



**THE WEED SOCIETY  
OF NEW SOUTH WALES Inc.**

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**Seminar Papers**  
**ENVIRONMENTAL WEEDS**  
**Friday**  
**13 July 2007**  
Auditorium, Blaxland Centre  
Ryde School of TAFE  
SYDNEY

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NSW DEPARTMENT OF  
PRIMARY INDUSTRIES



Collated / Edited by  
Stephen Johnson

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THE WEED SOCIETY OF NEW SOUTH WALES Inc.

## Environmental weeds

### Research – Education – Legislation - Control

**Date:** Friday 13<sup>th</sup> July, 2007

**Location:** Auditorium, Blaxland Accommodation & Conference Centre, Ryde TAFE

<b>Time</b>	<b>Topic</b>	<b>Speaker</b>
8.00 – 8.45 am	<b>Registration/Morning Tea</b>	
8.45 – 9.00 am	<b>Welcome</b>	Stephen Johnson President Weed Society of NSW
9.00 – 10.00 am	<b>KEYNOTE ADDRESS The future of weed research nationally</b>	Rachel McFadyen CRC for Australian Weed Management
10.00 – 10.40 am	<b>Legislation to manage environmental weeds – Noxious Weeds Act</b>	Stephen Johnson DPI
	<b>Management of environmental weeds in NSW</b>	Andrew Leys DECC
10.40 – 11.20 am	<b>Weed training in NSW tertiary education</b>	Frank Gasparre Ryde TAFE
	<b>Training opportunities at tertiary level on environmental weeds</b>	Michelle Leishman Macquarie University
11.20 – 11.40 am	<b>Conserving biodiversity through threat abatement: turning theory into reality</b>	Paul Downey DECC
11.40 – 12.00 noon	<b>“What is driving weed expansion in western Sydney?”</b>	Tim Beshara Greening Australia
12.00 - 1.15 pm	<b>LUNCH</b>	
1.15 – 1.35 pm	<b>Southern rivers coastal land restoration (Bitou bush) project</b>	David Pomery Illawarra Noxious Weeds Authority and Kerry Thomson Shoalhaven City Council
1.35 – 1.55 pm	<b>Impacts of invader management regimes in coastal communities</b>	Tanya Mason University of Wollongong
1.55 – 2.15 pm	<b>Searching for potential future solutions for managing aquatic weeds</b>	Nimal Chandrasena GHD Sydney
2.15 – 3.15 pm	<b>KEYNOTE ADDRESS Weeds and climate change</b>	Tim Low Author and Consultant
3.15 – 3.30 pm	<b>Summation</b>	Warwick Felton Immediate Past President Weed Society of NSW



# ENVIRONMENTAL WEEDS

Research – Education – Legislation - Control

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## **WELCOME**

**Stephen Johnson**  
**President**

**Weed Society of New South Wales**

The Weed Society of New South Wales is a group of people interested in promoting a wider interest in weed management through education, cooperation and community liaison. With over 170 members, we see ourselves as the peak group in NSW representing weed professionals working in environmental, agricultural and social fields.

The society has a rich heritage being formed in 1966, the first weed society in Australia. It is now affiliated with similar societies in other states of Australia and in New Zealand, under the umbrella organisation of the Council of Australasian Weed Societies. The council coordinates a number of activities on a national basis, most notably, the biennial Australian Weeds Conference.

The Weed Society of New South Wales has a voluntary executive committee that meet six times each year to plan activities. It also circulates a quarterly newsletter "*A Good Weed*" to the members containing topical articles about weeds, details of functions and activities and abstracts from seminars. The Society supports education and training by sponsoring annual awards to students at the University of New England, University of Sydney and Charles Sturt University, and travel scholarships for successful applicants to attend conferences or to undertake a study tour.

This environmental weeds seminar is one of several functions and activities that the Society has convened or is involved with in 2006. An expert panel of speakers has been assembled to discuss a range of environmental weed research, legislation, education and control issues. I thank them for their participation in presenting and discussing information on these important issues. I trust all attending this seminar will benefit from the information presented and the following discussions.

I would like to thank the organising committee, Lawrie Greenup, Emilie-Jane Ens and Peter Harper for the time and effort they have generously given in organising this function and to other members of the executive who have assisted.





