REVIEW OF PROGRESS TOWARDS THE NATIONAL WILLOWS STRATEGIC PLAN

(2006 – 2007)

Prepared by: Sarah Holland Clift
National Willows Coordinator

PO Box 103 Geelong VIC 3220
Ph: (03) 5226 4831
Email: Sarah.Holland-Clift@dpi.vic.gov.au

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EXECUTIVE SUMMARY

This report outlines progress made in 2006-2007 towards the National Willows Strategic Plan. In 1999, willows (except *S. babylonica*, *S.* x *calodendron* and *S.* x *reichardtii*) were listed as one of Australia's 20 Weeds of National Significance (WoNS), due to their highly invasive nature and impacts on stream and wetland hydrology and biodiversity. Although willows are listed as one of the 20 WoNS, there are in fact more than 30 naturalised willow taxa in Australia. As willows can spread long distances by seed across regions and States, national coordination is proving critical to ensure that management is effectively coordinated between areas.

Outcomes achieved to date are the result of a range of actions undertaken over the past 2.5 years and have been made possible through substantial support from the Australian Government, seven state and territory governments, regional NRM bodies, community groups, research organisations and local governments across Australia.

Stopping the spread of willows

The early detection of new willow outbreaks was significantly improved through increasing the knowledge and skills of over 570 willow managers; enhancing willow practitioner networks on a national and regional level; creating and updating regional willow distribution maps; and conducting a detailed weed risk assessment of all willows in Australia. New populations of highly invasive seeding willows were discovered in northern New South Wales, Perth and throughout South Australia. Seeding willows are under targeted eradication programs in Tasmania, the ACT, and parts of Victoria, New South Wales and South Australia. The mapping and weed risk assessment results will provide critical information for stopping future spread and setting strategic, long term priorities for willow management in Australia.

Managing existing areas

Willow management has been improved through sharing knowledge and refining best practice management techniques; developing complementary research projects focussed on management outcomes; increasing collaboration amongst researchers; and improving communication of this research to on ground managers through the National Willows Research Forum. Major control programs are underway in six regions of Victoria and eight regions of NSW, with a focus on rehabilitation of streams and wetlands. Smaller control programs are being conducted across Tasmania, northern NSW, central and western Victoria, eastern South Australia and in the ACT.

Gaining community support in managing the willow problem

Community understanding of and support in managing the willow problem has increased through running training and awareness workshops in all willow affected regions across Australia and through the development of the 'Willows: friend or foe' brochure and National Willows Resource Kit. Workshops were held across 36 Natural Resource Management regions in 7 States and Territories and attended by over 600 people.

Enormous momentum has been gained and our understanding of the complex nature of willows and their management is building. Detailed evaluation of key projects has demonstrated that clear outcomes are being achieved. However, there is also still significant work that needs to be conducted to achieve the three goals in the national strategy. It is important that the program continues to grow and adapt to ensure sound, long-term, on-ground outcomes continue to be achieved.

INTRODUCTION

This report outlines progress made in 2006-2007 towards the vision in the National Willows Strategic Plan: To stop willows destroying our waterways and wetlands. Outcomes achieved to date are the result of a range of actions undertaken over the past 2.5 years. The outcomes presented in this report are based on detailed evaluation conducted over the past 12 months on the activities undertaken.

History and impact of willows in Australia

Willows (*Salix* spp.) are among the most serious riparian and wetland weeds in temperate Australia. They infest thousands of kilometres of waterways and cause substantial economic and environmental impacts including reduced water quality and availability, increased erosion and flooding, reduced aquatic and riparian biodiversity and obstructed access to streams for fishing and aquatic sports. Willows have the potential to invade waterways, drainage lines, wetlands and other moist areas in all States and Territories. The largest infestations currently occur in NSW, the ACT, Victoria and Tasmania, with smaller infestations in South Australia, Western Australia and Queensland.

