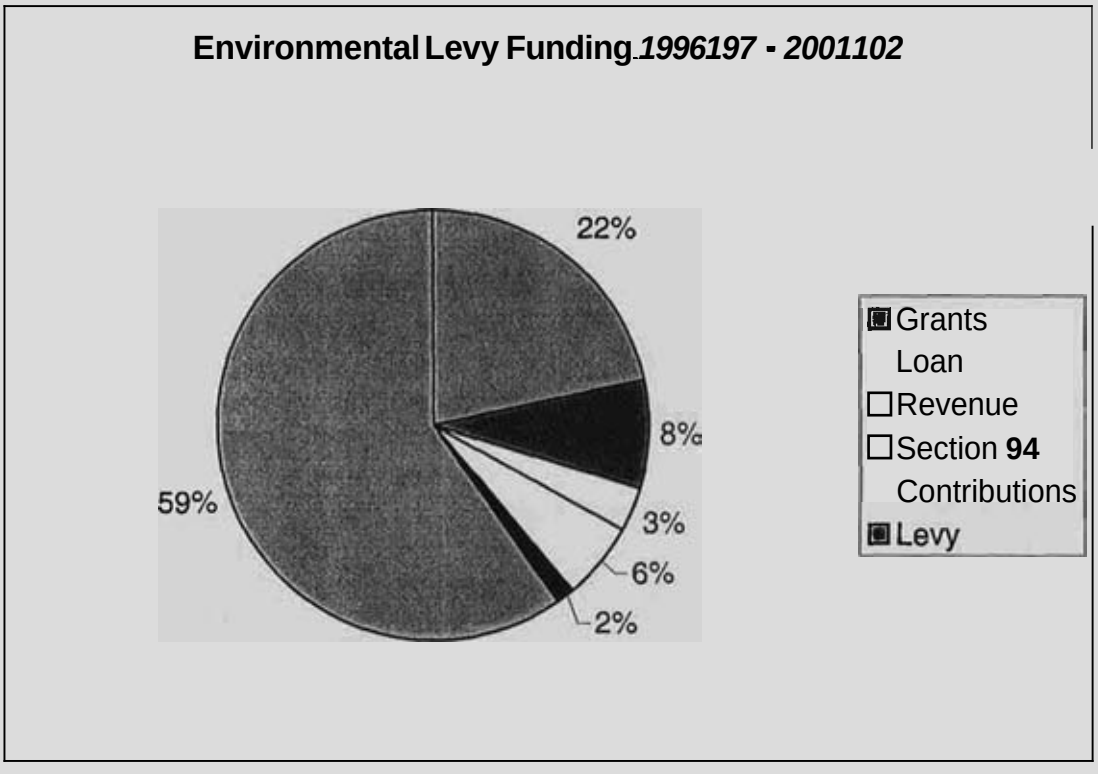
In addition to the rate pegging limit increases, in an area that is growing such as the Hastings, the growth in assessments also increases significantly, the income received each year as shown below.



Income

In addition to rate income, programs have been targeted where additional grant opportunities were available. Levy funds have also been added to from Section 94 Contributions, loans and General Revenue where appropriate. Total funding for the program has been derived as follows:

Source	
Grants	$ 635,296.00
Loan	$ 237,033.00
Revenue	$ 92,205.00
Section 94	$ 170,104.00
Contributions	$ 44,050.00
Levy	$1,744,384.00
Total	$2,923,072.00



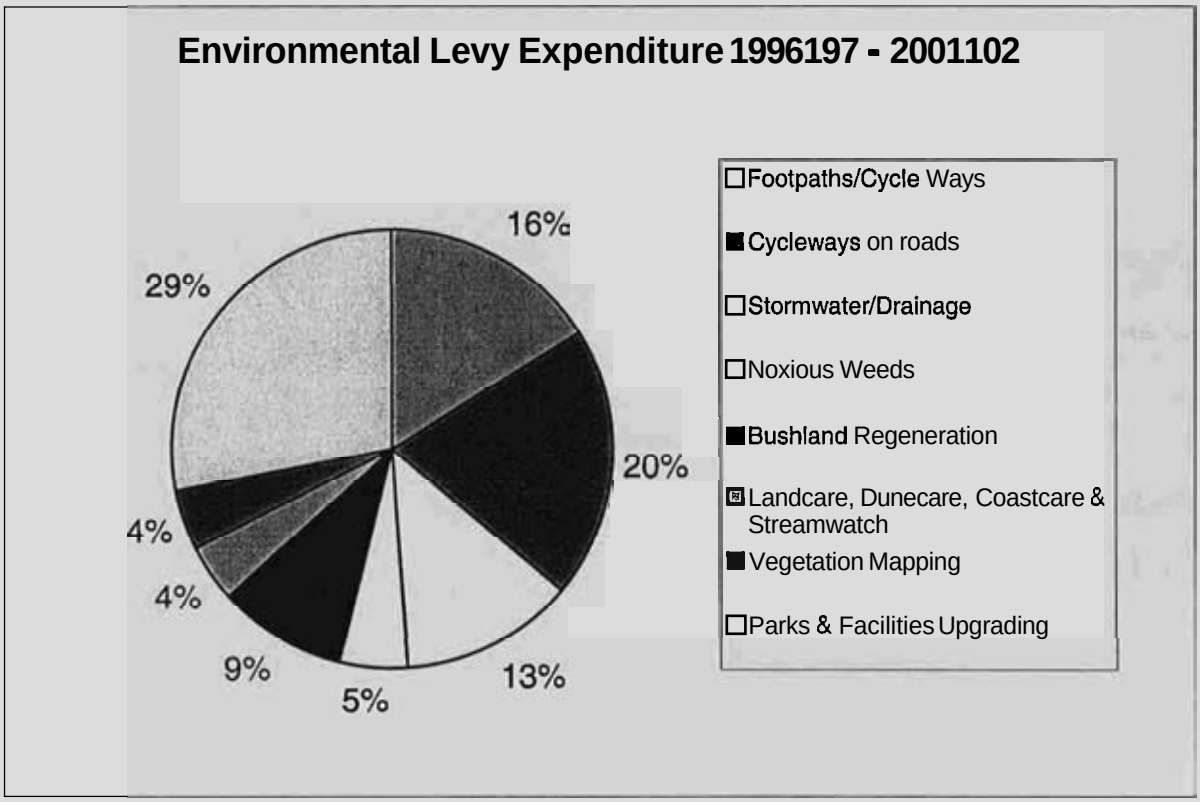
Expenditure

In the six years of the program up to 2001102 a total of $2.9m has been expended with 97 programs or projects being funded. Some of these are annual allocations. The focus of a proportion of the levy has been varied from year to year to take advantage of grant programs available, eg Cycleways, Stormwater, etc.

The distribution of expenditure on the various programs is shown below :

Environmental Levy Expenditure 1996197 - 2001102

Activity	Amount
Footpaths/Cycle Ways	$ 471,144.00
Cycleways on roads	$ 581,190.00
Stormwater/Drainage	$ 378,040.00
Noxious Weeds	$ 147,395.00
Bushland Regeneration	$ 270,836.00
Landcare, Dunecare, Coastcare & Streamwatch	$ 123,978.00
Vegetation Mapping	$ 128,728.00
Parks & Facilities Upgrading	$ 821,715.00
Total	$2,923,026.00



Conclusion

The Environmental and Community Infrastructure Levy has provided a significant source of funds to address a range of needs that may not have been met in the competition for funds from Council's General Revenue. Whilst in terms of the overall need, there is never enough dollars to meet the demand for funds. The growth of the Environmental Levy fund will deliver important benefits to the Hastings community in terms of improved facilities and environmental management into the future.

COLLECTION AND IDENTIFICATION OF RECENT PLANT NATURALISATIONS IN NEW SOUTH WALES AND ASSESSMENT OF THEIR RELATIVE IMPORTANCE

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Introduction

Collection and identification of recently established plants is essential so that potential problem species can be identified and control carried out before they become a major problem. Early detection of species was covered at the last biennial noxious plants conference (Hosking ***et*** al. 2001).

Collection of plant specimens

Specimens of all naturalised plants need to be collected and sent to an herbarium so that the species can be identified, or if known, so that the identification and its naturalised distribution can be confirmed. For techniques used to collect herbarium specimens see various herbarium publications or herbarium websites. A recent website with a well illustrated section on plant collecting is http://www.une.edu.au/botany/plant_collecting.htm

Photographs or digital images of naturalised plants growing in situ can also assist identification, particularly by illustrating the colour and habit of the live plants and details of the flowers, but should not replace the collection of herbarium specimens.

Hosking ***et*** al. (2001) outlines how recently naturalised plants are detected, how to send specimens to herbaria for identification and gives an example of a label for a specimen. Another label is presented here to show why there is often a need to recollect a plant once more information is available on a species previously collected (see Appendix 1). The original label mentioned that there was only one naturalised plant seen in the collection area.

Methods of assessing the relative importance of recently detected weeds

There are a number of databases, websites and books where information on weediness of species can be found. The following are databases, websites and books that we use regularly to assess weediness of naturalised plants.

(i) Databases and websites:

EXOTICS NATURALISED IN AUSTRALIA database (to see if the species occurs elsewhere in Australia and where information may be obtained). This is a database that has been put together by the first author with assistance from others. The database only includes species that are backed by herbarium specimens. Information from this database will be published and the database will be made available on the NSW Agriculture website.

GRIN (Germplasm Resources Information Network) database enables users to determine current names and obtain some information on species (and where to go for more information). This database suggests which name should be used and often gives reasons why. The web address is http://www.ars-grin.gov/npgs/tax/taxgenform.html

PIER (Pacific Island Ecosystems at Risk) website. This website is useful for tropical and sub-tropical species and often gives a great deal of information on species covered. It is regularly updated and frequently contains photographs. The web address is http://www.hear.org/pier/scinames.htm

HEAR (Hawaiian Ecosystems At Risk) website. This website has a lot of information on a large range of temperate and tropical weeds for Hawaii as well as for South Pacific islands. The web address is http://www.hear.org

The Nature Conservancy website. This website is particularly useful for temperate weeds. The web address is http://tncweeds.ucdavis.edu/esadocs.html

PLANTS database set up by the United States Department of Agriculture. This database covers all species naturalised in the United States of America (USA) and often has links to further information on species. Many areas in the USA have a similar climate to parts of New South Wales. The web address for PLANTS is http://plants.usda.gov/topics.html

(ii) Search engines:

These are useful to find information on species that have been identified. The main search engines that we use are Yahoo (http://www.yahoo.corn/) and Google (http://www.google.com.au/). In most cases typing in the full scientific name will reveal many sites dealing with the species. Not all of these will prove useful but if the species is a significant problem elsewhere this should be able to be determined from the information on the websites.

(iii) Reference **books:**

There are many weed and general plant books that provide information on weed species. A recent publication, *A Global Compendium of Weeds*, by Randall (2002) gives information on other publications (books, journals and internet sites) where a species is mentioned as a weed.

For species that are weeds elsewhere in Australia one of the best references is Parsons and Cuthbertson (1992). Most other Australian references deal with species that are already widespread in Australia and are thus of limited use in assessing or identifying new records for New South Wales. However, if you are assessing a weed for a local area, books such as Auld and Medd (1987), Blood (2001), Muyt (2001) and Smith (2002) are useful for environmental weeds and Auld and Medd (1987), Wilson *et al.* (1995), Wilding *et al.* (1998) and Moerkerk and Barnett (1998) are useful for crop weeds. For local areas general flora treatments such as the *Flora of New South Wales* series (Harden 1990–2002, Harden and Murray 2000) and Cunningham *et al.* (1981) often mention problems associated with various species.

For ornamental species that are naturalising in south eastern Australia publications by Spencer (1995–2002) are useful.

If a recently naturalised species has not been recorded as a weed in Australia it is often useful to use floras and weed references from countries with a similar climate to areas where the species is naturalising in Australia. For example Henderson (2001) covers plants that are a problem in South Africa and many of these species are also problems in warmer areas of New South Wales. For temperate weeds Webb *et al*. (1988) covers plants that are naturalised in New Zealand and many of these are, or are likely to be, weeds in Australia. In some cases references such as these cover weeds that have recently been identified as naturalised in Australia but have not been recorded as problems in Australia to date.

WARNING Information may not be always reliable from the above sources. Plants have often been misidentified so published information actually applies to another species. **Always** obtain an accurate identification for a species before trying to obtain information on the significance **and** control of that species. We **would** also strongly advise that species identifications **are checked** and if you are not happy with the identification try to obtain a name from another source. In a number of cases we have had to obtain the name of a species from overseas, as there are no Australian experts studying the taxonomy of various exotic species.

Plants of possible significance that have recently been recorded as naturalised in New South Wales

For each of the last three years about 20 additional naturalised plant species have been recorded for New South Wales by the herbarium in Sydney (Hosking, unpublished data). **A** few of these may cause problems in the future. Others may become problems but we are not aware of these species causing significant problems elsewhere. Some of the species that may cause problems (based on available information) are:

Calyptocarpus vialis (Asteraceae) - creeping Cinderella weed. First New South Wales specimen collected in August 2002 from a lawn in Moree. C. *vialis* has not previously been recorded from New South Wales although it is recorded as naturalised at a number of locations in Queensland (Henderson 2002). In Stanley **and** Ross (1986) this **species** is **listed** as a 'weed of gardens, **footpaths etc.'. It is** likely to be **a weed** in similar situations in New South Wales and is probably present on the north coast **of** New **South** Wales but not collected to date from this area. It is now common in **lawns** in Brisbane (Hosking, personal observation) as **well** as south eastern USA (Murphy and Johnson 2002).

Coprosma robusta (Rubiaceae) - karamu. First New South Wales specimen collected by John Hosking and Clive Barker on 24 March 2003 from alongside Bells Line of Road near Mt Tomah Botanic Gardens, Mt Tomah. The species is known from a number of locations in the Mt Tomah area. C. *robusta* has not previously been recorded as naturalised in New South Wales although it is recorded as naturalised in Victoria (Ross 2000) and Tasmania (Rozefeld *et al*. 1999). This species is also naturalised outside its native range in New Zealand (Peter Heenan personnel communication). This species has bird-dispersed seed and is likely to become more of a problem in areas where it is grown.

Hypericum kouytchense (Clusiaceae) - shrubby hypericum. First specimen collected by John Hosking on 7 March 2001 from Gordon Falls Park, Leura. *H. kouytchense* had not previously been recorded as naturalised in Australia. At the time of collection only one plant was seen but many naturalised plants are present alongside a stream further down the slope from the original collection area (Appendix 1). This species is recorded as naturalised in New Zealand (Robson 1985). The extent of the infestation at Leura suggests that this species could become more of a problem than indicated by records from elsewhere.

Pittosporum ralphii (Pittosporaceae) - karo. First New South Wales specimen collected by John Hosking and Clive Barker on 25 November 2002 from alongside Cliff Drive between Katoomba Falls Kiosk and Kedumba River, Katoomba. *P. ralphii* has not previously been recorded as naturalised in Australia but has also escaped cultivation in Great Britain (Clement and Foster 1994). This species appears to have been planted on the edge of native vegetation and from here it has moved into undisturbed native vegetation. This species is likely to be confused with native species so may become a problem in other areas where it has been planted. Once again this species has bird-dispersed seed.

Pinus patula (Pinaceae) - patula pine. First New South Wales specimen collected by John Hosking on 15 June 2002 from south of lower dam, Ponderosa Picnic Area, Hanging Rock State Forest (Hanging Rock is not far from Nundle). *P. patula* has not previously been recorded as naturalised in New South Wales although it is recorded as naturalised in Victoria (Ross 2000). This pine is considered to be a problem in New Zealand, Hawaii and South Africa (Webb *et al.* 1988, Cronk and Fuller 1995, Henderson 2001) so is likely to be a problem in Australia. This pine also appears to be naturalised in the Blue Mountains (Hosking, personal observation) but there are no specimens collected from this area to date. Seeds are wind-dispersed.

Senna multijuga - November shower. First New South Wales specimen collected by John Hosking on 14 March 2003 from alongside Kalang Road on southern edge of Bellingen. *S. multijuga* has not previously been recorded as naturalised in Australia. The species is an attractive ornamental and is likely to be grown in many areas as a result. The only other record of this species becoming a problem comes from Puerto Rico, where it is a garden escape (Liogier 2000). At present it is naturalising in the Bellingen and Thora areas. These plants can be as high as 20 m and are forming dense thickets alongside a road to the south of Bellingen.

Stephanophysum longifolium - tropical wild petunia. First New South Wales specimen collected by John Hosking and Ian Turnbull on 13 March 2003 from Bellingen Hospital grounds. *S. longifolium* has not previously been recorded as naturalised in New South Wales although it is recorded as naturalised at a number of locations in Queensland (Henderson 2002). The species is an attractive ornamental and is likely to be grown in many areas as a result. At present it is naturalising and forming a dense groundcover in the Bellingen area where it is known from a number of adjoining properties.