# THE FUTURE OF WEED RESEARCH NATIONALLY

**Rachel McFadyen, CEO  
Cooperative Research Centre for Australian Weed Management**

The year 2007 will be something of a watershed year for weed management in Australia. On the one hand, in the months preceding the national election there is already increased attention to responses to climate change and the impact of drought. The potential loss of key Senate seats to the Australian Greens is a threat to both main parties, and environmental policies will be seen as crucial. At the same time, the revised Australian Weed Strategy was approved in November last year, and a national Invasive Species Policy is being established under AusBIOSEC. National audits published in 2006 and 2007 (ABS farm survey; State of the Environment report; National Land & Water Resources Audit) have identified the high cost of weeds to agriculture and the environment, and data from these will continue to emerge.

On the other hand, the Weeds CRC which has been in existence since 1995 will finish in mid 2008, after which there will be no national coordinating body or representative voice for weeds research and delivery. The Federal Government Defeating the Weed Menace program also finishes in June 2008, and no announcement has yet been made regarding the future of the program. State governments continue to provide funds for weed management but research units are not well resourced and skills shortages and a tight labour market make it difficult to attract good people to short-term positions.

At the same time, there is increasing expenditure on weed management, by state and local governments as well as by bushcare and local environmental management groups, and this effort must be backed by good science. For example, expenditure on weed management needs to be prioritised against other NRM issues such as salinity and climate change, on a national as well as a regional scale. Yet prioritisation has to be based on good data on the impacts of weeds, both economic and environmental impacts, as well as potential impacts in a climate-change scenario. Furthermore, continued changes in agricultural systems, such as the adoption of no-till farming, GM crops, rising temperatures and changing rainfall and irrigation regimes, will all change the weed management scenario. There is a continuing need for nationally coordinated and strategic research to deal with these issues as well as with new and emerging weeds, none of which respect state or regional boundaries.

Numerous economic impact studies have demonstrated the excellent return-on-investment from money invested in weed management research. The 2007 Productivity Commission Report on public funding of science called for increased funding for 'public good' science, that is, research that benefits the economy as a whole and which results in public savings rather than private commercial profit. With a strong economy based on increasing budget surpluses from the resources boom, it is essential that governments provide adequate funding for the research required to inform policy and improve on-ground management of weeds in all environments.

## References

Australian Bureau of Statistics (2006). Natural Resource Management on Australian Farms. No. 4620. Australian Bureau of Statistics, Canberra.

Jones, R., Griffith, G. and Vere, D. (2006). An economic evaluation of the research benefits and returns on investment in the Invasive Plants Cooperative Research Centre. Technical Series No. 12. CRC for Australian Weed Management, Adelaide.

Page, A. R. and Lacey, K. L. (2006). Economic impact assessment of Australian weed biological control. Technical Series No. 10. CRC for Australian Weed Management, Adelaide.

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# LEGISLATION TO MANAGE ENVIRONMENTAL WEEDS

## THE NSW NOXIOUS WEEDS ACT 1993

Stephen Johnson  
NSW Department of Primary Industries  
Locked Bag 21 Orange NSW 2800

There are a number of legislative instruments that can be used to help manage environmental weeds in New South Wales (NSW). This paper discusses the *Noxious Weeds Act 1993* and how this Act can be used to reduce the negative impact of weeds in NSW. The paper also discusses how local government management plans are used to better implement on-ground management of Class 4 noxious weeds.

The most recent revisions of the *Noxious Weeds Act 1993*, implemented in late 2005, resulted in significant changes to the Act. In particular, the objectives of the Act and the control actions needed against specific classes of weeds were altered. As a candidate for noxious weed declaration, a plant must have a negative impact on the economy, community and/or environment of NSW, as well as a reasonable and enforceable means of control. The benefits and costs of declaration need to be carefully evaluated since they impose legal control requirements on the community.

The revised objectives of the Act have resulted in far more proactive management of all weeds, whether these weeds cause negative economic, environmental or social impacts. These objectives have been supported by five control classes aimed at preventing the establishment of new weeds, and restricting the spread of, or reducing the area of, existing weeds. Class 1 and 2 prohibited weeds are not present or have limited distribution in NSW, or regions of NSW respectively, and need to be eradicated from the land. Regionally controlled Class 3 weeds are not widely spread but are likely to spread further and need to be fully and continuously suppressed and destroyed. Locally controlled Class 4 weeds are widespread weeds, are likely to spread further, and need to be managed according to measures specified in a plan published by the Local Control Authority (LCA). A Class 4 plan enables a large amount of flexibility in management so long as the objectives of the class are not exceeded. Class 5 plants are restricted plants that are likely to spread within, or from NSW. Class 1, 2 and 5 weeds are notifiable which means, among many other requirements, that sale is prohibited. Explicit restrictions on sale also apply to some Class 3 and 4 weeds.