Willows were originally introduced to Australia from Europe, Asia, North America and South America for basket making, cricket bat production, stream stabilisation, ornaments and shelter. Over 100 species, subspecies, varieties, cultivars and hybrids (all generically referred to as taxa) have been introduced and, of these, more than 30 have become naturalised in Australia.

Willows can spread by seed or branches. Some willows can spread by seed up to 100 kilometres, highlighting the need for coordinated action across regions and States. The spread of some willows may appear slow for many years, but given the right conditions, just a few adult willows could produce thousands of seedlings in just one season. Almost all willow taxa are capable of hybridising with one or more other taxa if they flower at the same time and fertile male and female plants grow near enough for pollination to occur. While some resulting hybrids may not flourish, some have become apparently more invasive than their parents and there is the potential for strains to develop that are even better adapted to local conditions within Australia.

A national solution

In 1999, willows (except *S. babylonica*, *S.* x *calodendron* and *S.* x *reichardtii*) were listed as one of Australia's 20 Weeds of National Significance (WoNS). To help guide national coordination, the National Willows Strategic Plan was developed (ARMCANZ, ANZECC and FM 2001). This plan aims to deliver the following primary outcomes:

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

A National Willows Coordinator was appointed in April 2005 and the National Willows Taskforce (see Appendix 4) established in August 2005 in order to facilitate implementation of the Strategic Plan.

Progress to date has been made possible through substantial support from the Australian Government, seven state and territory governments, regional NRM bodies, community groups, research organisations and local governments across Australia.

Of particular note, significant contributions to ensuring a nationally coordinated approach is achieved have been made by the Australian Government (via the Defeating the Weeds Menace Program), the Victorian Department of Sustainability and Environment, Melbourne Water and several Victorian Catchment Management Authorities.

Progress to date

Between 2001 and 2005, some progress was made at regional levels, particularly in areas where serious infestations occur. The establishment of a National Coordinator and National Willows Taskforce in 2005, however, has seen a major increase in coordination between regions and States/Territories in managing the willow issue.

From 2005 to 2006, the National Willows Coordinator and Taskforce focused on reviewing progress that had been made to date, building effective partnerships and networks across Australia, identifying research, communications and on-ground management priorities and initiating major projects needed to address these priorities. The following major projects were initiated:

- Mapping and weed risk assessment of all willows across Australia, in order to better understand the invasiveness, impacts and present and potential distribution of different willow taxa and set more effective priorities for management at regional, statewide and national scales
- Various research projects, including a survey of insects and pathogens associated with willows in Australia; development of strategies for the biological control of willows; understanding the implications for management of the willow sawfly (an insect that has accidentally arrived to Australia and is causing significant damage to some willows); and genetic analysis of willow dispersal in Australia.
- Determining current best practice management of willows and developing a national management manual
- Eradication of seeding willows in Tasmania and development of a regional willow management plan for the Upper Murrumbidgee Catchment in New South Wales.

Some of the immediate outcomes of this work have now become evident this past year and will be discussed further in the body of this report.

In 2005, Victoria, Western Australia and the Northern Territory joined the other five States and Territories in declaring willows as noxious weeds (the current legislative status of willows can be found at www.weeds.org.au/WoNS/Willows). In addition, protocols for managing commercial cricket bat willow plantations under permit were established in Tasmania (by Department of Primary Industries and Water) and New South Wales (by Department of Primary Industries).

GOALS AND ACHIEVEMENTS IN 2006/2007

Goal 1: Stop the spread of willows

Desired outcome: The spread of willows is halted

Key outcomes of 2006/2007:

1. Improving our understanding of the potential threat of willows (including non-naturalised cultivated willows) and where to focus management through mapping their known extent and conducting a detailed weed risk assessment to identify high risk species
2. Increasing engagement of the Nursery and Garden Industry through their active involvement in the weed risk assessment of willows
3. Increasing the awareness, aspirations and skills of more than 600 people across Australia through a series of training workshops and resource materials
4. Improving our understanding and raising awareness of the potential threat of willows in outlying States (QLD and WA)
5. Continued development and implementation of regional and statewide extension and eradication programs
6. No records of willows being imported to Australia in the past two years.