Conclusion

Naturalised exotic plants are rarely collected so there are likely to be many new records for naturalised species in local regions but fewer such records for New South Wales or Australia. Species need to be accurately identified so that information can be accessed on potential problems caused by the species. This information can be obtained from many sources such as those suggested in this paper. As in Hosking *et al.* (2001) this paper is a continued plea for increased collection of naturalised exotic plants, particularly species that are not recognised by those with a reasonable knowledge of plants.

Acknowledgments

We would like to acknowledge all those who collect non-Australian native plants. The CRC for Australian Weed Management provided money for collection of species in the Blue Mountain City Council area. These species were collected as part of a 'Sentinel Sites' program to determine the usefulness of an early warning system for weed establishment. We would also like to thank Clive Barker (consultant from Blackheath) and Ian Turnbull (weeds officer, Bellingen Shire Council) for providing locality information and assistance with collections of recent plant naturalisations. Royce Holtkamp, Alan Maguire and Andrew Storrie are to be thanked for providing comments on drafts of this paper.

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Appendix 1. Example of a label for a recently recognised weed in New South Wales.

TAMWORTH AGRICULTURAL RESEARCH CENTRE
HERBARIUM (TARCH)

Family: Hypericaceae

Hypericum kouytchense H. Lév.

Det.: NKBR

Loc. Gordon Falls Park, Leura

NSW Subdivision: CT

Lat. 33^0 43' 22"S Long. 150^0 20' 00"E, Alt. 920 m
(Lat. & Long. based on WGS-84)
Coll. J. R. Hosking 2296 Date 28 March 2003

Notes Locally abundant (>100 fruiting shrubs most dense over 70 m of creek front, many more younger plants present) shrub 1.3 m high. Plants multi-stemmed from base and branching along stems. Stems red-brown, woody. Leaves opposite and decussate, dark green above, paler below, with gland dots, to 6 cm long and to 4 cm wide. Sepals 5, green around flowers. Petals 5, yellow, bent back when fully open, to 3.5 cm long and to 2.5 cm wide; stamens numerous, yellow with paler yellow anthers; style and stigma yellow, stigma 5-lobed; petals twisted in bud. Only one plant with flowers all others in fruit. Down slope from J. R. Hosking 2007 & P. T. Gorham.
Landform: creek bank on slopes from $0–20^0$ slope
Substrate: sandstone
Soil: black to brown sandy humic loam
Vegetation: growing with *Hypericum androsaemum* L., *Cytisus scoparius* (L.) Link, *Leycesteria formosa* Wall., *Lonicera japonica* Thunb., *Buddleja davidii* Franch., *Blechnum* sp., *Rubus anglocandicans* A. Newton and native and exotic herbs and rushes
Fruiting material from further up this slope was identified Norman K. B. Robson (BM) on 24 May 2001.

Dupl. to:

CANB MELNE NSW

TARCH N°. 6563


. the colt that never gets away .
ROD SPICER.

CENTROGEN

Initiatives for a Better Earth

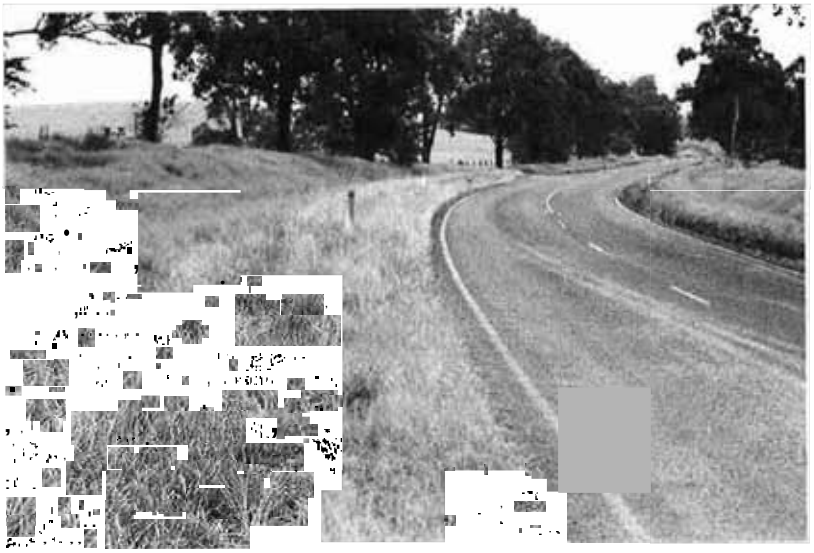
WEEDBUG - Wick Wiping Technology

Applications for WEEDBUG

- Can be used to control weeds along roadsides, in pastures, open spaces and rail lines
- WEEDBUG can be used anywhere a tractor can be used
- Treats:
  - Rats Tail Grass
  - Fireweed
  - Giant Parramatta Grass
  - African Love Grass
  - Serrated Tussock
  - Setaria
  - Paspallum
  - Rhodes Grass

Before Application of WEEDBUG

After Application of WEEDBUG



Services Centroqen Offers

- Designing Vegetation Management Programs
- Expertise and technical advice for WEEDBUG
  Training for WEEDBUG and Wick Wiping technology
  Delivery of Vegetation Management Programs
  Agronomic monitoring and evaluation
- Hire of specialised WEEDBUG machines

Contact Centroqen

Region	Name	Contact Number
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FNQ	John Adams	0438 240 030

CENTROGEN

Initiatives for a Better Earth

WEEDBUG - Wick Wiping Technology

State Governments acknowledge that one of the most significant environmental challenges facing the country is to minimise the impact of weeds.

Over the past ten years Centrogen has developed the WEEDBUG technology which is a cost effective and environmentally safe way of dealing with this challenge.

What is WEEDBUG?

- A Wick Wiping application.
- A safer and more environmentally friendly alternative to spraying.
- More economically effective in the long-term than slashing.

Advantages of WEEDBUG

- Effective removal of identified tall-growing environmental weeds while protecting and promoting the growth of desirable low-growing species.
- Only uses minimal quantities of herbicide - less than spraying.
- Has no soil contact.
- Has no contamination of waterways.
- Ensures a reduced risk to operators, residents and fauna.

How does WEEDBUG work?

- The centrifugal force drives the herbicide from reservoirs onto radiating rope 'wicks',
- Special 'wicks' are attached to the underside of height adjustable spinning disks.
- Controlled measures of herbicide are wiped across weeds.
- Appropriately selected 'kill' heights permit the eradication of tall-growing weeds.

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12th Biennial Noxious Weeds Conference

Conference Papers

Unpresented Papers

W1 Weeds – What are they and the process to follow

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Grafton

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NSW Agriculture
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Introduction

The Noxious Weeds Act 1993 in New South Wales categorises declared weeds into four groups. A different level of control is required for each group of noxious weeds.
The categories are W1, W2, W3 and W4. The Act requires the presence of a W1 noxious weed to be notified to the Local Control Authority within three days of its discovery and the weed must be fully and continuously suppressed and destroyed. In addition, the weed must not be sold or distributed anywhere in NSW, even if it is not declared W1 in a particular local control authority. The Minister for Agriculture can specify a W1 category for the whole state or for particular Local Control Authorities. The Local Control Authority is usually the local Council, Weed County Council or Weed Authority.

W1 weeds are usually not found in NSW or if they are, occur in rare and isolated infestations. They are high priority weeds, which have the potential to create
significant damage to the environment, agriculture or human health if not controlled immediately. There are fourteen noxious weeds that are declared W1 for the whole of NSW.

The aquatic weeds Salvinia and Water Hyacinth and the spiny shrubs, Prickly Acacia, Mesquite and Parkinsonia are declared W1 weeds in western and southern parts of the state. Water Hyacinth and Salvinia are declared W2/W3 noxious weeds along the coast north from Sydney. Alligator weed is a W3 noxious weed in part of Port Stephens's Council area, due to a large infestation. Bitou Bush is a W1 weed on Lord Howe Island only.

Procedures for Reporting and the Control of W1 weeds

The Noxious Weeds Act establishes that occupiers of land, including public authorities, are responsible for the detection, reporting and control of W1 weeds on land under their control. W1 weeds are also know as notifiable weeds. The Noxious Weeds Advisory Committee (NWAC) recognises that the initial costs of dealing with a major W1 weed outbreak may be beyond the resources of an occupier. The importance and urgency of the situation may require immediate action to protect the community. Therefore the NWAC sets aside a limited contingency fund to assist with the control of W1 weed outbreaks each year. NWAC has developed a policy (Policy Paper No. 3) that sets out the process to be followed when a new W1 weed is found.

When a new W1 outbreak is detected, it must be reported to the Local Control Authority (LCA) within 3 days. Agencies, landowners or community groups that suspect they may have found a W1 weed, should first contact their LCA or NSW Agriculture to positively identify the weed. The LCA can then take the appropriate action.

The responsible LCA must report the outbreak to NSW Agriculture, using the W1 weed reporting form. The control of a new outbreak needs to be coordinated between the LCA, NSW Agriculture, other public authorities and the occupier to ensure it is controlled effectively, rapidly and in a cost effective manner. The LCA must ensure that any actions that are necessary to prevent further spread of the weed are carried out immediately. NSW Agriculture can assist with planning, coordination and funding. However funding may only be considered when the proper protocol for controlling W1 weeds has been followed.

Depending on the severity and potential of a new W1 weed incursion, a management team may be set up to coordinate the control program. The team would include members from the LCA, NSW Agriculture and other relevant agencies. The management team would be responsible for;

- Developing an appropriate control program, including any quarantine or other restrictions
  Ensuring implementation of the program
- Seeking funds from the NWAC and other agencies
- Ongoing monitoring
- Organising media coverage and field days.

The control of W1 weed outbreaks on private and LCA lands may be funded by the NWAC for the initial control period. The initial period will depend on the weed species and the situation, as determined by NSW Agriculture. Subsequent control costs after the initial control program will be borne by the occupier. On LCA land, the LCA will be responsible for subsequent costs with assistance through the noxious weed grant.

W1 Weeds

Siam Weed

Siam weed *Chromolaena odorata* is considered a serious invasive tropical and sub tropical weed. It has the potential to spread along the East Coast of Australia. Siam weed was first identified in Australia in 1994, with several infestations in northern Queensland on the Tully River and near Mission beach south of Cairns. Siam weed is widespread throughout tropical parts of the world including Papua New Guinea, East Timor and Indonesia.

Siam weed is not known to occur in NSW. Its potential range is the subtropical area of the state along the coast from the Queensland border to the Sydney region. It is particularly suited to productive lands where the annual rainfall exceeds 1000mm.
Overseas, Siam Weed out competes pastures, crops, horticulture and native vegetation. In Australia the weed has the potential to seriously degrade large areas of grasslands, rainforest, forestry and riparian vegetation. Agricultural and horticultural production such as bananas, sugar cane, plantation forestry and pasturelands are also at risk. Siam weed has a phenomenal growth rate of about 5m/year, which allows it to smoother crops and vegetation. It has the ability to scramble into the canopy of vegetation up to 20m in height. Young regrowth plants of Siam weed can cause cattle deaths and abortions. In dry seasons dense thickets of the weed provide ideal fuel for bushfires. Siam weed may also cause skin complaints and asthma in allergy prone people.

Siam weed has a growth habit similar to lantana but is much more aggressive. The growth is soft when young, but becomes hard and woody when mature.

Alligator Weed
Alligator weed *Alternanthera philoxeroides* is a potentially devastating aquatic and terrestrial weed effecting waterways, poorly drained and flood plain areas. It is listed as a Weed of National Significance. It is a native of South America and a major problem in south- eastern United States, China, New Zealand, Burma, Thailand, Indonesia and India. Alligator weed has not reached its potential range in NSW, but has the potential to devastate the environment and agriculture if allowed to do so.

Alligator weed has extremely vigorous growth and a high tolerance to normal control measures. This makes it a major threat to wetlands, river and irrigation systems. It is one of the highest priority weeds for detection and management, with a significant amount of money spent on its control across the state.

Alligator Weed is present in NSW at a number of locations. It was first recorded near Newcastle in 1946 and dense infestations now occur in the lower Hunter valley. Significant infestations also occur in the Sydney basin and at Barren Box Swamp, near Griffith.

In November 1998 it was found for the first time as an aquatic infestation in northern NSW at Bangalow in Byron Creek, in the Richmond River catchment. Alligator Weed has a great potential to spread to all the floodplain catchments in NSW.

Horsetail
Horsetail *Equisetum spp.* is a very persistent weed, particularly in wetlands and low-lying areas. Temperate regions that exceed 500mm of rainfall are considered most at risk. E. *awense* native to Europe, Asia and North America has spread to New Zealand, Madagascar and South Africa. In NSW, E. *awense* has been recorded at 2 sites in Sydney and also found growing in a permaculture garden near Lismore. Various other species of Horsetail have been promoted and offered for sale in northern NSW as herbal remedies. Plants were seized recently from a market stall in Bellingen. Horsetail has also been promoted as a companion plant for Avocados to reduce the effects of waterlogging.

Horsetail is a non-woody, non-flowering perennial plant that reproduces by spores instead of seeds. It has erect green, unbranched stems 15-60cm tall, with no leaves. The shoots grow from extensive underground system of rhizomes.

The complex root system makes it extremely difficult to control once it becomes established. Horsetail is also particularly toxic to grazing animals. It can cause considerable stock deaths, particularly horses and sheep.

Miconia
Miconia calvescens is a tree native to tropical America. It is highly invasive in rainforests of French Polynesia and Hawaii. In Tahiti it has now spread to over 65% of the land area and is described as the green cancer of the island. During the 1970s & 80s it became a popular ornamental foliage plant in Australia and was sold by several nurseries in Queensland and New South Wales.

Computer climate modelling suggests that Miconia has the potential to invade tropical and subtropical areas in eastern Australia, including north eastern NSW.
Early investigations indicate that Miconia spp. have been sold and distributed in northern NSW. Currently it is unclear how many backyard plants exist in the region, but it is assumed they do occur. No wild infestations are known to exist.
In Queensland, an awareness campaign has been undertaken to locate and remove backyard plants. NSW recently declared Miconia a W1 weed to help prevent the dispersal through the nursery trade, and to remove any backyard and wild infestations.

Overseas authorities with first hand experience have warned that no expense should be spared to hunt this plant down and destroy it. Csurhes and Edwards (1998) list it as a top priority plant for control and removal in a report on Potential Environmental Weeds of Australia.

Senegal Tea Plant
Senegal tea Plant *Gymnocoronis spilanthoides* is a native of South America, originally introduced to Australia as an aquarium plant. It was first recorded in NSW in 1980, on Oxley Island near Taree. Subsequent infestations have been found in Dapto, Gloucester, Bangalow and Lake Macquarie. Recently, a new infestation was found growing in a farm dam adjacent to a nursery near Taree. All infestations are being treated with the aim of eradication.

Senegal tea plant is an aquatic perennial that grows over the water surface or in wet marshy soils. The plant can grow in various forms, producing runners and floating stems up to 2.5m in length, or growing as rounded bushes.

Similar to Alligator weed, Senegal tea is an aggressive, invasive weed. Its stems can grow up to 15cm a week, to form floating mats, restricting water access and use. Its major identifying features are; opposite leaves, hollow stems and white flowers. It reproducers vegetatively and by seed. It seems the most significant means of spread has been through its promotion in the aquarium trade.

Water Lettuce
Water lettuce *Pistia stratiotes* is a free-floating, perennial, aquatic weed that can grow up to 15cm tall and 30 cm wide. The plant consists of a dense rosette of overlapping velvet like leaves. It reproduces vegetatively as well as producing seed that can remain viable for many years.

Water lettuce, sometime known as " Water Rose " has been extensively used by people in home aquariums. It is not uncommon to find it for sale in pet shops and nurseries. It is suspected that many of the new infestations resulted from the dumping of water lettuce from home aquariums.

Water lettuce infestations have been recorded in a number of locations on the north coast. The largest being several areas found in the Richmond River catchment during the past 6 years. A persistent infestation is also receiving ongoing treatment in the Manning catchment near Taree.

Lagarosiphon
Lagarosiphon, *Lagarosiphon major* is a perennial aquatic weed that forms large submerged interwoven mats. It has long stems that grow up to 5m, with curved alternate leaves. Female plants occasionally produce small purple flowers. Its preferred habitat is in temperate regions, in freshwater dams, ponds and slow moving streams.

This is another W1 weed that has been introduced as an aquarium plant. Its only known records of occurrence are an aquarium in Sydney and in 1977 a farm dam in Melbourne.

Parthenium weed
Parthenium weed *Parthenium hysterophorus* is an annual plant that grows to 1-1.5 m in height. It has erect, much branched stems with deeply lobed alternate leaves. It is pale green in colour and the foliage is covered with soft, fine hair. It has small, creamy white composite flowers. In good conditions Parthenium weed can germinate, flower and set seed within 4 weeks.