It is significant to note that all 20 Weeds of National Significance and 8 of the 28 National Environmental Alert list taxa are under direct legislative control across NSW (ranging from bans on sale to on the ground management programs). The declaration of a further 12 taxa of possible threat to NSW will be investigated in future. A large number of species that have negative impacts on economic and/or environmental areas are also declared.

The objective of a Class 4 weed declaration is “*to minimise the negative impact of those plants on the economy, community or environment of NSW*”. Class 4 weeds are generally widespread but have the potential to spread further and include common environmental weeds such as the blackberry, morning glory and the privet species, and lantana, bitou bush and boneseed (in areas where these weeds are not declared in a higher class). With the exception of Galvanised burr, the growth and spread of all Class 4 declared plants must be controlled according to the measures specified in a management plan published by the LCA.

Local government is responsible for the conduct and implementation of the *Noxious Weeds Act 1993*. The concept of Class 4 management plans arose out of recognition that, as

professional land managers, LCA staff should be responsible for planning and implementing the best on-ground management of such weeds according to local conditions. In many cases this simply formalised existing management plans, and has now provided the public with an opportunity to view these plans.

In a Class 4 management plan, an LCA can specify management that does not exceed the objectives and control measures for a Class 4 weed (Johnson and Lisle 2007; Sydney Weeds Committee 2007). A plan can be as specific or general as needed, include multiple species if required and be implemented on areas from a specific location through to a local government area, or to a regional basis (assuming cooperation between LCAs in developing and implementing the plans). One or a number of individual management practices can be directed in specific or general areas, for example hand pulling in environmentally sensitive areas, or for different age and size class weeds, for example the prevention of certain plants from flowering and setting seed.

The LCA is responsible for developing and reviewing these plans. Having said this, many LCAs would welcome the input of interested stakeholders in developing and refining such plans. Further details on the LCA management plans can be obtained by contacting relevant weeds or vegetation officers at the local council, and in a number of cases such information is available on the world wide web and Sydney Weeds Committee (2007).

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Johnson, S. and Lisle, S. (2007). Noxious Weeds. Class 4 management plans. Primefact No. 253. New South Wales Department of Primary Industries, Orange. 4 pp.

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# **MANAGEMENT OF ENVIRONMENTAL WEEDS IN NEW SOUTH WALES**

**Andrew Leys**  
**NSW Department of Environment and Climate Change**  
**PO Box 1967 Hurstville NSW 1481**

In New South Wales, introduced weeds and pest animals are the second greatest threat to biodiversity after land clearing. In addition, weed infestations can reduce the aesthetic appeal of our natural environment for public recreation and appreciation, and can invade neighbouring properties where they may reduce agricultural/horticultural production.

The complete eradication of weeds over wide areas of different land tenure is rarely practicable. It is therefore necessary to prioritise weed management efforts and allocate resources to those areas where control will be of greatest benefit. In NSW, weed management priorities for the conservation of biodiversity are identified in the Threatened Species Priorities Action Statement (PAS), in statewide threat abatement plans and in regional weed strategies.

In this presentation I will discuss the legislation, policies and planning instruments that relate to environmental weeds in New South Wales.



# **WEED TRAINING IN NSW TERTIARY EDUCATION**

**Frank Gasparre  
TAFE  
Ryde NSW**





# **TRAINING OPPORTUNITIES AT TERTIARY LEVEL ON ENVIRONMENTAL WEEDS**

**Michelle Leishman**  
**Department of Biological Sciences**  
**Macquarie University NSW 2109**

In this seminar I outline the potential pathways available for training on environmental weed issues in tertiary education institutions, focusing on NSW. At the undergraduate level, there are no study programs that focus on environmental weeds. Some universities offer individual units, such as the Integrated Weed Management unit that was developed through the CRC for Weed Management Systems and is offered at Charles Sturt University and the University of New England. This unit covers weeds of agricultural systems as well environmental weeds, and is offered through faculties that have been traditionally associated with weed science, such as agriculture and agronomy.

More commonly, undergraduate students doing Bachelors degrees in Science, Environmental Science, Environmental Management or Natural Resources will undertake units that may include individual lectures or practical classes on invasion biology, biocontrol or restoration ecology. However this is on a fairly ad-hoc basis and there is no coherent study focus on environmental weeds offered.