Future activities required:

The following activities have been identified by the National Willows Taskforce as still being required to fully achieve this goal. A proposed time frame for the completion of each activity has also been given.

- Short term (by December 2007): Refine willow mapping data through on ground mapping of strategic areas, finalise weed risk assessment and provide clear recommendations to each State or Territory based on the outcomes of this work. Develop implementation or monitoring protocols as part of these recommendations. Complete and promote national management guide.
- Medium term (by December 2008): Investigate ratings or prioritisation systems that have been used for other weeds and workshop an appropriate system for willows. Ensure weed risk assessment results are recognized by all affected regions. Based on weed risk assessment results, determine any changes required in the national policy on importation and continue to monitor if any willows are allowed import into Australia.
- Long term (next 2-5 years): All States to implement the recommendations made in the weed risk assessment report, including making relevant changes to legislation. Develop an inventory of all willow collections (including cricket bat plantations) and establish protocols for the appropriate management of these. Develop an ongoing, targeted training package for early detection and rapid response to new willow threats. If required, develop a submission to AQIS to effect changes in the national policy on importation of willows.
- Ongoing: Continue to raise awareness of willows through the promotion of current resource materials and the development of new materials that target priority species and areas (including willow free areas) and emphasise the alternatives to willows. Continue active engagement with regional bodies in effective willow management.

Emerging issues:
Willows have always been a controversial weed to manage, given their range of values and the short term effects of removing them. A number of issues have recently emerged that threatens some of the work achieved towards the national strategy to date. This will require some significant attention to ensure that a balanced viewpoint is put forward and that adequate information is available to respond to these issues. These issues include promotion of the continued planting and use of willows:

→ for riparian rehabilitation by advocates of the natural sequence farming technique (Andrews, 2006). This approach promotes the values of willows, but neglects the willow invasion process and their ability to so readily spread to other areas by seed and vegetative means. It also neglects the large amount of scientific evidence that has accumulated on the negative impacts of willows on riparian and aquatic environments in Australia.

→ as a potential fuel and energy source or 'biofuel' (Low and Booth 2007). Willows are attracting great interest as biofuels in the U.S.A. and Europe, with black willow (*S. nigra*), one of Australia's most invasive willows, described as 'particularly' promising. Willows were listed as a potential fuel and energy source in Australia in a report prepared for the Rural Industries Research and Development Corporation (RIRDC). New Zealand company Biojoule, who are trialling willows to make ethanol, says there is interest in Australia in the process.

The active planting of willows for either of these purposes will only increase the spread of willows, rather than stopping it as this goal intends.

Analysis of key outcomes for 2006/2007:

1. Understanding the potential threat of willows in Australia

Mapping and weed risk assessment of all willows across Australia is underway to better understand the invasiveness, impacts and distribution of the >30 naturalised willow taxa and set priorities for management at national, state and regional levels. This work will form a basis for guiding and measuring progress towards the future management of willows across Australia. Key outputs of this work to date include:

- sourcing existing mapping data from regional, state and national databases, updating distribution maps at regional willows workshops and encouraging people to collect and contribute additional mapping data following the workshops
- compiling a comprehensive list of all willow taxa currently in Australia, through reference to available literature and contact with the nursery and garden industry and willow and weed experts
- Two national workshops to develop and weight the impacts assessment criteria for willows, which included participation of a wide range of people from different backgrounds, disciplines and geographic areas.

For the list of willow taxa being assessed, results of the impacts assessment and to monitor for any future outputs of this work, refer to www.weeds.org.au/WoNS/willows. The process and results to date were presented at the Victorian Weeds Conference (Steel *et al.* 2007).