Central Queensland is heavily infested with Parthenium weed, where it continually threatens to move further south. A significant infestation is still causing concern in the Lockyer valley. During 2002 fourteen new roadside outbreaks of Parthenium weed were discovered and eradicated in NSW.

A mature plant can produce 15,000 seeds, which can be easily spread in contaminated agricultural produce, seed, machinery and vehicles. It is a requirement under the Noxious Weeds Act that all grain harvesting machinery be cleaned and inspected before entering NSW from Queensland.

Karoo Thorn
Karoo Thorn *Acacia karoo* is part of the large non-native Acacia family that has the potential to become major environmental and agricultural weeds in south-eastern Australia. Karoo thorn can grow into a large tree and produce up to 19,000 seeds per annum. Acacias generally produce creamy, yellow or orange, spherical or elongated, powder puff flowers and large numbers of pods.

Specimens of Karoo thorn can often be found at Zoos, where the keepers try to recreate the native surrounds of the captive animals. At Taronga Zoo, a number of Karoo thorn plants can be found in the giraffe and meerkat enclosures. A number of plants are also known to occur at Stockton near Newcastle and at least one plant in the Sydney botanic gardens.

Hawkweeds
Hawkweeds *Hieracium spp.* are a perennial herb of variable height between 15 – 90 cm. No known wild infestations occur in NSW, although a number of plants were recently seized at a nursery in Lismore.

Hawkweeds are native to the Northern Hemisphere, predominantly temperate and montane areas. They have now become major weeds of pasturelands in north eastern America, Japan and New Zealand, where hawkweeds invade grasslands and displace native tussock grasses.

Generally hawkweeds are perennial herbs with alternate leaves, with yellow, orange or red coloured flowers. The flower head may be a cluster or solitary, up to 3cm in diameter.

Mexican Feather grass
Mexican Feather Grass *Nassella tenuissima* is a densely tufted, perennial tussock forming grass, growing to about 70cm high. It is very similar to serrated tussock and indistinguishable from it except by the flowers and flowering heads. It is an even more aggressive pasture invader than serrated tussock and is similarly of no value as forage.

It is potentially a serious new weed that has recently been found for sale in nurseries in Victoria and NSW. Its potential range is through eastern Australia from Victoria to southern Queensland. There have been no known occurrences of Mexican feather grass being established in NSW.

Knapweeds
Spotted and black knapweeds *Centaurea spp.* are perennial herbs growing up to 1m in height. They are botanical relatives of the undesirable thistles, St Barnaby's thistle and Maltese cockspur. Knapweeds have been introduced as garden ornamentals and have been observed for sale on several occasions.

Kochia
Kochia scoparia is a summer growing annual that was introduced recently to Western Australia to provide fodder and for soil conservation purposes. It has a dense compact appearance, with upwardly curving side stems. It grows from 20 – 150 cm tall and is toxic to stock. As the plant matures its colour often changes to pale yellow, pink and dull brown. There are no known recordings in NSW.

Broomrape
Broomrape Orobanche *spp.* are serious weed pests of crops worldwide. They are parasitic plants that attack the roots of other plants and weeds. Branched broomrape is an upright fleshy weed lacking green parts, up to 30cm high.

The only know occurrence is in South Australia, but it has a great potential to spread to other states, posing a serious threat to agriculture, horticulture and native flora. Broomrapes could be accidentally introduced on vehicles, machinery, contaminated soil, fodder and livestock.

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Serrated Tussock – What have we learn't?

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Introduction

Serrated tussock (*Nassella trichotoma)* is a perennial tussock grass thought to be introduced into Australia around 1900. It is a native of South America. The weed was first identified in NSW in 1935 from plants collected near the Yass River. At this time it was known as Yass River Tussock.

Currently serrated tussock infests over 1.1 million hectares in south-eastern Australia. It is a serious weed for a number of reasons (Agfact, 2003):

- It is a prolific seeder; seeds are carried long distances by wind primarily, but also by water, stock and man,
- It infests high and low productivity country,
- It is difficult and costly to control, particularly on non-arable land, and
- It has a low feed value and is unpalatable to sheep and cattle.

The weaknesses of serrated tussock are:

- As a seedling it is a weak competitor,
- It rarely grows in wet areas or under a heavy canopy of trees,
- Seedlings cannot emerge from depths greater than 1.8 cm, and
- Hot summers do not favour its growth.

Control Options

A single control option on its own will not win the war against serrated tussock. Success will only be achieved by employing a number of options and carrying them out in a planned way.

Control options currently being used are:

1. Chipping individual plants and placing pasture seed and fertiliser on the disturbed ground.
2. Herbicide application via spot spraying, boom spraying, ropewick or aerial spraying. The two chemicals registered for serrated tussock control are flupropanate and glyphosate.
3. Pasture management to favour desirable species in the pasture. This will include the regular use of fertilisers and strategic grazing to maintain 100% groundcover and pasture herbage masses sufficient to shade out seedling tussocks.

4. Sowing introduced pastures is an economic control measure in arable areas. In the years following pasture establishment it will be necessary to fertilise regularly, use grazing management to favour the desirable species and use a flupropanate herbicide to selectively remove serrated tussock seedlings when/if they appear.
5. In arable country 1-2 years of cropping may be used prior to sowing a new pasture, to eradicate serrated tussock and to help pay for control.
6. Afforestation – currently radiata pines are the best tree for suppressing/eliminating serrated tussock growth.
7. Biological control options are currently not available. Research into 3 possible fungal pathogens has been occurring in Argentina over the past 4 years. They include:
    - Puccinia nassellae, a rust attacking the leaves of serrated tussock,
    - *Ustilago* species, a smut attacking the flowering spikes and preventing the plant from flowering, and
    - Corticium species, attacking the root and crown of the tussock.

Work has ceased on *Ustilago* species due to concerns over agent host specificity and effectiveness in weed control and ceased on Corticium species due to problems with isolation of the fungus (Anderson et al., 2002). Work is continuing with P. nassellae to better understand its specificity or lack thereof to Austrostipa species (Anderson et al., 2002).

Control Successes and Problems

Serrated tussock situations can be broadly classified into three categories as listed below. Successes and problems are discussed in brief.

i. Arable – There is a wide choice of control measures to control serrated tussock on arable land. Basically there is no excuse for having tussock on this type of land.

ii. Non-arable – high fertility – Success can be achieved with broadacre aerial spraying of serrated tussock and replacing it with a competitive introduced perennial based pasture eg. Australian phalaris plus subterranean clover (Vere and Campbell, 1984). The problem here is the economics of the procedure when under low returns for grazing enterprises. More recent work showing the use of glyphosate in a selective manner may be a cheaper option if there are desirable background species present. This work involved the spraying of glyphosate when the background species were either dormant or in the case of annual species, had set viable seed or had not germinated (Verbeek et *al.*,2001).

    In non-arable areas where tussock has invaded perennial native grasses such as Weeping grass (Microlaena stipoides) and Wallaby Grass (Austrodanthonia spp.) there are real problems with using fluproponate herbicides selectively to kill the tussock. These herbicides will damage/kill these native species, leaving little competition for new tussock seedlings. Note that fluproponate sprayed at the registered rates will not kill native perennial grasses such as Redgrass (Bothriochloa macra) or Kangaroo grass (Themeda triandra).

iii. Non-arable – low fertility and acid soils – Such areas that have medium-large serrated tussock invasions pose the biggest problems for control particularly where the background species present are Weeping grass (Microlaena stipoides) and/or Wallaby grass (Austrodanthonia spp.). Due to the low fertility of the country and often limited soil depth, it is impossible to re-sow aerially with introduced species. The most environmentally sound solution may be to revegetate the area with trees (preferably radiata pine) and exclude grazing.

Conclusion

There are a number of areas where future research needs to occur. These include:

1. Using fertiliser and grazing management to improve competition from desirable species invaded by serrated tussock,
2. Increasing the specificity of herbicides to kill serrated tussock and minimise off-target damage,
3. Decreasing the spread of serrated tussock across the landscape through the use of wind breaks,
4. Continue investigations into biological control agents and,
5. Further develop a range of afforestation options for rehabilitation of low productivity land heavily infested with serrated tussock.

Two research projects have recently been undertaken in New South Wales to investigate points one and two mentioned above. Funds through Landcare have allowed planting of tree belts to occur on farm on the Southern Tablelands decreasing the spread of serrated tussock seed. Over the next 18 months further research is planned to investigate the potential biological control agent P. *nassellae.*

In addition to such research, serious noxious weeds such as serrated tussock need to be recognised as a community problem in order for wide spread control to occur. Serrated tussock is a huge problem to our environment in terms of biodiversity and agriculturally and can be compared to land degradation problems like salinity. As with salinity, control of serious noxious weeds needs to occur on a catchment scale with a coordinated community approach for beneficial change to occur.

All landholders must become more vigilant and responsible with regards to reducing the spread of serrated tussock. It is important to develop a consistent and coordinated approach across regions.

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MANAGEMENT OF AQUATIC PLANTS – *"CONSTRUCT A WATER BODY AND THEY WILL COME"*

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ABSTRACT

The City of Penrith, in western Sydney, has a number of constructed and natural wetlands, and it was the focus for the rowing, kayaking and canoeing competitions during the Sydney 2000 Olympic Games. Management of these constructed and natural water bodies has taken on a new dimension due to the presence of indigenous and introduced submersed and emergent aquatic plants. Aquatic plants are essential for water quality control and bio-diversity, however their presence in water bodies used for primary and secondary contact recreational activities is an issue for the managers of such systems. Biological and chemical controls have proved either ineffective or have environmental issues associated with their use, and water level control is generally expensive due to the need for large industrial pumps.

The international governing body for rowing (FISA) requires that the water column, down to a minimum depth of 3 m below the hull of the scull, be free of aquatic plants. In order to achieve this requirement economically, every form of physical intervention for the control of aquatic plants had to be investigated and trialled in the lead up to the Sydney 2000 ***"Green Games".*** Freshwater Environmental Management Pty Ltd, a Penrith based company, has developed a unique deep cutting and harvesting technology that is now used, in the Penrith district, for the control of submersed, floating and emergent aquatic plants.

KEYWORDS

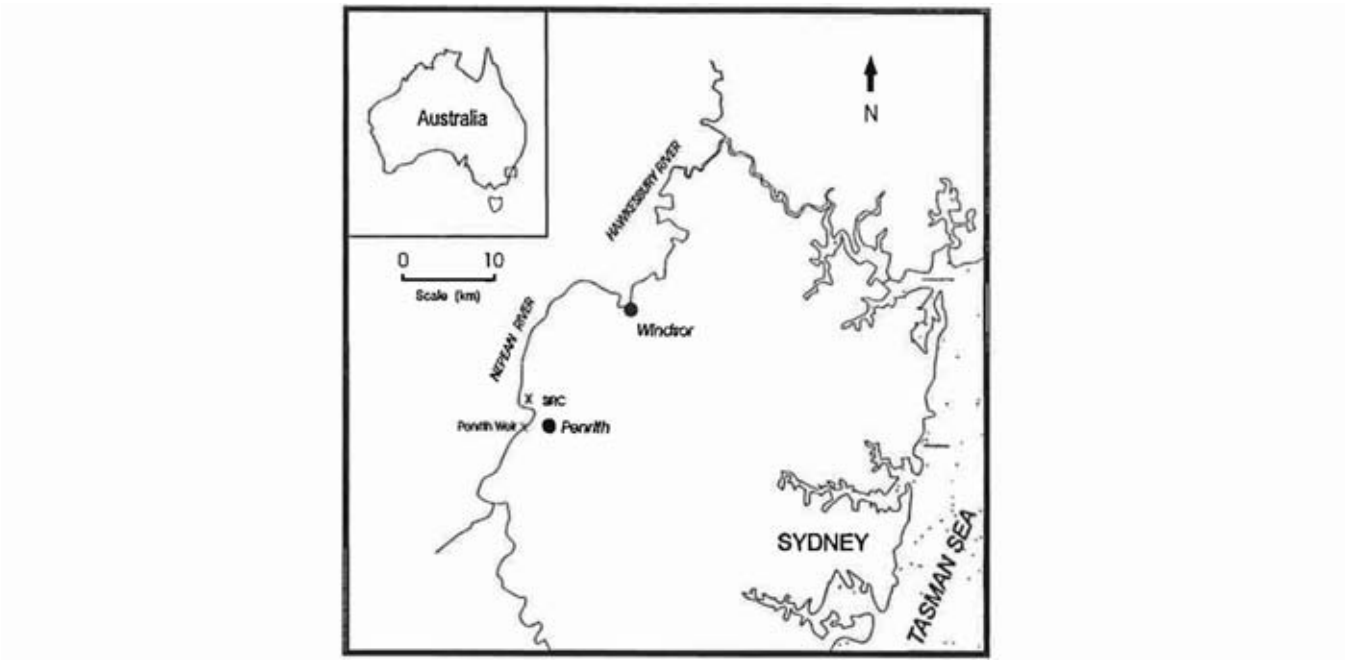
Aquatic plant management, Egeria densa, harvesting, herbicide, weed control matting, screw pump.

1 INTRODUCTION

Penrith is located approximately 60 kms west of Sydney in New South Wales, Australia and has a population of approximately 180,000 people. It covers an area in excess of 400 km^2 and has close to 6,000 ha zoned for future urban expansion. The Central Business District is located on the eastern side of the Nepean River and extends westward to the foothills of the eastern escarpment of the Blue Mountains. The alluvial floodplains of the Nepean River have been extensively quarried for gravel and sand and the Penrith Lakes Scheme is the result of the rehabilitation of these quarries into a series of interconnected water quality treatment, recreational and wildlife lake systems, with a surface area in excess of 700 ha and park and urban area in excess of 1,900 ha (Carter D.R. et al, 1992). These lakes and the adjacent Nepean River became the focus for rowing, canoeing and kayaking during the Sydney 2000 Olympic Games, also known as the *"**Green** Games"*.

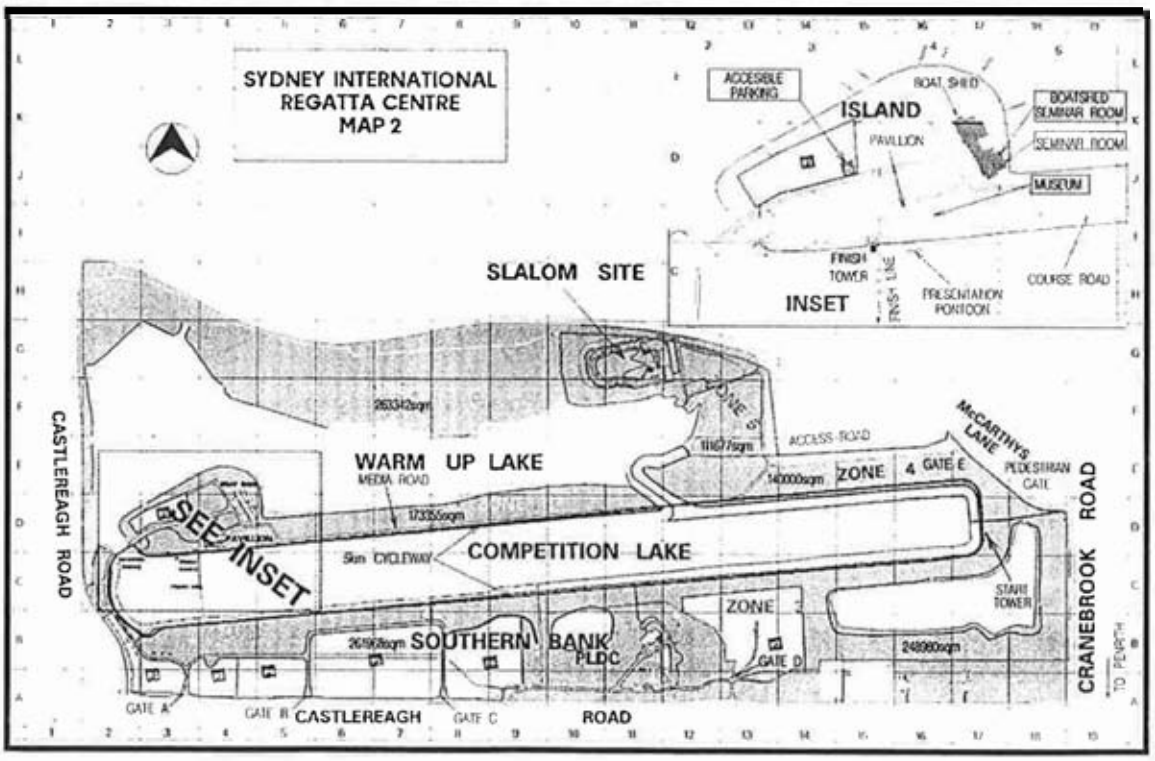
Water based recreation has long been integral to the Penrith region and these activities have centred around the reach of the Nepean River inundated by the construction of Penrith Weir in the late 1800's. Panthers World of Entertainment, on the eastern side of the Nepean River, includes a Water Ski Park and Aqua Golf, and recent urban release areas in the city have taken advantage of the *"**River Mountains Lakes**"* logo of the region to include constructed wetlands as a central theme to their developments.