At the postgraduate coursework level, the situation is much the same as for undergraduate study. There is no named program in environmental weeds, but there are a few units in Masters of Environmental Science and Masters of Natural Resources courses that include lectures and practicals on environmental weeds. In other states there are more options available, for example University of Queensland offers postgraduate programs on Weed Science and Plant Protection, as well as short courses such as Tropical Weed Science and Biological Control of Tropical Weeds.

Postgraduate research training offers many more opportunities for students interested in environmental weeds. There are a number of active research laboratories that offer supervision for Masters and PhD students. I will give examples of the range of research areas available, including fundamental biology of particular weed species, development of environmental weed control and best practice restoration ecology, understanding the fundamental processes of invasion biology, effects of environmental weeds on biodiversity and likely responses of environmental weeds to climate change.



# **CONSERVING BIODIVERSITY THROUGH THREAT ABATEMENT: TURNING THEORY INTO REALITY**

**Paul Downey**  
**NSW Department of Environment and Climate Change**  
**PO Box 1967 Hurstville NSW 1481**

The recognition that alien plants are a major cause of biodiversity loss has not led to a greater understanding of which species are at risk, or the development of on-ground conservation management strategies. To turn the theory of biodiversity loss due to alien plant invasions into an on-ground management reality, an 11-step process was developed using the alien shrub *Chrysanthemoides monilifera* (L.) Norl. Several new processes were needed to achieve these 11 steps, for example, the Weed Impacts to Native Species assessment tool was developed to assess the biodiversity at risk. This led to a significant increase in the number of the native plant species known to be at risk (from six to 160+). Sites were then assessed based on the alien plant and the biodiversity at risk, which led to 169 priority sites for control. Coordinated implementation and monitoring are crucial steps to ensure that all the stakeholders (government and community) are undertaking control in a manner that ensures conservation outcomes are achieved and reported. While this process is gaining wide acceptance in Australia, it requires considerable resources and commitment both in the planning and implementation phases (i.e. all 11 steps). Irrespective, the benefits to date have outweighed the costs, resulting from a better understanding of impacts, longer term commitment to restoring sites, wide community support and significant new funds. These 11 steps could be applied to abate other threats to biodiversity.



## **“WHAT IS DRIVING WEED EXPANSION IN WESTERN SYDNEY?”**

**Tim Beshara, Project Manager  
Greening Australia**

Sydney's urban frontier has expanded greatly over the last few decades into the largely agricultural Cumberland Plain. This urban growth has had unexpected consequences for biodiversity well beyond the loss of habitat and urban edge effects. Many weed species, including those introduced by Macarthur, were minor nuisances until recently when their range has undergone a massive range expansion. I will argue that historic land management practices limited the spread of these weeds. The massive urban growth has led to property speculation and land banking beyond the urban fringe. Private property, instead of being sustainably managed (or at least managed to maximise productivity) now lies dormant or under managed waiting for future development. Controlling weeds in the paddock is no longer central to maintaining the productive value of land in western Sydney. Generational change and a loss of weed management skills in the agricultural sector have also contributed. The upshot of this is that large areas of land previously resilient to weed invasion are now prone to infestation.

Public land management has also contributed to an expanding weed problem. In western Sydney 11 different state government agencies, multiple local councils and two federal government agencies own large tracts of land. Land management standards vary greatly between agencies. Tracts of land are often left either unmanaged or under managed. The focus of the landowner is the maintenance of facilities or utilities on the land rather than the land itself. Short-term agistment is often used as a stopgap measure for the management of surplus land. With this approach there is no long-term incentive for the agister to bear the cost to manage weeds and thus weeds are allowed to proliferate.

African olive is perhaps the weed that has most taken advantage of this relaxation of land management. It now covers 4,000 hectares and outside of land clearing is perhaps the greatest threat to Cumberland Plain Woodland. The relaxation in land management has allowed the African olive to expand to levels where the landscape ecology of the Cumberland Plain has shifted. These large infestations now support a permanent guild of frugivorous birds. In the past these bird guilds were present in small populations in the pockets of Western Sydney Dry Rainforest on the Razorback (which is unsurprisingly where the olive population first established). As the olive population has grown a greater population of frugivores is supported. A larger population of frugivores has promoted a more rapid expansion the African olive infestations. This is analogous to the spread of privet by currawongs in Sydney's sandstone gullies. Unlike the privet problem, the spread of African olive is not restricted just to the degraded gullies, and the majority of Endangered Ecological Communities and a range of land uses are potentially affected.