This project is being conducted by Department of Primary Industries Victoria on behalf of the National Willows Taskforce and will be completed by the end of 2007. Many organisations have contributed to this work and significant in-kind contributions have been made (see Wadley and Holland-Clift 2007 for a list of acknowledgements for the mapping component). Of note, the South Australian Department of Water

Land and Biodiversity Conservation and Murray Darling NRM board have contributed substantial resources and effort to map willows in South Australia.

On ground mapping is planned for September to December 2007. Areas prioritised for on ground mapping are based on the known outer most ranges of each willow taxon (to confirm the current climatic limits of each taxon) and on Ramsar listed wetlands that may be at potential threat by willow invasion (to enable national prioritisation based on high priority assets). Following this, a detailed evaluation report will be prepared that outlines the outcomes of this work in detail (to be available from www.weeds.org.au/WoNS/willows).

2. Improving relationships with the Nursery and Garden Industry of Australia (NGIA) through their active involvement in the weed risk assessment of willows

At a horticultural media forum held in Melbourne in May 2006, a nursery grower raised concern about most willows being declared as 'restricted weeds' in Victoria. The concern raised at this forum highlighted the need for greater consultation with the NGIA in the planning and implementation of a weed risk assessment process for any weed, as it provides them with the opportunity to contribute their knowledge and expertise and to develop an understanding of why certain legislative decisions are being made.

Over the past year, the National Willows Taskforce (NWT) and NGIA have worked together to involve growers in the weed risk assessment process for willows, to identify and prevent the further importation and sale of problem willows. The contact made and feedback received from nursery growers was documented in a National Willows Taskforce brief in June 2007 (available from members of the National Willows Taskforce, see Appendix A). Of particular note, two representatives of the NGIA attended the National Willows Impacts Assessment Workshop in February 2007 and actively participated in the development of the impacts criteria to be used for the willows weed risk assessment. In addition, all growers listed in the Aussie Plant Finder as selling willows were directly contacted. Of these, only four out of 16 growers expressed a desire to sell willows in the future and these four were most interested in selling taxa from the subgenus *Chamaetia*, which are not yet known to be naturalised in Australia. The weed risk assessment results to date indicate that most taxa within subgenus *Chamaetia* are likely to have relatively low impacts in Australia compared with the other two willow subgenera. The final list of willow taxa and the process for assessment was sent to the willow growers and NGIA for approval. There were no opponents to the process or the list.

3. Increasing the awareness, aspirations and skills of willow managers to respond to potential willow threats

A series of willows workshops were conducted across all willow-affected regions in Australia in order to create and/or update regional maps highlighting where willows occur and train willow practitioners in the impacts of willows, identification, the willow sawfly and setting priorities for management. The workshops were seen as a cost-effective method for collecting broad information on willow distribution across Australia, as well as training participants in the key skills required for them to more effectively map and therefore manage willows within their regions.

In total, 29 willow workshops, attended by a total of 576 people, were held across 29 CMA or NRM regions in 5 states and territories across south-eastern Australia between September 2006 and March 2007. Through a detailed evaluation of the workshops (Wadley and Holland Clift 2007), it was clear that they played a major role in

- increasing the knowledge, attitudes, skills and aspirations of over 570 willow managers across Australia
- creating and/or updating regional maps highlighting where willows occur and generating further interest in mapping willows
- enhancing willow practitioner networks on a national and regional level, with an average of 20 participants and nine organisations represented at each workshop
- the discovery of new populations of highly invasive seeding willows in northern New South Wales and throughout South Australia.

Originally, 20 workshops were planned as part of this project but, due to the large level of interest received, an additional nine workshops were required. This indicated a heightened level of awareness of willows across Australia. In addition, several workshop participants are now planning to run additional workshops within their regions in 2007/08 using the resource materials developed for the workshop series. Thus far, an additional five workshops have been planned in the ACT and New South Wales by the Upper Murrumbidgee Catchment Coordinating Committee and Central West Catchment Management Authority. This demonstrates that the information and key messages will continue to be passed on to other people within these regions beyond the life of this specific project.