Figure I: *Locatioiz of the Sydney International Regatta Centre (SIRC) and the Nepean River at Penrith NSW, Australia. (Source: Roberts D.R. et al, 2001)*



This profusion of constructed wetlands, lakes and water bodies in the Penrith region has resulted in the ideal habitat for aquatic plants i.e. shallow, quiescent water. These water bodies have now been extensively colonised by both indigenous and introduced species of water plants, submersed, emergent and floating. Many of them are gazetted as noxious weeds e.g. *Alternanthera philoxeroides* (alligator weed) and *Salvinia molesta* (salvinia), while others such as *Egeria densa* (dense waterweed), *Hydrilla verticillata* (hydrilla), *Potamogeton* spp. (pondweeds) and *Vallisneria americana* (ribbonweed) interfere with the safe operation of the water body as a recreational resource. Their management and control has now become a financial burden on the community and managers of these water bodies have a responsibility to manage them in a cost effective manner that ensures their viability as passive and/or active recreation resources.

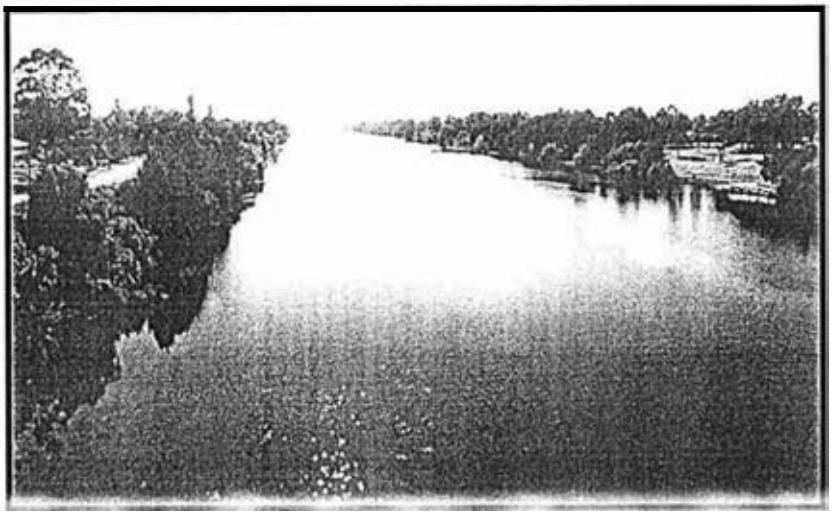
Figure 2: *Sydney International Regatta Centre showing the Warm Up Lake, Competition Lake and the Whitewater Slalom Course. (Source: http://www.regattacentre.com.au, access date: 28 March, 2003)*



2 MANAGEMENT OF AQUATIC PLANTS

In the 12 months leading up to the Sydney 2000 Olympics, the Olympic Coordination Authority spent approximately $2 million (AUS) on aquatic plant management in the Competition and Warm Up Lakes at the Sydney International Regatta Centre (SIRC), an area of approximately 80 ha. To complement this and maintain the Nepean River as a major international training facility Penrith City Council and the Department of Land and Water Conservation spent, in the 3 years leading up to the 2000 Olympics, an additional $300,000 (AUS) harvesting submersed plants upstream of Penrith Weir, an area of approximately 45 ha.

Photograph *1:* View of the Nepean River looking downstream from the M4 bridge towards Penrith Weir.



2.1 MANAGEMENT OPTIONS

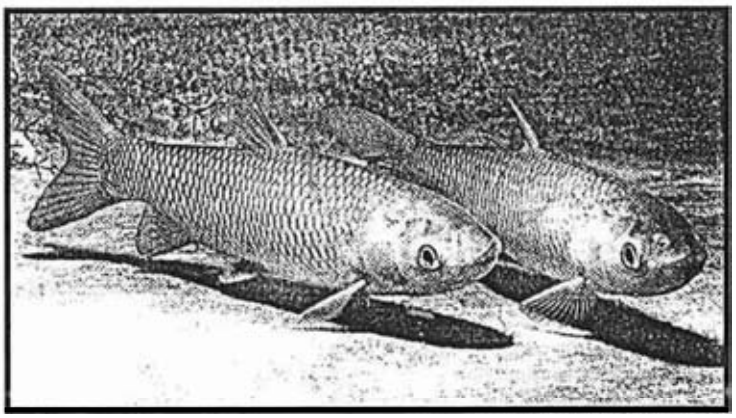
The options available to control aquatic plants include:

2.1.1 Biological – use of natural predators of the plants e.g. grass carp (Ctenopharyngodon *idella*);
2.1.2 Chemical – use of herbicides to retard growth or kill the plants; and
2.1.3 Physical – use of mechanical means to cut, dredge, dry out restrict light.

2.1.1 BIOLOGICAL CONTROLS

The Nepean River has been identified as a Prescribed *Stream* under the Native Vegetation Conservation Act, 1997 and the introduction of non-native fish is a Key Threatening Process under the Fisheries Management Act, 1994. The ownership of the water contained within water bodies in New South Wales is vested in the Crown and is administered by the Department of Land and Water Conservation (DLWC). Consequently before any fish can be seeded into waters of the State approvals from NSW Fisheries and DLWC are required. Consequently the use of non-indigenous biological controls in the Nepean River and the SIRC (a Key Threatening Process for threatened species within both) was not considered an appropriate management strategy for the "Green Games".

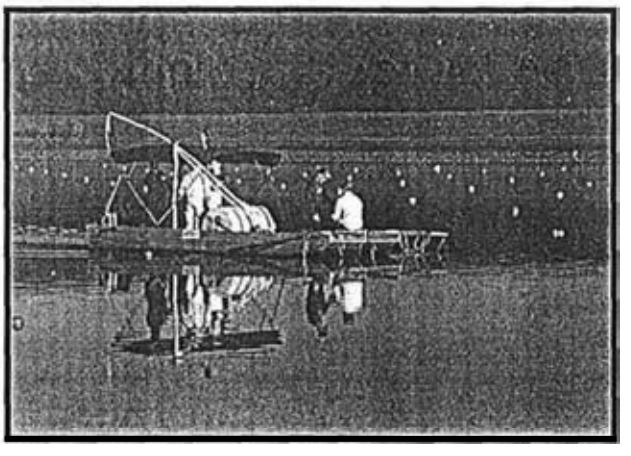
Photograph 2: Grass Carp (Ctenopharyngodon *idella)* (Source: *Pieterse* A.H. et al, 1993)



2.1.2 CHEMICAL CONTROLS

Herbicides were considered to be the only form of control that would deliver the FISA requirements of clear water to a depth of 3 m below the hull of the sculls in the short time available. However, the process of **adding any** substance to waters of the Crown is classed as pollution under the **Clean** Waters Act and a permit from the NSW Environment Protection Authority (EPA) is required. The only **suitable** herbicide **was** considered **to** be Fluridone (registered by the National Registration Authority for use in **Australia)** and trials **were** carried out in the Competition lake as to its suitability. Permits for the trials were approved by the EPA.

Photograph 3: Trial dosing of Fluridone - highest concentration measured was 35 ppb



"The theoretical dose rate for Fluridone in the SIRC was 20 ppb" (Roberts D.E. et al, 1999). Although there was little variation in the biomass within the competition lakes there were significant reductions in the health of all submersed species. "After **3** months there was no evidence of Fluridone causing a reduction in plant biomass at the treatment locations, however hydrilla was observed to have lost its green pigment, pondweeds were translucent and ribbonweed exhibited patches of translucence" (Roberts D.E. et al, 1999).

2.1.3 PHYSICAL CONTROLS

Time constraints and the environmental problems associated with herbicides and the introduction of herbivorous fish meant that the main form of submersed aquatic plant control used in both the SIRC and Nepean River required major infrastructure and physical intervention. While conventional surface harvesting (Aquarius) was used in the Nepean River, every form of physical cutting and removal, available in Australia was trialled and evaluated for use in the SIRC, and it is these trials and evaluation that will be dealt with in this section.

Physical controls included:

WATER LEVEL ADJUSTMENT

Large portable pumps were transported to the quarry access road between the Rowing Lake and Lake A and the water level in the Rowing Lake and Competition Lake were lowered by 1.5 m over a period of two weeks.

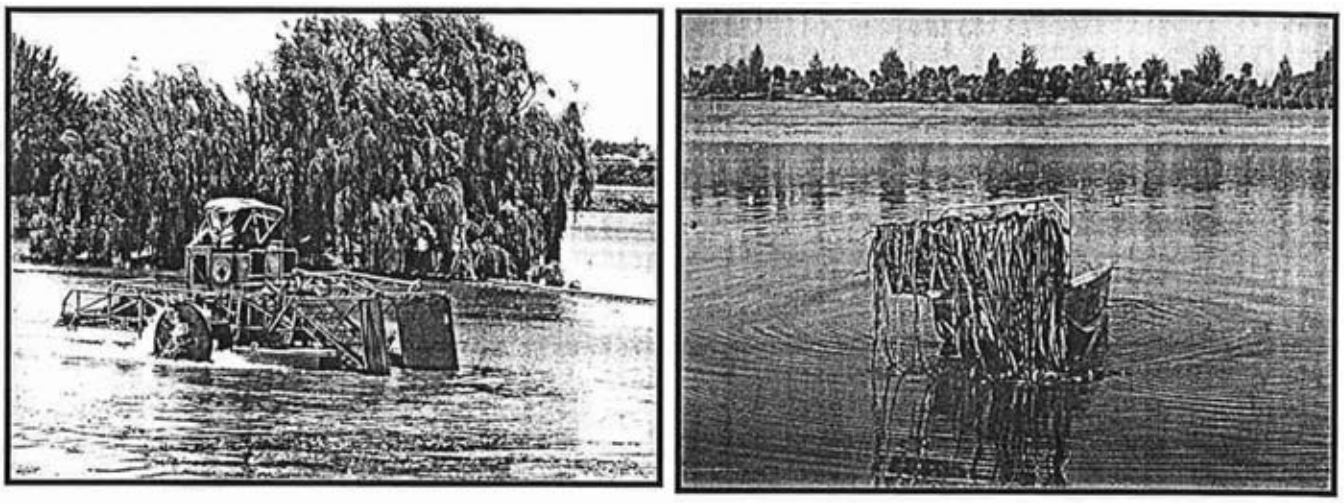
SURFACE HARVESTING

Conventional surface harvesters (Aquarius) were then employed to harvest as much of the submersed aquatic plant material as possible. Once the water level was lowered by 1.5 m the average depth through the 2 lakes was about 3.5 m. The Aquarius harvester was modified to achieve a cut 2 m deep. This still left 2 m of plant material within the water column (effective cut was only 1.5 m) and with growth rates of around 0.5 m per week the plants would soon occupy the whole of the water column. The paddle wheels on the harvesters and the prevailing winds spread the plant material throughout the lake system, making it extremely difficult to pick up the cut biomass.

Floating booms proved difficult to deploy and maintain in the confined area of the lakes and "tinny" run-abouts were modified to include a scoop on the bow, which allowed them to follow behind the harvesters, scooping up the floating plants. RiverVac Australia Pty Ltd and their *Aquatic Vacuum* ***Rig*** proved successful at sucking up floating **plants** but the prevailing winds and the volume of other boating traffic made it difficult for them to control their equipment in the confined spaces between the lanes and the shallow water along the foreshores.

Photograph 4: The Paddlewheels on the Aquarius Harvester at a) scatter the cut biomass over the surface of the water body to be picked up by tinny run-abouts with bow mounted scoops b)

4a) Aquarius Harvester *4b) "Tinny" run-about with bow scoop*



CHAINSAWS AND CHAIN DRAGS

In the lead up to the 2000 Olympics the SIRC and the Nepean River were both in constant use and there was little opportunity to keep the plants below the 3.5 m clearance required by FISA. Consequently it was necessary to eliminate the plants from the competition lakes, especially within the "field of play". Two options were investigated and then disregarded as not feasible. They included:

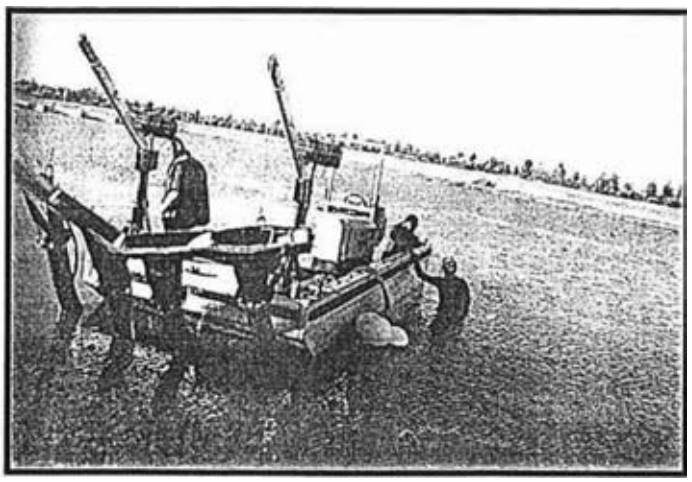
i. Pneumatic Chainsaws – proved effective in shallow areas inaccessible to other techniques. Blade and chain were readily choked with cut plants. Very limited application with a HIGH RISK;

ii. Chain Drags – were suspended below the boats and used to remove the plants, roots and all. Limited success as the plants tended to bend over allowing the chain to run over the top of them, leaving many of them still viable and rooted into the substrate.

AIR-LIFT DREDGE

The solution to the constant regrowth of the plants was to completely remove the plants from the "field of play". This was achieved through the use of a purpose built Air-Lift Dredge, capable of removing all the biomass within a 2 metre width in a single pass. Although extremely successful at removing the biomass, it disturbed the substrate resulting in an increase in turbidity and provided conditions conducive to blue-green algae blooms. Fortunately it was operated during winter when water temperatures were below 12°C and the blooms did not occur until the summer months, well after the Olympic competition had finished.

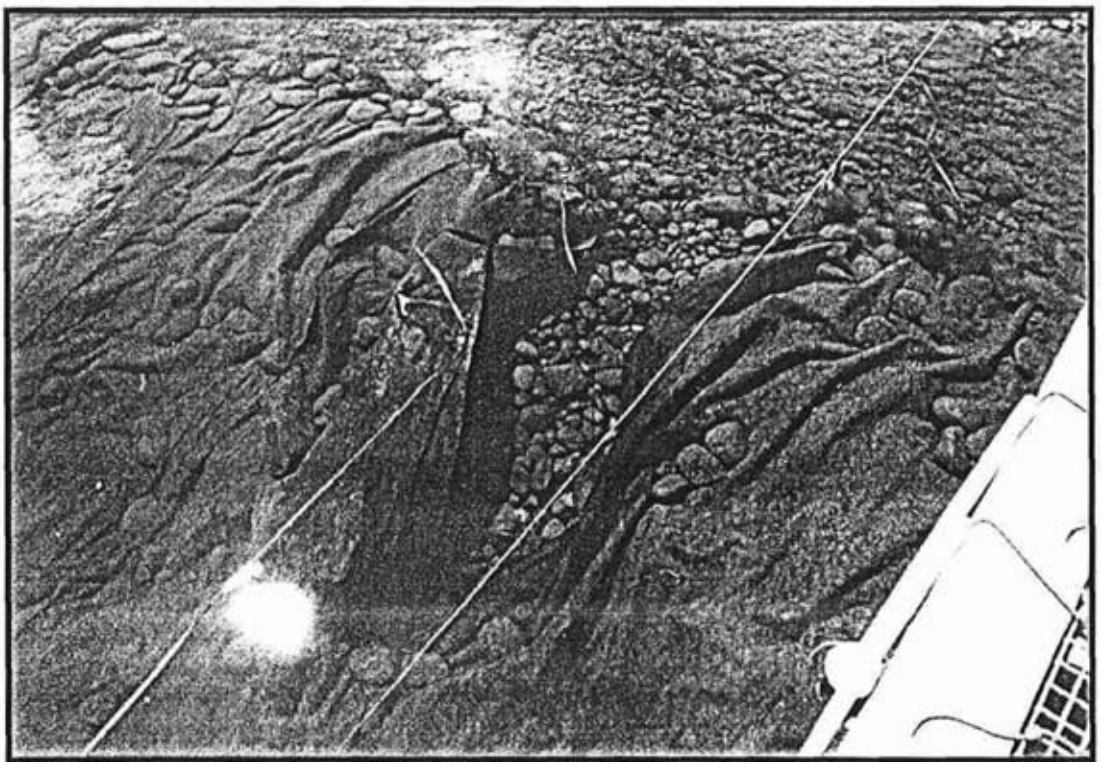
Photograph 5: Intakes, winches and compressor for the boat mounted Air-Lift Dredge



WEED CONTROL MATTING

Once the air-lift dredge had removed the remaining biomass AMOCO *Groundcover* terrestrial weed matting was laid by 2 teams of Commercial Divers. This prevented any re-growth of submersed plants in the areas where the matting was laid.