## **SOUTHERN RIVERS COASTAL LAND RESTORATION (BITOU BUSH) PROJECT**

**David Pomery  
Illawarra District Noxious Weeds Authority  
PO Box 148 Kiama NSW 2533  
and Kerry Thompson**

Bitou Bush is a serious weed of conservation areas in coastal SE Australia, restricting access to beaches and destroying native bushland. It is recognised as one of the 12 most invasive environmental weeds in Australia, one of twenty Weeds of National Significance and a Key Threatening Process under the *Threatened Species Conservation Act 1995*.

The distribution of Bitou Bush is estimated to be almost 10,000 hectares from Wollongong to the Victorian border. With funding of \$490,000.00 received through the Natural Heritage Trust (NHT) provided by the Southern Rivers Catchment Management Authority (SRCMA), the *Southern Rivers Coastal Land Restoration Program* is a four year initiative that commenced in April 2004. Approximately 650 ha of Bitou Bush has been controlled with NHT funds which includes initial and follow-up control, over 4,000 trees planted and 35 ha of degraded coastal landscape revegetated.

In undertaking this work, the project extends control efforts of agencies and community volunteers currently in progress throughout the region, as well as complimenting adjoining landholders in a collective program.

The Illawarra District Noxious Weeds Authority is managing the project on behalf of the SRCMA in partnership with Landcare Illawarra, NSW Department of Corrective Services, and Wollongong, Shellharbour, Shoalhaven City, Eurobodalla and Bega Valley Shire Councils.

The Illawarra area utilises the services of Community Service Order clients whilst in the Shoalhaven, Eurobodalla and Bega areas and bush regeneration contractors are employed for major control works. Community volunteers are also an integral component of on-ground works contributing significantly to Bitou Bush control and revegetation works.

The project is a prime example of forging strong partnerships between people from many agencies and different facets of the community, who are all focused on combating a serious weed invasion whilst aiming to attain long-term biodiversity outcomes throughout our coastal zone.





# IMPACTS OF INVADER MANAGEMENT REGIMES IN COASTAL COMMUNITIES

Tanya Mason, Associate Research Fellow  
School of Biological Sciences, University of Wollongong

Plant invasions threaten biodiversity conservation and increasing management effort is required to restrict the impacts of these invaders. However, management itself results in disturbance and the compounding effects of both invasion and management on biodiversity must be considered in conservation planning. I explored the effects of both plant invasion and management disturbance in coastal dune communities of New South Wales invaded by the South African shrub bitou bush (*Chrysanthemoides monilifera* ssp. *rotundata*) (Mason and French 2007). I investigated whether management practices restore original, or create new coastal communities. In fore dune communities, I compared the effects of intensive, manually-based invader control (e.g. cut and paint and hand weeding techniques) with those of extensive control (mainly herbicide spraying from aircraft). I also examined one management regime, which was typically intensive, in hind dune communities. I found that extensive management created communities that diverged from non-invaded sites while intensive management achieved communities which approached non-invaded conditions. However, intensively managed sites were also richer in other exotic species than extensively managed sites. So, while intensive management better conserved native biodiversity, it also facilitated secondary invasion by exotic species that could potentially replace the original invader.

In hind dune communities, managed sites had significantly higher exotic species richness and different species compositions compared with non-invaded sites.

In addition to standing vegetation dynamics, I also investigated soil-stored seed banks affected by bitou bush invasion and management (Mason *et al.* 2007). I found low similarity between the standing vegetation and seed banks at all sites and this indicated that seed banks cannot be relied upon for complete dune restoration. Management of bitou bush in the standing vegetation reduced the density of bitou bush seeds in the soil, but it did not reduce the number of other exotic species. Both managed and bitou-invaded sites had significantly fewer native tree species than non-invaded sites.

In conclusion, management practices which reduce invader biomass are not a stand-alone cure for the invasion malaise. A number of native species become less abundant or disappear from dune communities as a result of both bitou bush invasion and management processes. Reintroduction of native species either through replanting or reseeded activities must complement control efforts. Further, plant community responses are dependent on the type of management and on the resident community.

## References

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Mason, T. J., French, K. and Russell, K. G. (2007). Moderate impacts of plant invasion and management regimes in coastal hind dune seed banks. *Biological Conservation* **134**: 428-439.