4. Determining and raising awareness of the potential threat of willows in outlying States (QLD and WA)

Although there are few willows known to occur in Western Australia and Queensland, a preliminary weed risk assessment revealed the potential for willows to become problems in these two States, if certain willow taxa become established. For example, preliminary assessments suggest that *S. alba* and *S. cinerea* are of greater concern to Western Australia than *S. humboldtiana* and *S. matsudana* (see Figure 1).

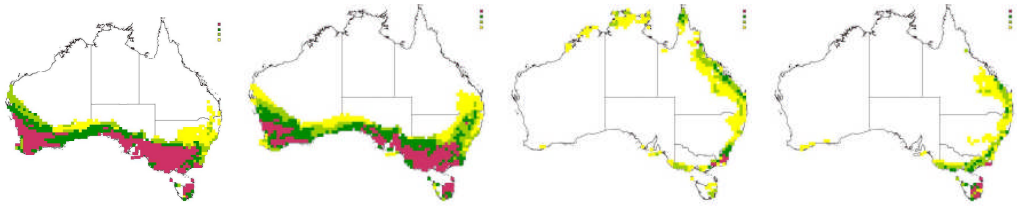

Figure 1: Preliminary potential distribution of different willow taxa in Australia, produced using CLIMATE modelling. From left to right: *S. alba*, *S. cinerea*, *S. humboldtiana* and *S. matsudana*.

The National Willows Coordinator gave two presentations in southeast Queensland and six in southwest Western Australia in April and May 2007 to raise awareness of the potential threat of willows and the need for more detailed mapping data in these two States. In addition, surveys were undertaken in both states to help determine the extent of willows present.

Prior to visiting Western Australia, there was only one record of willows lodged in the Western Australian Herbarium (a *Salix babylonica* specimen). There are now 42 confirmed and 18 anecdotal records of willows in Western Australia. The willow taxa identified were *Salix cinerea* grey sallow, *Salix x sepulcralis* var. *chrysocoma* golden weeping willow, *Salix babylonica* weeping willow, *Salix matsudana* Peking willow (still needs confirming), *Salix matsudana* 'Tortuosa' tortured willow, and *Salix humboldtiana* (syn. *Chilensis*) Chilean pencil willow.

Prior to visiting Queensland, there were 49 records of willows lodged in the Queensland Herbarium. The willow taxa recorded were *Salix* x *rubens*, *S. aurita, S. babylonica, S. cinerea, S. discolor, S. humboldtiana, S. nigra* and *S. viminalis*. Of these, the records of most concern were of *S. cinerea* and *S. nigra*, but initial surveys were unable to confirm the records of these two taxa. *Salix matsudana* (still needs final confirmation) and *Salix matsudana* var. Tortuosa were identified as additional taxa occurring in Queensland. An additional anecdotal record of *S. nigra* potentially occurring in the Casino area was also received from a participant at the Coffs Harbour workshop in northern New South Wales.

Further collation and updating of willow distribution data for these States is being conducted in spring 2007. Department of Primary Industries Queensland and Department of Environment and Conservation Western Australia have assisted in organising presentations and workshops, providing guidance on which areas to target and in providing local contacts for these areas.

5. Continued development and implementation of regional and statewide extension and eradication programs

Highly invasive seeding willows have been identified as primary targets for eradication, to prevent further spread by seed. Numerous programs are underway to tackle high priority seeding willows in different regions. These include:

- The identification, mapping and eradication of naturalised non-crack willow populations in Tasmania. This project is being conducted by Tasmanian Land and Water Professionals, with funding and/or in-kind support from the Defeating the Weeds Menace program, local government, regional NRM boards, Department of Primary Industries and Water and private industry.
- The continued control of black willow (*S. nigra*) in North East Victoria, the ACT and the Murray, Murrumbidgee, Northern Rivers and Hawkesbury Nepean regions in New South Wales. Funding and/or in-kind support is being provided by Willow Warriors Inc., Friends of the Colo, North East, Murray and Murrumbidgee Catchment Management Authorities, Department of Sustainability and Environment Victoria, Department of Primary Industries New South Wales, local government and the Eastern and Western Riverina Noxious Weeds Advisory Groups.
- Programs for the control and eradication of grey sallow (*S. cinerea*) in the
  - Wingecarribee Swamp and Coxs River Catchment in New South Wales, with funding and in-kind support from the Sydney Catchment Authority, Lithgow Oberon Landcare Association Management Committee and Hawkesbury Nepean Catchment Management Authority.
  - Onkaparinga catchment in South Australia, with funding and in-kind support from the Defeating the Weeds Menace program, Department of Water Land and Biodiversity Conservation and Adelaide and Mt Lofty Ranges Natural Resource Management board.
  - Victorian Alpine National Parks, with funding and in-kind support from Parks Victoria, North East Catchment Management Authority, Friends of Baw Baw National Park, local government, the Australian Government Envirofund, the Four Wheel Drive Club of Australia and Mt Hotham and Falls Creek Resorts.

The explosion of grey sallow in Victoria's alpine national parks and New South Wales' Wingecarribee Swamp and the early detection and eradication of grey sallow in Tasmania were promoted as case studies for the regional workshop series (see point 3 above) and developed as a one-page promotional flier to highlight the value

of early detection and eradication of seeding willows (available for download from www.weeds.org.au/WoNS/willows). Actions to control grey sallow and its associated hybrid in South Australia were largely in response to the regional workshops (Dennis Gannaway, personal communication) and the resultant increased understanding of the potential threat of these willows in this State.

The weed risk assessment project will further guide where eradication and extension efforts should most strategically be targeted in future.

6. No records of willows being imported to Australia in the past 2 years.
A report was obtained from the Australian Quarantine and Inspection Service on the importation of willows from Israel or the USA since 1st January 2002. The most recently recorded importation of willows into Australia was on the 7th October 2005. Between 2002 and 2005, there were 10 records of willows imported to Australia, with nine from Israel and one from the USA. Eight of these were imported to Victoria and two were imported to NSW. By the end of 2005, willows were listed as noxious weeds in all States and Territories. Since then, no willows have been imported to Australia. AQIS noted, however, that they cannot guarantee that willows have not been imported under an incorrect Tariff code or a misleading description.

Goal 2: Manage existing infestations

Desired outcome: Willows effectively managed

Key outcomes of 2006/2007:

1. Understanding the threat and current impacts of willows and where to focus management through mapping their known extent and conducting a detailed weed risk assessment to identify high risk species
2. Assessing and improving methods of control through research and development activities
3. Detailed review and establishment of best practice management guidelines
4. Continued suppression of invasive willows through the development and implementation of active management programs

Future activities required:
The following activities have been identified by the National Willows Taskforce as still being required to fully achieve this goal. A proposed time frame for the completion of each activity has also been given.

- Short term (by December 2007): Verify existing mapping data and collect further information on highly invasive taxa and in high priority areas. Feed this into weed risk assessment of willows to ensure the assessment is based on the best information possible. Encourage regional bodies to investigate chemicals appropriate for use on willows in their region through the national management guide.
- Medium term (by December 2008): Investigate options for the biological control of willows. Continue research to understand the willow sawfly. Review and update the National Willows Strategy, including changes to actions 2.2.6 (use the term 'education' instead of 'enforcement') and 2.2.2 (remove 'generic regional plans).
- Long term (next 2-5 years): Improve riparian rehabilitation practices. Review and refine best practice guidelines. Where needed, develop protocols for the management of cricket bat willow plantations, particularly in Victoria.