Photograph 6: AMOCO "Groundcover" weed control matting at the start line of the Main Competition Lake. Note the plant-free zone under the weed control mat has been in for one year



2.2 POST-OLYMPICS AQUATIC PLANT MANAGEMENT

The cost of controlling the submersed plants, in the 3 months leading up to the *Green Games* was approximately $2 million (AUS). This cost was not sustainable for post-Olympic management funding. A new form of submersed aquatic plant control was needed that did not have the environmental concerns of the biological controls, nor the contamination concerns of the chemical controls, nor the problems and costs associated with the physical controls previously used.

2.2.1 COST-EFFECTIVE SOLUTION MUST INCLUDE A DEEP CUT WITH COLLECTION

The answer has come in the form of a locally developed, unique technology that incorporates cutting to a depth of 4 m with suction pick up and onboard collection. The technology was developed by Freshwater Environmental Management Pty Ltd (FEM) and incorporates a hydraulically operated "hedge trimmer" cutting head mounted within a pyramidal hood attached to a screw pump by a 200 mm diameter intake hose, with a top mounted mesh collection bag. Various mesh sizes are available for the collection bags depending on the type of aquatic plants being removed and the sensitivity of the water body. The mesh openings range in size from 2 mm through to 10 mm. Small mesh sizes are generally used for plants that spread by pieces but the key determining factors are the flow rate required to suck efficiently and the size of the plant pieces to be retained.

2.2.2 CUTTING EFFICIENCY

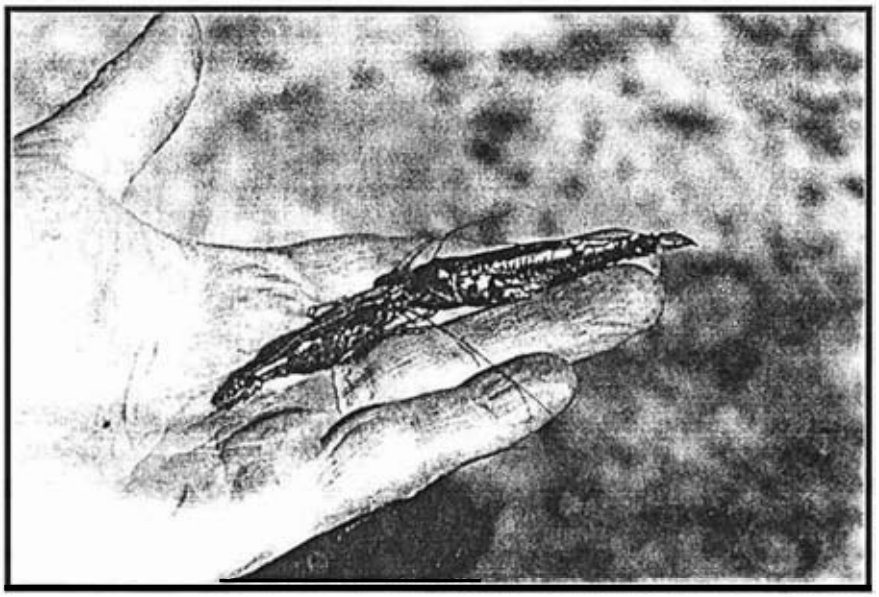
In trials on the Nepean River, cutting mainly *Egeria densa* the FEM technology cut 10 ha in 8 days to an average depth of 2 m. The low profile of the vessel reduces the affects of wind and allows it to be easily manoeuvred in close conditions such as the 13 m wide rowing lanes of the SIRC lakes or around the targets in Panthers Aqua Golf pond. In addition to the manoeuvrability of the vessel the winch controlled cutting head and hood can be adjusted in real time to follow the contours of the bottom of the lakes, allowing the plants to be cut parallel to the bottom of the water body, up to the water surface and about 0.5 m above the waterline.

Photograph 7: FEM deep cut technology elevated to demonstrate the maximum depth of cut (4 m)

2.2.3 BY-CATCH

Small numbers of flathead gudgeons and freshwater shrimp have become entangled in the cut plant material collected in the mesh bags. None were physically damaged; a testimony to the design of the screw pump, but most had died due to suffocation in the compacted plant material. Larger eels (>0.5 m long) have been observed going through the pump into the collection bag and escaping.

Photograph 8: Freshwater Shrimp and Flathead Gudgeon by-catch from Panthers Aqua Golf pond



A video camera was mounted in the hood during the harvesting trials in the Nepean River and juvenile catfish were observed entering the hood, turning around and escaping before being sucked up into the collection bag. The noise and vibration caused by the hydraulic operation of the cutting head appears to provide sufficient warning for most fish to escape before they are trapped by the 200 mm diameter suction intake hose.

2.2.4 SURFACE PICK UP

With the hood raised such that the top rail is about 100 mm out of the water and the suction inlet is still below the water level and fully primed, the technology has proved extremely efficient at collecting either plant pieces that have escaped from the hood or floating weeds such as *Salvinia molesta* and *Azolla* spp. Measurements in the field have estimated capture efficiency at 95% or greater.

Photograph 9: Hood must remain printed to collect floating plants - Nepean River at Penrith.

3 CONCLUSION

Management of constructed water bodies is inextricable linked to the values placed on the aquatic ecosystem by the community and the recreational activities they wish to carry out on or in the water body. In the case of the SIRC lakes the original Deed of Agreement, signed by the Penrith Lakes Development Corporation and the Department of Urban Affairs and Planning identified what is now the main competition lakes as the final treatment ponds in a series of 5 stormwater and sediment detention basins. Today these lakes form a primary contact recreational facility of international significance. Its management has changed from water quality control with secondary contact to active and passive recreation with a primary contact requirement. The difference in costs to achieve these changed objectives is approximately $200,000 (AUS) per year.

The Nepean River at Penrith has been the major rowing venue for the Sydney region for 100 years and management of the submersed aquatic plants has always been an issue ever since Penrith Weir was constructed (1890s) and the upstream reach was flooded as a means of securing a water supply for Penrith. In the lead up to the 2000 Olympics the NSW State Government and Penrith City Council (PCC) spent approximately $300,000 (AUS) over 3 years harvesting submersed plants in the river. The recent trials conducted by FEM have cost PCC $19,000 (AUS) to cut 10 ha of the Nepean River to a depth of 2 metres. The total area requiring control is in excess of 50 ha. Under ideal growing conditions *Egeria densa* can grow up to 500 mm in length per week. Based on these figures and a **3** month peak growing season it will cost approximately $300,000 (AUS) per year to keep the river open to boat traffic.

Removing *Salvinia molesta* (introduced floating fern) from Rotary Lake and *Azolla* spp. (native floating fern), from the Peach Tree duck pond (both are < 0.5 ha in surface area), using hand removal techniques, costs PCC $6,000 (AUS) per year. To further complicate matters many of the waterways and natural water bodies in Penrith are infested with *Alternanthera philoxeroides* (alligator weed, an identified Noxious Weed) and *Myriophyllum aquaticum* (parrots feather). Both are capable of colonising the surface of shallow lentic systems and if not controlled they can reduce the conveyance capacity of open drainage lines (Sainty G.R. et al, 1994).

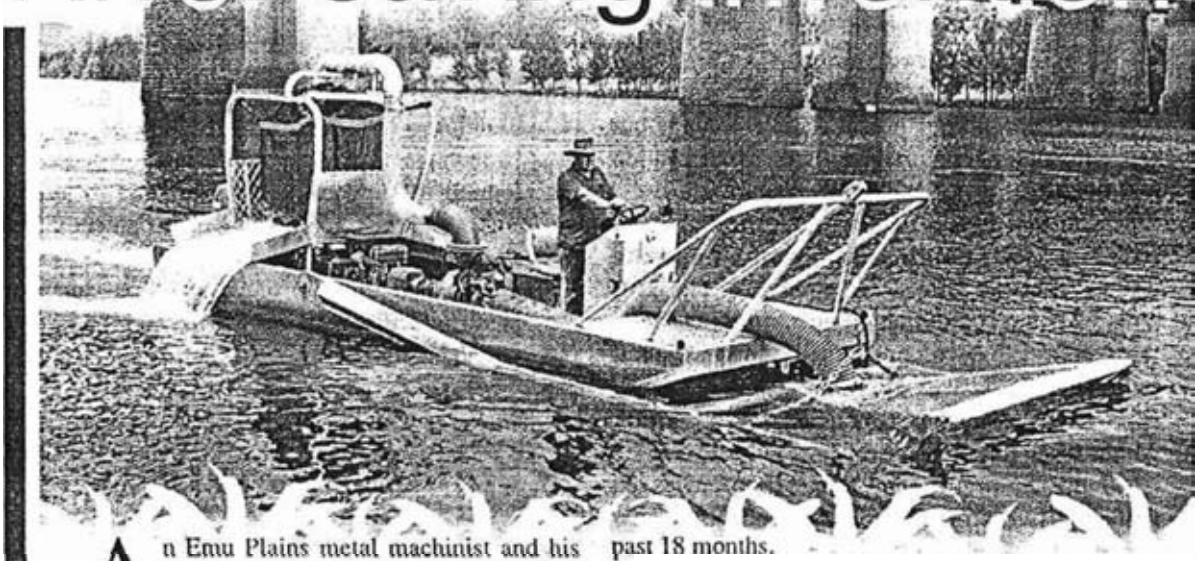
The development of the FEM deep cut and collection technology has provided a physical method of control that allows managers of open water bodies the ability to cost-effectively harvest aquatic plants and in combination with biological and chemical controls give some hope for the long-term control of troublesome emergent, submersed and floating plants.

Figure 3: Article on page 5 of the Western Weekender Newspaper, dated October 11, 2002

NEPEAN-HAWKESBURY RIVER SYSTEM

by Alison Mills

River saving invention



An Emu Plains metal machinist and his business partner have come up with a practical solution to one of the major environmental problems of the Nepean-Hawkesbury River system.

Chris O'Toole, who operates C&K Hydraulics together with Gary Lane who runs Lifter Transport, have invented completely from scratch a machine which can efficiently arid safely harvest the exotic South American aquatic plant, *egeria densa* or dense water weed, which is literally choking large sections of the river system.

So named because of its extremely dense foliage. egeria is an invasive arid rapid growing plant which was introduced into the river during the 1970's and 1980's.

Egeria is sold as an aquarium plant, and it is believed aquarium enthusiasts unaware of its potentially invasive abilities, unwittingly created the problem by disposing of it into the river.

It now poses not just an environmental threat to other native aquatic plant species and marine life, but to the safety of anyone using the river for recreation and ultimately, to the economic viability of the river as a source of tourism revenue.

It is also a serious issue for Penrith City Council as it considers how it might utilise the Nepean River as a focus for marketing Penrith as an aquatic leisure centre for the Sydney region.

Egeria is still legally imported into Australia as an aquarium plant and despite it's aggressive growth habit - it can reproduce from just one 5mm section of foliage and grow up to half a metre over five days - has yet to be declared a noxious weed.

Chris arid Gary have formed another company, Freshwater Environmental Management Pty Ltd, to market their highly specialised harvester. which they have dcsigncd and built over many hours during the past 18 months.

This project stemmed from their involvenicnt with the International Regatta Centre where they have been helping to keep native aquatic plants under control since before the Sydney 2000 Olympic Games.

"This machine has very real economic advantages for Penrith and what is needed to deal with it is a whole of government approach." Chris said.

"The infestation of this plant in our river is something which should concern State and Federal authorities as much as Penrith Council. it is really very much in the national interest," Chris said.

Chris and Gary have been working closely with Penrith City Council's stormwater coordinator and catchment management specialist, Geoff Hunter, whose extensive knowledge of the plant's biology has been invaluable to the development of the harvester.

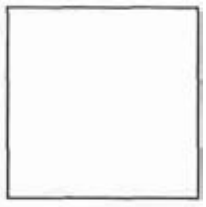
"Unfortunately, we are only able to control egeria by seasonal harvesting, with current technologies we will not be able to eliminate it. Poisoning is not an option, but his harvester will allow us to control it very effectively," Geoff said.

The harvester is much more than just a machine which cuts weeds. it is attached to a pump which removes the cut plants and is rnountcd on a purpose specific low profile boat which carries it. It cvcn has a special trailer which is used to transport it, every part of the equipment has been created and manufactured by the pair.

The machine is capable of cutting egeria underwater to a depth of four rnctrcs, catching it in a special hood, which contains the cut material ready for a pump to suck it into special catch bags which prevent any small pieces from escaping and re-establishing.

The craft can be launched from a conventional boat ramp and manoeuvred into shallow areas near river banks, and in difficult to access places can be lifted by a crane and lowered into the water.

Figure 3: Article on page 5 of the Western Weekender Newspaper, dated October 11, 2002



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3rd SOUTH PACIFIC STORMWATER CONFERENCE

Presenter(s) Information Form

PRESENTER(S) DETAILS

Presenter **(1):** Geoffrey Hunter

Co-Presenter (if applicable) (2):

Organisation **(1):** Hunter Environmental Services

Organisation (2):

Paper Title Management of Aquatic Plants – *"construct a water body and they will come"*

BIOGRAPHICAL SUMMARY OF PRESENTER (approx 50 words in total)

Presenter (1) Geoff has 30 years experience in stormwater and aquatic **ecosystem** management. In the lead up the the 2000 **Sydney** Olvmpics, he was sub-contracted to the Olympic Coordination Authority to advise on aquatic plant management within the water bodies created at the various **Olympic** facilities. He has been intimately involved in the development of a new underwater harvester that is now used **extensively** in western **Sydney** to control aquatic plants. This new technology will be the focus of his presentation.

Co-Presenter (if applicable) (2)

TECHNICAL REQUIREMENTS FOR PAPER PRESENTATION

Please indicate which visual aids you will require by ticking the appropriate box. Do not tick boxes as a backup option, i.e. if you intend using Powerpoint tick the Powerpoint box only and not, for example, overhead projector as a backup option.

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TO BE RETURNED BY 14 APRIL 2003

PAPER ON CAMPHOR LAUREL FOR THE 12TH BIENNIAL NSW NOXIOUS WEEDS CONFERENCE.

BY JOE A FRIEND, C.R.C.,LISMORE

TITLE OF PAPER:

'THE HISTORICAL HYBRIDISATION OF CAMPHOR LAUREL ,*Cinnamomum* carnphora Nees et.Eberm., CHEMOTYPE OUTCOMES, and Cross-Hybridisation to Evolve More-toxic New Generations; Cumulative Toxin Loading or Increased Toxin Production Now Seasonally Impacting on Wildlife, Livestock and the Water, Air, and Soil Environments'

OVERVIEW:

In Federal Parliament after the recent Easter break, two questions were raised by the sometime-Speaker, Mr Ian Causley, asking: "Is the Endangered Species Unit (of federal government's Environment Department) applying the Federal precautionary principle to the exotic and toxic camphor laurel tree?", and "Is the Minister(for Environment) aware that the introduced Camphor tree is invasive in five states and there is increasing evidence of its toxicity to native birds and animals?" – to which there has been nil answers forthcoming to date.

Since important weed species reached certain national prominence with the adoption of a National Weeds Strategy, it is becoming increasingly clear that toxic or 'poisonous plant species' such as Camphor laurel, Broad-leaved Privet,and no doubt a long list of seriously allelopathic exotic 'garden plants' have been ignored or left in the 'too hard basket' for future Chemists, and Toxicologists to respond to.

However, in the case of Camphor laurel, even a preliminary scientific appraisal of this species' chemically active constituents proves that the trees are toxic in "all its parts", but more powerfully toxic in the root-bark that has been out-of-sight, and 'out-of-mind' for so long; not only are the most-toxic parts of the tree underground (Hiraizumi 1950), most of the chemical-toxins produced by the plant are both colourless and odourless; only one of the 12 or more toxins is pungent, which is camphor, whilst only one of the toxins, in the bark, safrole, has a distinct yellow oil colour.

This Paper explores the 'scientific stepping stones' by which Cinnamomum carnphora has been 'discovered' to be powerfully toxic in both the long-term to some livestock, and a range of New South Wales fauna, through both acute-poisoning that is becoming more frequent in 'heatwave conditions', as well as long-term cumulative-sterilising processes.

Six years of in-depth research has led to the collation of most, if not all available colonial records, and the publication of three booklets on how Camphor laurels can kill frogs, how native fish are depleted from Camphor laurel invaded streams, and the direct threat of increasingly more toxic Camphors to our remnant bird fauna.

Finally, this Paper develops the theme that certain toxic plants, particularly species known and proven in some cases to have 'extremely toxic' chemotypes can and will develop greater toxicity, or become more frequently 'extremely toxic' as the known, most-toxic chemotypes within the species both produce greater yields of fruit and seed per season, and as is now revealed, can spread their seed faster, and further by vectors such as native birds.