## SEARCHING FOR POTENTIAL FUTURE SOLUTIONS FOR MANAGING AQUATIC WEEDS

Nimal Chandrasena Principal Ecologist  
Sydney, GHD Pty Ltd

The main aquatic weeds posing challenges in NSW include floating, submerged, emergent and shoreline species. These are:

- Floating - Salvinia (*Salvinia molesta*), Water Hyacinth (*Eichhornia crassipes*), Azolla (*Azolla pinnata*) and Water Lettuce (*Pistia stratiotes*);
- Submerged - Cabomba (*Cabomba caroliniana*), Egeria (*Egeria densa*), and Hornwort (*Ceratophyllum demersum*);
- Emergent and shoreline species - Alligator Weed (*Alternanthera philoxeroides*), Milfoil (*Myriophyllum aquaticum*), Mexican Water Lily (*Nymphaea mexicana*), Primrose Willows (*Ludwigia peruviana* and *L. longifolia*) and Hygrophila (*Hygrophila costata*).

Collectively, these have significant ‘triple-bottom-line’ impacts, which are environmental (reducing biodiversity), economic (annual, recurrent costs of control), and social (reduced aesthetic values and recreational opportunities associated with water bodies and waterways). ‘Strategy’ is defined as a plan to achieve a particular long-term outcome. It involves *direct action*, as well as *indirect action*. Being strategic is essential in managing weeds, and aquatic weeds are no exception. Some *key principles* which underpin a strategic approach include:

- Planning and rationalising management needs and actions-includes acting locally while thinking more upstream (sources of weeds) and downstream (impacts of control action);
- Coordination of actions across catchments (inter-agency co-operation);
- Prevention of entry, early detection of infestations and eliminating the problem;
- Integrating control methods (manual, mechanical, chemical, biological and cultural);
- Training and education - Community, industry (i.e. aquarium, nursery, shipping) and stakeholder education and training (weed officers, inspectors and contractors); and
- A commitment to long-term ecosystem management.

Below are some of the major *challenges* for strategic aquatic weed management with some thinking prompts:

- (1) Balancing the social and economic needs with environmental needs (for instance, could or should we wait until a new ‘equilibrium’ is established after ecosystem disturbance? Are all aquatic weeds/plants to be deemed equally ‘bad’?)
- (2) Cost-effective control (herbicides are the least expensive option), integrating the limited number of methods available (reducing water clarity will reduce submerged species);
- (3) More effective and safe methods of control, minimising potential adverse environmental impacts of recurrent control action on waterways (reducing reliance on herbicides; increasing the effectiveness of existing biological control agents and searching for newer ones);
- (4) Preventing the wider spread of existing infestations into un-infested areas (requires increased allocation of resources for implementing weed management plans); and
- (5) Continuing global spread of non-indigenous plants (many more potentially problematic species are likely to enter Australia through global trade and transport).

## Search for more effective solutions

### Broader Ecosystem Management

Aquatic weed management has to commence as ecosystem management within a given watershed catchment. Understanding the connectivity between ecosystem components (water clarity, nutrients, grazing fish, aquatic plants) is important for successful interventions. Management focus must change to reducing factors (human disturbances) that cause plant invasions. Intervention planning must address: (a) human-caused inoculum spread, (b) factors controlling plant establishment (such as increased nutrients in waterways, lack of competitive natives, availability of new 'space' to capture, and lack of natural enemies).

### Eliminating the Problem- Weed Hygiene

Preventing entry through increased surveillance and good 'weed hygiene', early detection and elimination are all the more important with aquatic weeds than with some other weeds, because after an initial entry, the vehicle of spread is often water (floods and stormwater flows). Increased resources for weed scouting and training for plant identification are essential.

### Integration of Control Methods

Any opportunity for integration of control methods must be adopted. This may range from (a) scouting and manual removal of small (floating) infestations, (b) use of physical barriers to arrest spread via stormwater; (c) detention basins and wetlands to mitigate nutrient flow from catchments; and (d) creek and riparian zone rehabilitation with competitive natives.

### Herbicides

In my view, some areas to focus future R&D are the following:

**Effective treatment 'regimes'** - For Alligator Weed management, this would include:

- Timing and frequency of multiple treatments, split-applications;
- 'Site-specific' treatments, targeting a desired management outcome (i.e. eradication of small infestations; containment of larger infestations).

**Other herbicides**- To increase options for managing Alligator Weed and other riparian weeds, more R&D is needed on 2,4-D Amine and Triclopyr 3A - both have US aquatic registration.

**Use of Additives** - This includes:

- Use of biodegradable additives to increase spray retention, cuticular penetration, and overall foliar uptake (e.g. vegetable oils, polymeric alcohols, starch-like additives); and
- Ammonium salts to prevent Glyphosate inactivation by 'hard' water and increase uptake.
- Possibility of incorporating a commercially available hormone (such as Na salt of 2,4-D at 500 ppm; 1-Naphthyl Acetic Acid, NAA or Amino ethoxy vinyl glycine, AVG at 100-250 ppb) into herbicide treatments, to prevent disintegration of patches.

**Special delivery techniques**- More R&D is needed on several emerging techniques for aquatic treatments, including the use of Diquat-gel (Hydrogel<sup>®</sup>) for submerged weeds.

**Integration with bio-control agents**- Possibilities are (a) Leaving untreated areas as 'refuges' for over-wintering; (b) Making Alligator Weed more 'palatable' for *Agasicles* with a very low dose, sub-lethal herbicide treatment.

### Biological Control Agents

The search continues for novel biological control agents for Alligator Weed, Cabomba and others. The speed of progress, as well as eventual cases of developing successful agents will depend on: (a) the amount and quality of the resources allocated, and (b) continuing funding commitment for seeking long-term solutions.

# WEEDS AND CLIMATE CHANGE

**Tim Low**  
**Environmental consultant**

A much weedier world can be anticipated under climate change. Environmental weeds should benefit from the following aspects of climate change.

1. **More Extreme Events.** Under a changing climate we can expect more floods, cyclones, fires and droughts (Intergovernmental Panel on Climate Change 2007). Extreme events benefit weeds by stressing or destroying competing native vegetation, and often by providing a pulse of nutrients. Flammable pasture grasses will benefit especially from more fire, and weedy vines from more violent storms.
2. **Changing Temperatures and Rainfall.** Climate change will leave many plants unsuited to new climates. The hope is that native plants will track climate change by dispersing across southwards or upslope. But weeds are often more effective than native plants at dispersal, in part because they are often transported unintentionally by people (Sutherst *et al.* 2007).
3. **Nursery Trends.** As the climate changes, nurseries will introduce new stock better adapted to the new conditions (CRC for Weed Management 2007), thereby enlarging the pool of potential weeds, and ensuring that garden plants are well matched for the prevailing climate.
4. **Carbon Dioxide Fertilisation.** Fast-growing plants tend to benefit more from carbon dioxide fertilisation than slow-growing plants (Poorter and Navas 2003). Weeds often grow faster than the native plants they replace.
5. **Reduced Effectiveness of Biocontrol Agents.** Plants fertilised by carbon dioxide usually produce tougher leaves, with more toxins and lignin and a lower nitrogen content, rendering them less palatable to herbivores (Bezemer and Jones 1998; Coviella and Trumble 1999; Johns *et al.* 2003). Some, but not all, biocontrol agents will become less effective.
6. **Reduced Glyphosate Effectiveness.** Glyphosate, the main chemical used to control weeds in Australia, will lose some effectiveness, as judging by recent experiments (Ziska *et al.* 2004; Ziska and Goins 2006).

When Australians ask, 'What can I do about climate change?', part of the answer should be: 'Remove weedy plants from your garden and local bushland'.

These conclusions are adapted from a report I wrote for the Australian Department of Environment and Water Resources, after running a workshop in November 2006 about climate change and invasive species, as a member of the Biological Diversity Advisory Committee (which advises the Minister for the Environment and Water about conservation policy).

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## **THE KEYNOTE SPEAKERS**

**Rachel McFadyen**  
**Chief Executive Officer**  
**Cooperative Research Centre for Australian Weed Management**

Rachel McFadyen is the Chief Executive Officer of the Cooperative Research Centre for Australian Weed Management. The Weeds CRC has scientists across the nation and Rachel, though based in Brisbane, spends much of her time travelling. Rachel's background is in biological control of weeds of the tropics and sub-tropics, and she has worked on parthenium weed and annual ragweed among others.

**Tim Low**  
**Environmental Consultant and Author**

Tim Low is a well known biologist, environmentalist, writer and photographer. Three of his books have won national awards. "Feral Future : The Untold Story of Australia's Exotic Invaders" (1999), inspired the formation of a new conservation group, the Invasive Species Council, the first of its kind in the world, and led to invitations to speak in Hawaii, Mexico, South Africa and all over Australia. Tim travels widely around Australia and overseas, as an environmental consultant.