AN HISTORICAL OVERVIEW

To understand the full history of how it has come to pass that highly toxic plants have become ignored or overlooked in the 'rush' to make-up long Lists of 'Environ-mental Weeds' in the states and territories, one has to recall the case of Oleander shrubs introduced from Europe in the nineteenth century.

In Sydney, and other parts, if not all of New South Wales, sometime soon after World War One, Oleander plants were banned, and declared 'Noxious' by 1920, and everyone born in Australia came to learn that Oleanders were the most-toxic, banned plants: 'not to touch' when you are kid! (Friend, in-Sydney, 1950s)

Oleanders have at least one, and maybe a couple of toxic alkaloids in the leaves, and milky-sap that flows through the plants. In France, during WW I, some Australian soldiers died soon after using the broken-off stems of native Oleanders, to stir their tea!

So, the story spread readily out from Sydney after the end of that war, and the plant soon became listed by colonial Plant Toxicologists, and Agricultural scientists.
I believe the Oleander story, and its declaration by the NSW Government, led to the formation of a 'NSW Poisonous Plants Committee' , sometime after 1920. This Committee published some documents, one of which is still held at the Royal Botanic Gardens Library in Sydney, and which names Camphor laurel, Oleander, and many other plants as distinctly poisonous.

Why NSW's Poisonous Plants Committee fell-apart, or no longer met after or about 1950, and was certainly defunct by 1965 is not certain; but maybe the Government felt that the job of identifying all the serious weeds had been done, so the Plant Toxicol-ogists were not replaced after that time; pensioned-off with 'a package' maybe! On the other hand, there are some 5 Veterinary Pathologists employed at a place like Wollongbar Research Station, yet no expert/specialized Plant Toxicologist employed elsewhere other than head office of the NSW Agriculture Department.

Could it be that the reason for such general disinterest in Plant poisoning and Exotic species toxicology (indeed, there are no published paper/s anywhere on Privet or Camphor laurel poisonings of livestock or wildlife-fauna in Australia) goes back to early decisions of colonial governments?:-

Two confirmations exist to date:-

1. To disseminate specimens, seed, or cuttings of Broad-leaved Privet, and Camphor laurel trees and shrubs throughout the state, commencing in 1848, and 1866 respectively, according to Royal Botanic Gardens-Sydney official record books; and,

2. The NSW Government's forefathers of NSW Agriculture, including one promi-nent, rich landholder near Burringbar, south of Murwillumbah first imported a 'Japanese type' of Camphor laurel, from Hiroshima in 1881, as recorded in Botanic Gardens' record books, and certain colonial plans were afoot at that time, to create a camphor-oil industry, like Taiwan (Formosa) then had, and help to make the colony rich/er.

The subsequent hybridization of the Japanese type, or subspecies of Camphor laurel, crossed with the early 1828 introduction of a 'Chinese' type/subspecies of the tree led, it is almost proven, to the invasive spread of new hybrid-cross Camphors', having different morphologies, leaf colour, and varying inflorescence structure and conformation; just late last year, after the spring-summer flowering of Lismore camphor laurel trees, I completed a Draft Floristic Key (Friend 2002) to the principal chemotypes of Camphor laurels.

But to provide you with a better picture as to why colonial thinkers, and Agriculturalists did not pursue the possibility that Camphor trees might be too-toxic for our wildlife, one has to read the plans of ex-Sydney scientists like Maurice Holze (1898) who, in the South Australian Journal of Agriculture, under the heading 'Economic Botany', promoted the idea of growing Camphor laurel trees in plantations: "in culture, over the hills" surrounding Adelaide"!

In fact, there may have been historical competition between New South Wales, and South Australia at that time, to have large tracts of these trees, at a time when the celluloid-film industry was taking-off, and large volumes of camphor was needed to produce reel film for the burgeoning film industry.

By 1950 in the NSW Northern Rivers town of Lismore, many landholders knew that Camphor laurel trees readily killed farm stock horses when/after the horses ate tree bark (in the mid 40's drought), and a number of free-range poultry raisers had found that their eggs were both inedible, and sterile – with the chooks turning sterile after eating fallen Camphor' berries.

After a not-widely reported incident (Bangalow, 1955) of mass-death of native rainforest pigeons, forced to consume more Camphor fruit, and less Bangalow Palm fruit, even more landholders became suspicious of the species' potential to become occasionally toxic- always around mid-to-late summer(berries), but also in autumn - to unsuspecting, on-farm stock horses.

The Autumn-seasonality of higher level toxicity has been confirmed by Veterinary Toxicologist Dr.R.McKenzie (unpublished,official QLD-Record, Brisbane, 2000), for the Queensland Government.

Poisonousness of Camphor laurel trees has been reported in English since 1905 (Smith, U.K.), but most especially by Fuller and McClintock(1982), and in Australia by Hurst (1942, NSW), and Wilson (1997); in the latter textbook, currawongs are described as becoming more 'aggressive' after consumption of Camphor' berry, and hence to be more likely to kill small birds.

Spread of Camphor laurel is Now a National Problem

Occurrence, and field confirmations of Camphor laurel tree-seedling spread now exists for three states of eastern Australia, as well as southwestern Western Australia (Perth); but to date, the extent of farm homestead spread, and town-spread is restricted to New South Wales, Victoria, and Queensland. Although not known to survive in equatorial Australia, isolated outbreaks do occur at-altitude around Atherton in Far North Queensland.

The invasive, geographic spread of more 'aggressive/assertive' type-hybrid Camphor' trees has been noted in rainforest borders near Atherton, as high as 800 metres in wind-blown rainforest margins on the New South Wales:Queensland border, up and through the canopy of hind-dune, littoral rainforest near Byron Bay, as well as to dominate high-tide seawater-mangrove communities along parts of Stradbroke Island, Queensland; in all these cases, the tree-types are known to be first, or second-generation hybrid Camphors', spread by migratory pigeons or other birds from large, old Camphor trees within 5-8 kms of the new outbreaking infestations.

NSW Government Report Condemns Isolated 'Paddock Camphors'

Lone Camphor laurel trees, once relied upon for shade for stock, have been tested chemically for toxins, especially camphor%, by, a NSW Government agency, the Department of State and Regional Development, based in Ballina and Tweed Heads, NSW ; finding that Camphor trees in clusters, or small forested areas are far-less toxic than single Camphor laurels in-isolation across grazing paddocks of old dairy-farming districts.(DSARD 1999)

That is, single Camphors', with nil or negligible tree competition, access added pasture fertilizer, water, and all available sunlight, to maximize toxin production, almost certainly in seasons both sides of Autumn , as well as being worst in Autumn! This theory has been verified by years of detailed Camphor tree surveys, both in Lismore (L.C.Council, park-shade, street-trees, 2000-03), as well as at The Channon (1998-2003), comparing native bird movements and feeding in four individual 'paddock Camphors'.

Additionally, it is known from Northpower electricity line workers who have pruned and cut back Camphors' for decades in NSW's Northern Rivers', as well as put in new power posts across various districts, clearly testify to the fact that sizeable Camphor laurel trees consistently have sizeable rooting systems covering very significant areas of 'paddock land' otherwise only occupied by grasses/pasture, and that Camphor' roots can readily traverse over 100 ms within the soil profile's top-metre', accessing available nutrients and water.

Increasing Levels of Camphor Tree Toxicity !

Although 'mass native bird death incidents' have only been reported for three occasions (1955, 1987, and 2002) in the New South Wales' Northern Rivers districts, they all occurred in relatively dry, or droughted summer periods involving multiple days of intense daytime heat. It is believed that such conditions are when the molecule camphor becomes significantly more chemically labile, and volatile (>41 deg.C).

Mountain Brushtailed Possum is not only consuming an increasing volume of particular, young Camphor laurel tree bark in various parts of NSW's Northern Rivers', but the square centimeter rate of bark consumption per spring season has been on-the-increase over the past 2-3 years of droughted seasons around Lismore, NSW – on two studied farms, in 'wild' bush, as well as in National Park-World Heritage boundary-buffer zone areas adjacent to Nightcap National Park, via The Channon.

In certain separate cases of young Camphor tree-bark attack, every square centimeters of bark has been chewed-off saplings as tall as 8 metres, on 2 well forested farms (Tuntable, and Rosebank); the stripped young trees do not survive this intensity of attack!

At Melbourne Botanic Gardens, possums coincidentally started eating rapidly increasing volumes of older Camphor laurel tree bark, to the point of making the trees unsightly; tree-guards to deter possums were installed around the tree-butts. It is still not clear, and unresearched if the possums know/can tell what level of toxins they are consuming, if they are turning sterile, or dying from excessive camphor consumption at a young age; what is evident is that all possum species are becoming uncommon to-rare in and around Lismore satellite villages e.g. The Channon, where 'more toxic' chemotypes of Camphor laurel are known to predominate in the tree-community.

'Vomiting and Asphyxiation' ; the Classic Symptoms of camphor-poisoning!

Wildlife as well as medical textbooks published in the United States clearly state that birds (and other animals)poisoned by excess camphor consumption induce "vomiting and asphyxiation", which then causes death (suffocation), from Camphor berries becoming stuck in the pharynx or thereabouts. Individual birds have been dissected to verify this form of death (Camphor laurel Research Centre, The Channon 2002) in different bird species.

Whereas historically, naturalists and birdwatchers believed that birds had no trouble consuming Camphor berry/ies, and seeds – in the case of stomach-grinding species – and nothing got poisoned, but that Camphor trees became widely disseminated across farms, fencelines, and along roadsides etc, knowledge of any camphor toxicity appears to have only commenced (in America) circa.1990.

Numerous individuals, including scientists who have bought Northern Rivers' farms to regenerate as well as for early retirement have reported sighting dying and dead-birds 'falling out of flight-formations, as well as out of Camphor' trees directly, in-summer, and in autumn across a wide range from Goonengerry to Dunoon, and Teven.

CSIRO Provides Evidence Against Camphor re: Small Bird Species Disappearance

In rainforest ecology field-studies published during the late 1970s, CSIRO Division of Wildlife Research, Canberra revealed that the once widely common small bird species *Silvereye* had been sighted consuming Camphor laurel fruit-berry, only a decade prior to the species' almost total demise in areas adjacent to, west, and southwest of the Nightcap National Park, as well as in coastal districts including inhabited towns where they had been reported for decades as being the most common small bird species.

(CRC-The Channon,'last seen', small-flock in-camphors!; 1999).

Numerous letters in regional newspapers have testified to the fact that most small bird species have dwindled, or disappeared across the entire geographic range of the Northern Rivers region, over the past 10-15 years; no single cause has been ascribed or fully investigated, yet Camphor laurel ingestion, of the most high-yielding, most-toxic chemotypes would appear to be highly implicated.

Indigenous Birds Now Consuming Too Much Camphor Berry !

Over the same period (ca.15 yrs) that larger native rainforest pigeons have become increasingly less-common on roadsides, as well as in diminished flock sizes, numerous dead White-headed Pigeons have been handed-in, dissected, and inspected from various districts across NSW's Northern Rivers, from Uki in the northeast, to Alstonville, Wollongbar, Lismore, and The Channon-Terania Creek; almost all specimens of freshly picked-up pigeons have yielded crop-contents 100% replete with Camphor laurel (ripe)berry; stomach contents appear to be crushed Camphor berry/seed.

In the only case so far provided by 'Save the Camphor Tree' environmentalists, living in Tweed Shire, certain native rainforest pigeons being reared, or recovered from a 'sick' status have been fed on Camphor berries, but investigations reveal that the fruit selected for those birds was from significantly old 'Chinese' (not hybrid types) Camphor trees, and Tweed Shire Camphor laurels are known to be the least-toxic of all Camphors in the Northern Rivers of NSW.

There is nil evidence that native pigeon species, especially the Fruit Doves which are even more rare than the larger Pigeon species have any knowledge of what is a 'critical intake' of high-camphor%, or high-safrole% Camphor berry to be consumed; i.e. the New South Wales Government has never conducted any research/studies into how safe any of the types/chemotypes of Camphor laurel are to native birds or any other fauna, and yet, to date, the public, and amateur ornithologists merely assume that 'the birds know' what will be / most likely be 'the critical dose' of a certain tree fruit type.

Apparently, this is not true, especially for the smaller dove-pigeon species, which have been widely reported to become 'punch-drunk' on ripe Camphor berries at various places over the last 20 years, flying into windows upon 'seeing' their reflections, only to have to recover and repeat the procedure, until sunset often on multiple days in succession!

Within 2 years(2001-2003) at the Camphor laurel Research Centre, more than a tucker-box full of Camphor' berry-full bird, possum, koala, and bandicoot carcasses have been collected and dissected – because the Government no longer cares to do the essential autopsies!(Nor does The Australian Museum analyse why fauna is 'road-killed'!

Bird sterility, either the result of cumulative camphor ingestion, and/or as a result of cytotoxins released from ingested seed (Ling Jun et a1.1995) has been verified for chooks, geese and game-fowl by farmers doing their own on-farm experimentation – as a result of NSW Agriculture taking no notice of complaints about Camphor laurel for more than 50 years!(various interviewees); ribosome-inactivating compounds are implicated.

Soil-water, and Ground-dwelling Frog Species Significantly Impacted

In the first piece of ground-breaking evidence to be independently provided to the Camphor laurel Research Centre (CRC-The Channon,1998) U.K's Royal Botanic Gardens at Kew-Surrey found from root sample inspections that hybrid Camphor laurel root surfaces were literally covered by 'toxin-oil excretion glands', which pump-out excess, or defensive oil-toxins almost certainly evolved originally to help defend the tree (in Australia), from aggressive native, underground beetle and moth larval attacks.

No prior scientific investigations have been initiated into the pollution of soil-water, and thence, waterway pollution from the slow, steady dissolution of oil soluble toxins, or the water-soluble bark alkaloids of Camphor', all of which may become, or be yet proved to be more soluble in the presence of the various aponins, or soap-like compounds exuded frequently, and in sometime high-volume from various indigenous flora e.g. *Jagera* s ~ . ('Foambark') trees – which appear to have evolved to preferentially germinate under Camphor laurels (CRC observations, 2001-2003, The Channon).

Camphor-camphor toxicity believed to be Causing Cumulative Long-term Impacts

In addition to 'acute-toxicity' effects corroborated by textbooks from the northern hemisphere, mammalian studies – especially of humans poisoned by camphor accumulations throughout their lives, clearly indicate that the molecule camphor can, and has caused long-term toxification of lower abdomen organs, including the spleen, pancreas, and kidneys in human beings–in Australia.(CRC-Lismore interviews,2000-02).

This likely scenario would be naturally compounded by a measured (Kew-Royal Botanic Gardens-U.K.2002) increase in the camphor% content of leaves of Camphor laurel trees known to be implicated in the death of medium-sized birds in Lismore, NSW; a fully unprecedented high level of camphor (>93% of all organic contents) is believed to be a 'world record', extremely-high level of the toxin camphor in any leaf, of any plant species; heightened carbon dioxide, increased average daytime temperatures, extreme ultraviolet readings, and an elevated level of faster and more frequent winds are believed to be the main causes of the increased camphor production in Camphor laurel leaves.

CSIRO Provides 'Indicator-Proof' That Bark Alkaloids Can Kill Marsupials etc.

In a major text published in 1987 (C.S.I.R.O.,Melbourne) this eminent organization revealed that the same two reasonably common alkaloids found in Camphor laurel root-bark, and trunk bark (and possibly other parts as well), were 2 of the same three alkaloids that killed 'all the mice' in feeding trials performed with a relative 'Laurel species'/shrub found growing in Papua New-Guinea.

These water-soluble bark 'killer'-alkaloids (recently confirmed by RMIT Toxicologist & Chemist, 2002), are also highly implicated in the general demise of most native fish species in streams densely infested by large Camphor laurels that overhang waterways, and seasonally drop significant volumes of detritus, leaf, twigs, and bark leachates. Most indigenous, once-common fish-species that only ten years ago inhabited most freshwater streams inland beyond 8-10 kilometres from the coastal sea-breezels have now become defunct along most Camphor-infested streams and rivers – including parts of the lower Clarence River system, the Orara and Tweed Rivers(worst affected), and the Brunswick and Richmond River systems as well as all their inland creeks.

Interviews (1998-2001) with commercial fishermen who used to weekly fish the lower reaches of the abovementioned rivers almost all state that "you cannot find, and it is not worth fishing anywhere within a hundred metres of any large old Camphor laurel, or a Camphor laurel infestation. Similarly, kids' no longer even bother 'going fishing' in the majority of inland streams, e.g. Terania Creek – like they used to do only 10 yrs ago.

EVIDENCE That Camphor laurel Trees Are Evolving, &/or 'Turning More Toxic':

With every generation of new Camphor laurels appearing in farm paddocks, in suburban gardens, and on public lands including streambanks, new genetically unique,'hybrid-crosses'of the tree species are beginning to appear; field observations in the Corndale district, near Lismore – where, it is believed some of the very first Northern Rivers Camphors' were planted in the 1870s, new trees as low as 3 ms, and as young as 3 years old have been shown to start fruiting(2002-2003) – in the drought; the new types of Camphors', arising out of the known 'Bird Killer' hybrid, first identified and analysed by Kew Botanic Gardens(London, 2002) appear to be even more fertile, and spreading in habit.