## **THE SEMINAR'S CHAIRPERSONS**

**Stephen Johnson**  
**President, Weed Society of New South Wales**

Stephen has been a member of the Society for around 10 years and on the executive for five years.

He is a Weed Ecologist and works for the NSW Department of Primary Industries at Head Office in Orange. In this role he provides technical and scientific advice on the ecology and management of noxious weed species, and conducts weed risk assessments.

Aside from nearly nine years experience as a research (weed) scientist in irrigated cropping systems, Stephen has both research and life experience in crop agronomy and pasture management in high and low rainfall zones, and in dryland cropping. Stephen trained as a botanist and plant ecologist, and has spent six months working in Wageningen in the Netherlands developing models to predict herbicide resistance.

**Jim Swain**  
**Treasurer, Weed Society of New South Wales**

Jim worked in the agricultural chemical industry until retiring from Ciba-Geigy in 1997 as the Research and Development Manager. Since that time he worked as a part time consultant working on a number of projects for the crop protection industry.

He has been actively involved with the Weeds Society of NSW for many years serving as a committee member, as President for the period 1978 to 1980, Secretary from 2002 to 2005 and is currently the Treasurer.

He is a board member of the Australian Institute of Agricultural Science and Technology (AIAST) where he is the chair of the National Accreditation and Personal Development Program committee.

Jim is a Life Member of Croplife Australia, a Fellow of the Australian Institute of Agricultural Science and Technology and a Council of Australasian Weed Societies medalist.

**Mike Barrett**  
**Public Officer, Weed Society of New South Wales**

Mike joined the Society in 1970 and has served on the committee for a number of years, holding the executive positions of President (1975 to 1976) and Public Officer. On a National scene he has acted as Secretary/Treasurer for the Australasian Council of Weed Societies and was on the organising committee for the 1979 Asian Pacific Weed Conference

Mike worked for ICI Rural Division for over 20 years and was involved in a number of research and development projects, including aerial application of herbicides, infra-red photography, sod-seeding, weed control in lucerne and in the NSW state rail system.

Over the last few years he has been actively running his consultancy business working mainly in the area of Plant Breeders Rights (PBR), chemical training and horticultural consulting.

**Warwick Felton**  
**Immediate Past President, Weed Society of New South Wales**

Warwick has been a member of the Society for over 30 years and on the executive for over 20 years serving as President in 1987, 1988, 2005 and 2006.

He was a Senior Research Scientist with the NSW Department of Agriculture (NSW DPI) working at Agricultural Research Centre Tamworth in the areas of crop agronomy, no-tillage farming systems, weed management, and herbicide application technology. Warwick spent 40 years in research and retired recently.

Warwick has received numerous awards in recognition of his contribution to weed science including AgQuip Land Inventor in 1991, Brownhill Cup in 1991 for contributions to Conservation Farming, Council of Australasian Weed Societies medalist in 1992, Excellence in Engineering Awards in 1992 and 1993 and the NSW Agriculture Staff Award in 1998.

Currently, Warwick is a member of the Advisory Board for the Faculty of Agronomy and Soil Science at the University of New England.





**THE WEED SOCIETY  
OF NEW SOUTH WALES Inc.**

*A society promoting the awareness and understanding  
of weeds and their management.*

### ***Aims and Objectives***

- To promote a wider interest in weeds and their management.
- To exchange information and ideas.
- To encourage the investigation and study of weeds and weeds management.
- To represent members' interests at State and National levels through appropriate organisations.
- To produce and publish relevant information on weeds.

### ***Activities and Projects***

- Quarterly newsletter "A Good Weed"
- Seminars and meetings with guest speakers
- Funding of travel grants
- Student prizes
- Displays and field days
- Co-operation with Weedbuster Week
- Member of Council of Australasian Weed Societies

### ***For further information contact:***

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## ACKNOWLEDGMENTS

### **Seminar Organising Committee**

*Lawrie Greenup*

*Emilie Ens*

*Peter Harper*

### **Coordination - power point presentations**

*John Cameron and Erica McKay*

### **Welcome to speakers and delegates**

*Stephen Johnson (President)*

### **Summary of the day's presentations**

*Warwick Felton*

### **Collation and preparation of proceedings**

*Stephen Johnson*

*The committee thanks all who took part and attended the seminar and particularly the speakers for their presentations and supply of written documents for these proceedings.*



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