Further evidence against Camphors' comes from anthropocentric sources, including notable NSW and South Australian academics, amongst them Botanists, and Museum Directors who have become allergic or hypersensitive to both the molecule camphor, or some/many of the volatile toxins emanating from the tree twig bark's modified lenticel excretion glands (Kew Royal Botanic Gardens,2002) on hot days.

A mounting body of so-far privately published scientific evidence, covering no less than nine biological disciplines is, in its entirety damning evidence against the feral, exotic trees that Camphor laurels are. It is a tragedy in itself, that neither the universities or the New South Wales Government have not, and apparently will not professionally investigate, or direct Environmental Consultants (e.g. Bishop 1993) to continue their valuable contributions to the science of Camphor laurel toxins ; nor to insomuch as try and prove to the public that the trees are in fact safe to fauna, and to humans.

Camphors' Have Killed Human Children

Breyer-Brandevijk (1962) in Africa provides well documented evidence that as the first colonial Camphor laurel plantations matured in East Africa and elsewhere(India), African children attempting to eat Camphor' fruit died from exceeding a 'critical dose'; noone appears to have ever studied how much African bird- or other wildlife was impacted by the 1880s-plus Camphor laurel plantations, or whether they were removed.

That Camphor has killed European children, and elsewhere was confirmed by notable international pharmacist- Martindale(2001)

(See Diagram-Table One)

Camphor laurels Set to Change Old English Common Law in Australia

In an 'Appeal Case' to the Australian High Court in early 2002 (Telegraph-Sydney, 09 April 2002), known, more toxic chemotypes of Camphor', described to be consistently breaking-up pedestrian pavements, breaking-down stonewalls, and starting to breach the foundations of heritage buildings nearby, local residents won the right to eradicate, and replace the street-trees(2 Camphors; 'yellow-green type'); substantive evidence suggests that these trees' roots were becoming an extreme nuisance in recent years of less than 100 years age, only started to become a public-nuisance since the advent of the hottest-recorded years (Meteorological records,Melbourne),since the late 1980s, or early 1990s ; Old English common-law was overturned by High Court lawyers.

The 'Hot' Political Issue That Camphor laurel Is…

Firstly, it is most interesting to note (see for instance Holze 1898) that the attempts to grow or plant extensive plantations or plantings of Camphor laurel in Australia, was not only not restricted to northeastern NSW, but all the attempts pre-dated the knowledge published after 1905, that the trees were, or had become more toxic, perhaps by way of domestication, breeding and selection.

For more than fifty years, and probably more, NSW authorities have been 'trying to forget' that it was the NSW Government, via the Botanic Gardens(Sydney), the Departments of Agriculture, Forestry, and Education that disseminated the tree far more thoroughly than any bird species ever could; even more thoroughly than all the state's bird resources put-together ever could, over the entire period (1840 to 1970); not only are numerous bureaucrats keeping-on trying to ignore the issue when it is raised, NSW Environment authorities have tried denying in Parliament that there even is a problem; it is in fact a grave, political issue when Environment authorities won't even come to visit or sample 'dying creek systems', seasonally noticed 'dead fauna', and continue to deny funding of the essential research into the problems caused by camphor in our water, in our soils, in our fauna, and in-all-probability polluting certain flora with toxic-gene containing pollen; the latter is the latest, most serious side of what could in fact be called G-E Camphor, the result of our unwitting domestication of a so-called 'landscape tree'.

SUMMARY

The East Asian tree, Camphor laurel, and its various chemotypes appears to be a highly evolved 'pesticide tree species' – probably the most highly evolved, to defend itself, in the entire southern hemisphere. Although few botanical records exist, it has been proven that the NSW Government, including four of its agencies and Departments helped circulate the tree widely, into all regions of this state, as well as interstate; as a result, we are on-the-brink of a major catastrophe, with tree-spread now starting in Victoria, and becoming rapidly worse in southeast Queensland, Atherton, and around Perth, W.A. The species is almost certainly responding-to, and getting more toxic as a result of the combined effects of more available atmospheric carbon, hotter weather in-general, and the vagaries of, plus dessication due to extreme ultraviolet days, and high-winds.

The 'chemical-cocktail' seasonally exuded, volatilized, and environmentally distributed by the trees, is made up of a wide range of powerful yet unrelated toxins; the tree-species' adaptability, and rapid colonization-infestation is both the result of many bird vectors, and people not being able to 'see' the toxins, or their effects in the short-term. Most damage or deaths to fauna occurs in mid-summer or autumn, at times when most people do not go walking in the long-grass, let alone look for dead-birds!

Long-term damage/s, usually wrought beyond 5 years after tree maturity appears to be the mode or route by which this species causes serious ecological damage. As these effects and negative impacts occur in time-periods beyond 'political timespans' of 3-4 years, no university has to date taken any serious interest in the tree's toxins – even though it is over 55 years since farmers first 'raised the alarm bells' with the then NSW Department of Agriculture.

After six years of intensive research, it definitely appears that NSW's Noxious Weeds Act (1993) needs to be smartly amended to bring it into alignment with other interstate, and international Noxious Weeds Acts, so that full mention of the weed descriptors: 'toxic plant', or 'poisonous species' are again incorporated into the Act.

Finally, real-funding, and a modern prioritization of funding, in line with International Best Practice, to address our most-toxic weed species first, must be made available at the earliest opportunity to properly research the control options for Camphor laurel which is effectively 'out of control' in north eastern NSW.

DIAGRAM-TABLE ONE;

Scientific *'stepping-stones'* : Key Findings towards proving Camphor Laurel's increasingly toxic status/10-15 deadly toxins; CRC-Camphor Research Centre-Lismore, NSW, Australia.

Cinnamomum camphora Nees et Eberm.

Date	*Finding/Scientific Findings:*	*Authority/Reference*
1942	NSW Poisonous Plants Committee publishes book confirming the toxicity(to livestock) of Camphor laurels spread by NSW Gov't since 1866.	NSW Government & the Botanic Gardens,Sydney.
1998	Royal Botanic Gardens, Kew, London, provides stated proof of toxin--exudation glands on most outer root surfaces of Camphor Laurels, for toxins to be seasonally excreted into soil water thence to waterways.	UK Government, Chief Plant Physiologist and Botanists.
1999	Queensland Government Vet.Toxicologist provides official confirmation that horses DIE after eating the bark of particular Camphor' trees.	QDPI --Yeerongpilly, Brisbane, QLD.
1999	Camphor Laurel leaf + twig oil,distilled from Goonengerry in Byron Shire, found to contain benzene-carcinogens and 0.6% napthalene(fish poison), plus volatile compounds , plus safrole(carcinogen).	ATORI'at SCU
2000	Camphor laurel leaf(ex-NSW Northern Rivers) tested for toxicity to aquatic organisms, by C.S.I.R.O's Key Centre for Advanced Analytical Chemistry and declared "extremely toxic"on key test micro-organisms.	CSIRO, Lucas Heights, Sydney
2001	Camphor'root-oil distilled from a representative sampling of Northern Rivers Camphor trees(Corndale & Mullumbimby), & proved to be more than 25% greater toxicity than Camphor leaf+twig oil prev. tested (2000).	CSIRO, Lucas Heights,Sydney NSW.
2001	Creek precipitate/s identified by AGAL-Sydney, as an as yet-unnamed sterol exuded by the roots of Camphor trees, a rusty-orange precipitate; nil biota capable of living in this chemical environment (/3 yrs obs.)-excepting mosquitoes;streams first turn opaque-'milky'.	Aust.Government Analyt. Laboratories Sydney, NSW.
2001	United States and U.K.authorities ban all imports of Camphor laurel manufactured(Chinese)linaments & camphorated oils, including bark-oil known to contain'suspicious compound-toxins'from CL-branchlet bark	**Martindale** Text-book, *Pharmocopaeia*, Vol. 31; p1684.
2002	Royal Botanic Gardens, Kew, London, issues a formal Report on the modified toxin excretion glands along twigs and young branchlets of new growth on most toxic Camphor Laurel types; leaves of known Birdkiller'Camphor tree in Lismore analysed to prove >93% camphor.	UK Government, Chief Plant Physiologist and Botanists
2002	First-ever record of Lewin's Honeyeaters, an omnivorous species at-the-base of the most-toxic known chemotype 'Bird Killer'Camphor laurel street-tree, in-drought time, Lismore;(Feb'/late-summer).	Camphor laurel Research Centre Lismore, NSW.
2002	First recorded 'mass native bird death incident', February heatwave; estimated 100 magpies, rosellas, galahs, and other spp.dead nr CL's	CRC-Lismore, & LCC, Lismore City Council
2002	Observed death of Green-winged Dove-Pigeon, by **vomiting & asphyxiation**, dissection revealed swollen Camphor'berry in bird's pharynx	Camphor Laurel Research Centre staff
2002	US text books confirm that animals dying from camphor poisoning (in America)display primary symptoms of **"vomiting & asphyxiation".**	US *Poisonous Plants* Textbook
2003	First koala dissected for analysis of blood and stomach content samples; camphor-smelling, and yellow-green contents colour; + frothing-at-mouth; 2.**King Parrot** dead 12 hours after consuming ripe CL berries (post-mortem), bird vomiting at pickup ,& left-side-paralysed	Vet.G. Tomkins/ (Friends of the Koala), Lismore

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www.camphorlaurel.com

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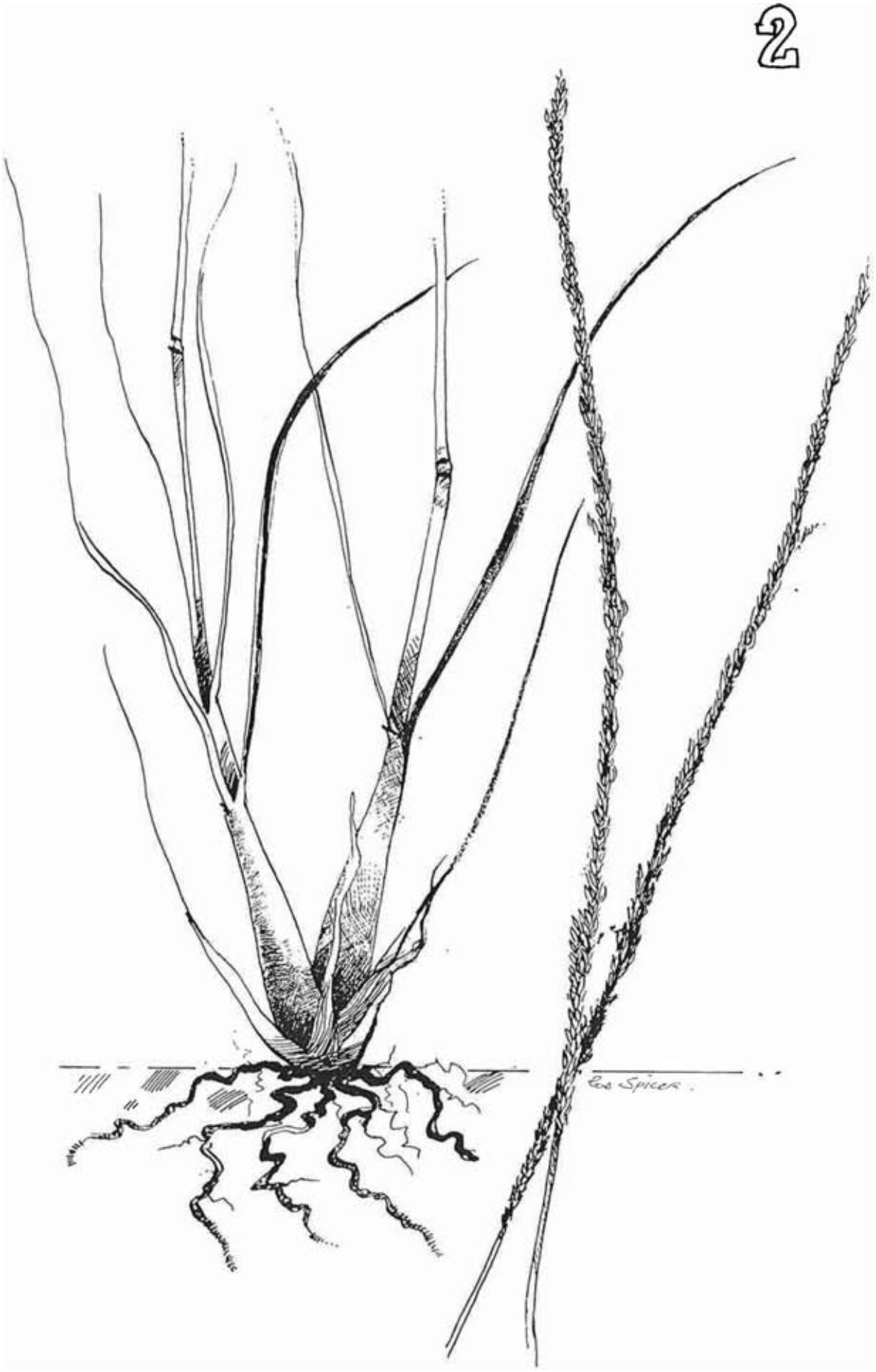
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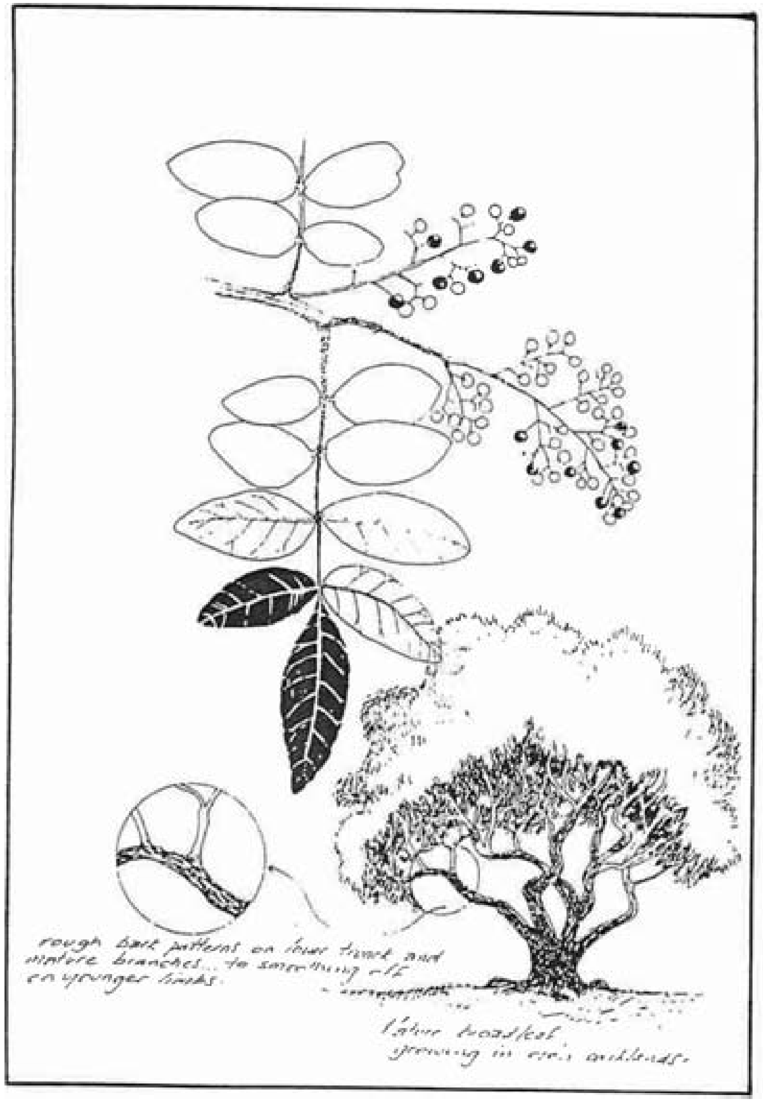
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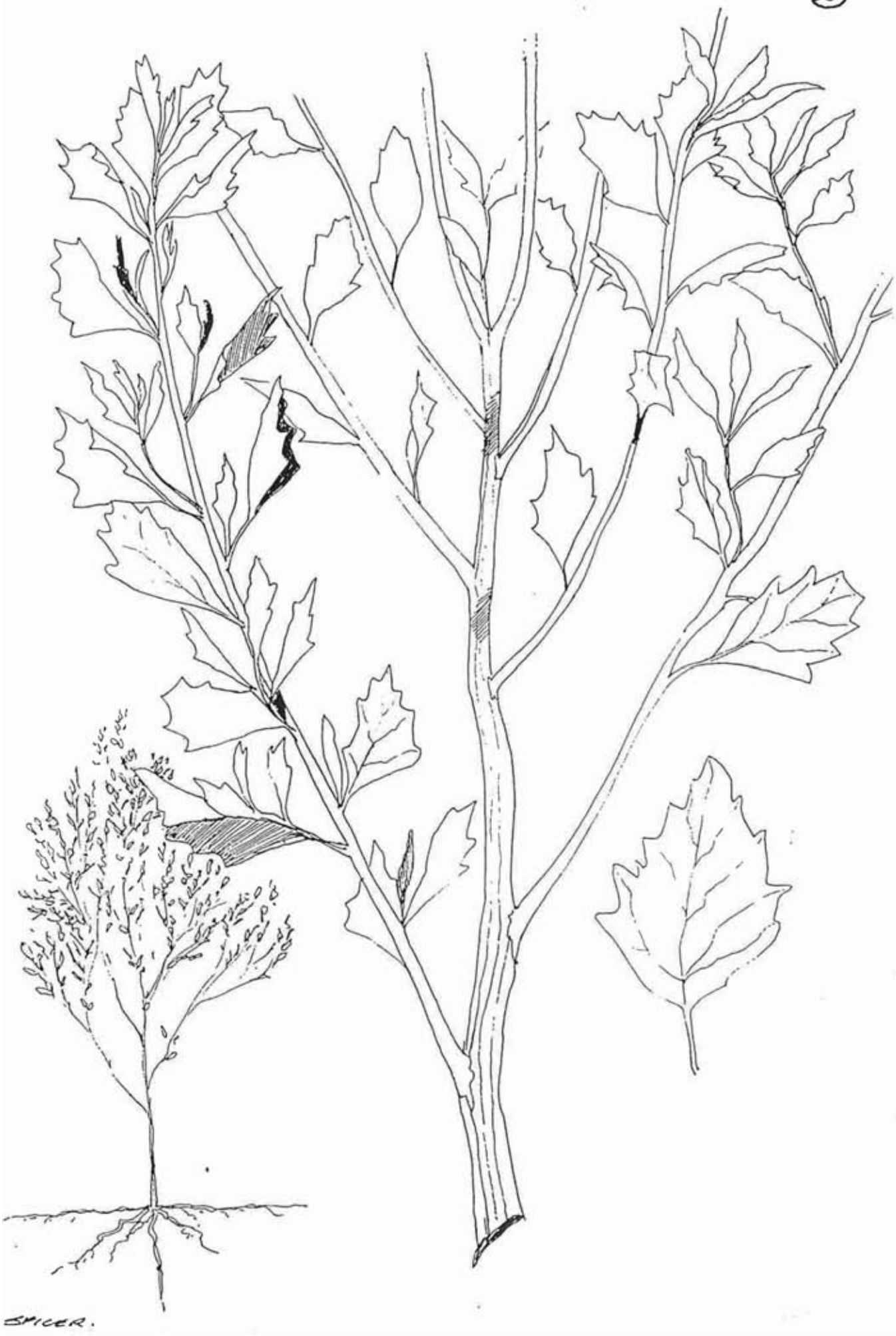
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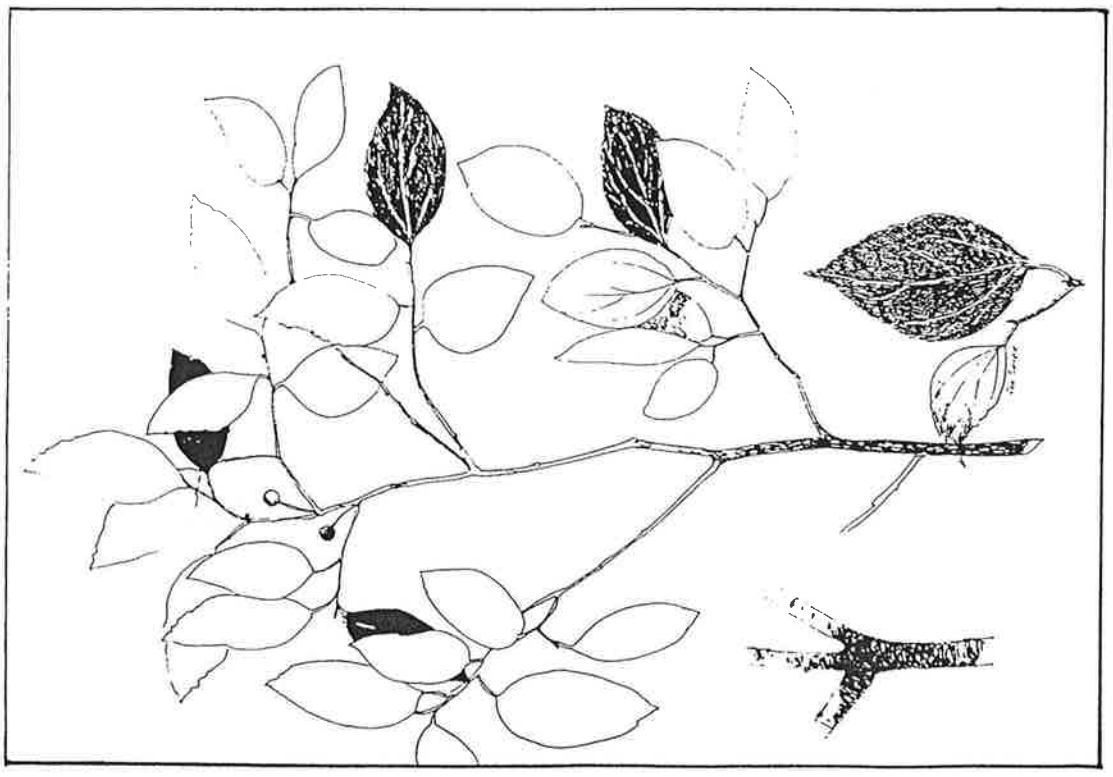


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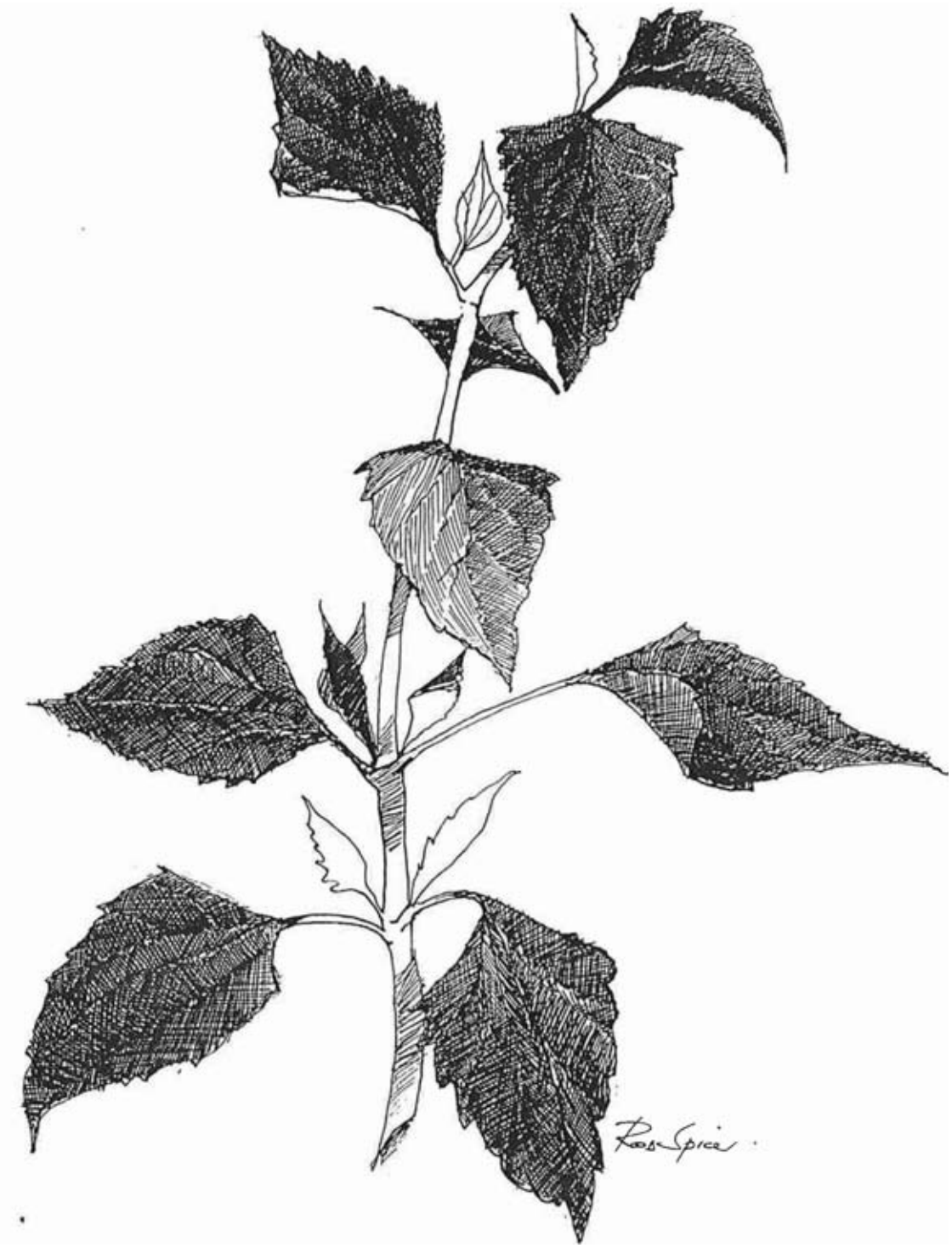
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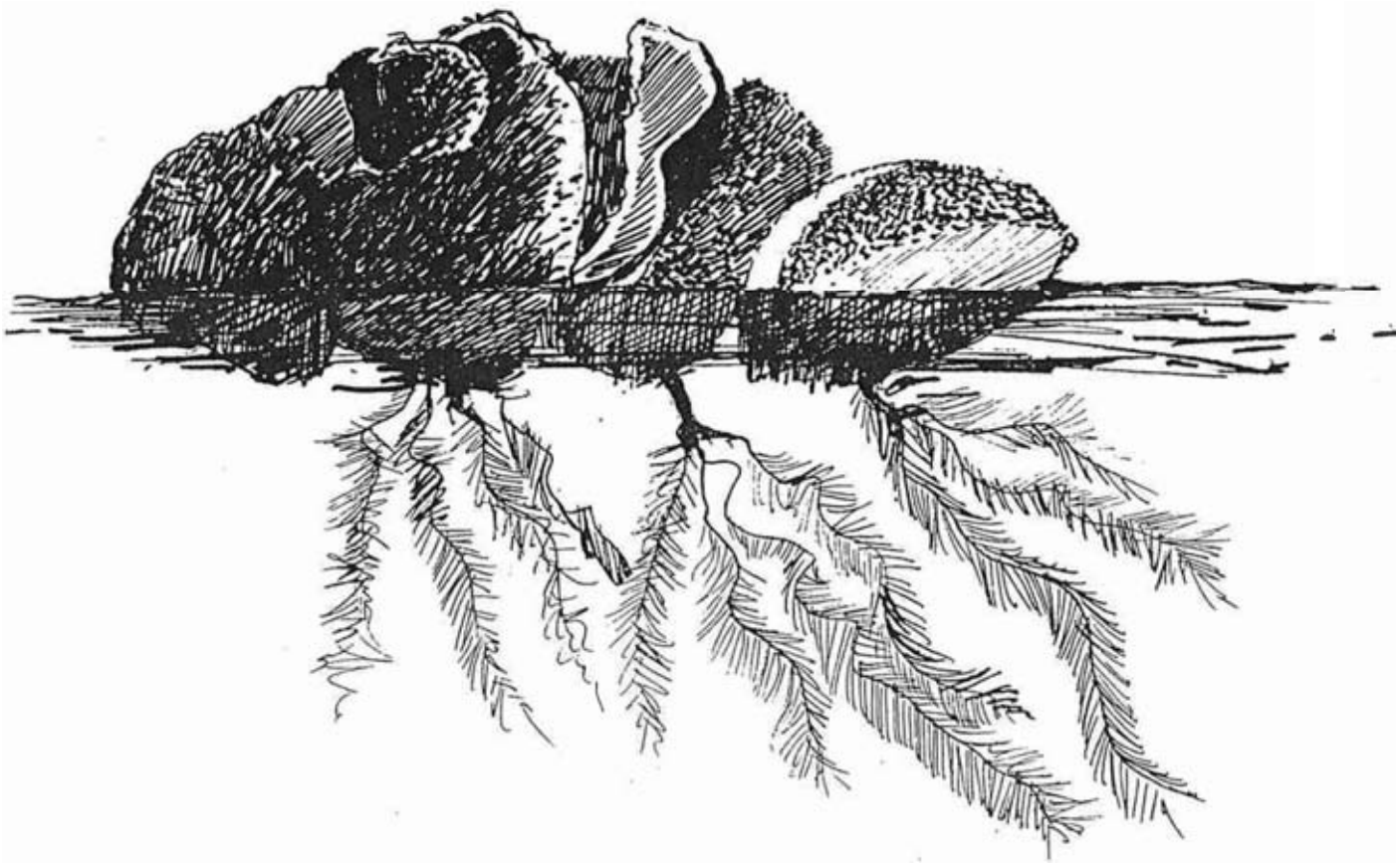

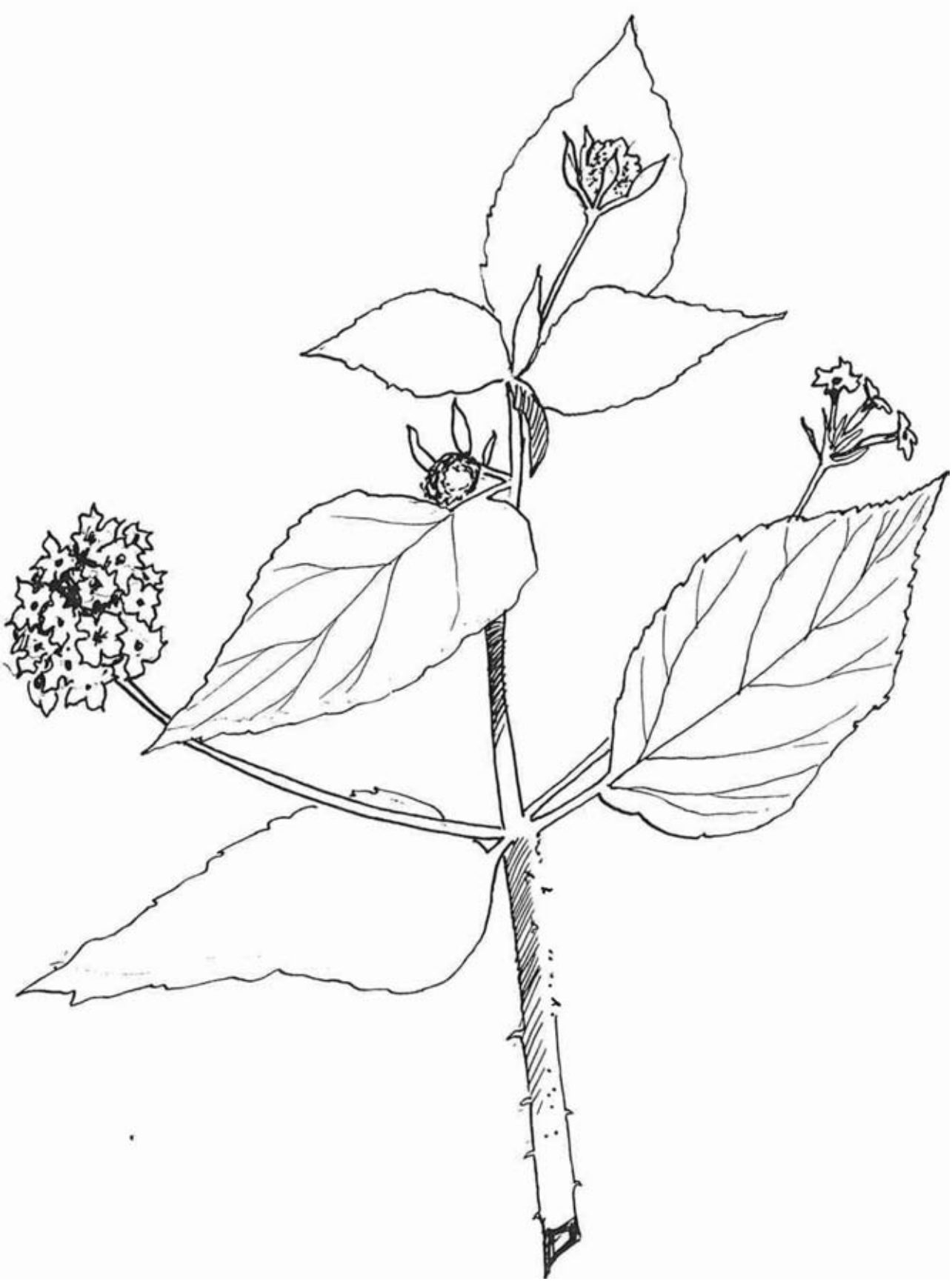

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