Change in direction of strategy:
Strategy 2.2.6 identifies the need to enforce eradication and control of priority species. The National Willows Taskforce believes that enforcement should only be conducted in areas where lack of voluntary compliance threatens a specific control program. In general, the national program aims to focus on education rather than enforcement. The results of the weed risk assessment, however, will be used to encourage legislative review where needed.

Strategy 2.2.2 identifies the need to develop regional plans based on a generic willow management model. It is believed that a generic model is inappropriate given the complex nature of willow and riparian management and the variations in biology, spread and impacts of different willow taxa. To address this issue, the principles of planning and conducting a willow management plan are included in the national management guide to assist people in developing regional management plans.

Analysis of key outcomes for 2006/2007:

1. **See point 1 in Goal 1 for analysis**

2. **Assessing and improving methods of control through research and development activities**

<u>National research forum</u>

A National Willows Research Forum was held in Canberra in February 2007 to:

- provide an opportunity for researchers and willow practitioners to learn about past and current research on willows in Australia and the implications of this research for on-ground management of willows;
- network with researchers working on willows across Australia;
- contribute to the development of national research priorities for willows;
- identify opportunities for collaboration on research projects.

Through a detailed evaluation of the forum (Holland Clift 2007a), the first three aims were clearly met. Participants said they found hearing an overview of willows research and activities, networking, prioritising research gaps and the format and running of the forum as the most useful aspects overall. The fourth aim is more long term and needs to be measured over time, but initial feedback indicates that the forum will result in increased collaboration on research projects, with one such collaboration already under development between the willow sawfly and genetics teams. There was overwhelming support to hold another research forum in future and it was proposed that a second National Research Forum be conducted in winter 2008.

a) b)

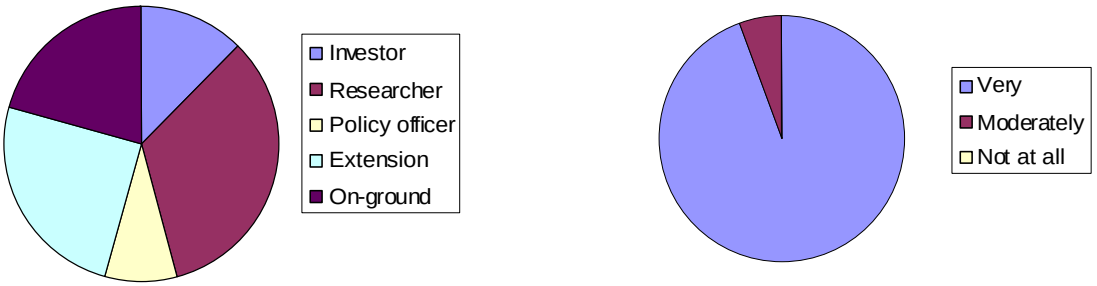

Figure 2: Research forum participants' responses to the questions a) 'how would you classify your role in relation to willows?' and b) 'how useful did you find the Research Forum overall?'

One of the key outcomes of the Forum was the development of priority research gaps needing to be addressed for willows. The top five research themes were:

1. Long term monitoring and evaluation of willow management in rehabilitation areas;
2. Further research on the water use of willows compared to other vegetation;
3. Study on community attitudes to willows and how to address them;
4. An analysis of the ecological impacts of willows based on a synthesis of available pre and post willow removal monitoring data;
5. The biological management of willows.

Since the Research Forum, there has been some progress made on developing research projects for each of these research gaps, but funding still needs to be secured to further these projects.

The proceedings and some of the presentations from the forum can be downloaded at www.weeds.org.au/WoNS/willows.

Research underway

- **Willow sawfly:** The Department of Primary Industries Victoria has continued to conduct research on the willow sawfly (*Nematus oligospilus*) in Victoria, with funding assistance from Melbourne Water and the Department of Sustainability and Environment and significant in-kind contributions from Parks Victoria, the North East Catchment Management Authority (CMA) and several other Victorian CMAs. Research to date has focussed on understanding the potential impacts and spread of the sawfly (Ede 2006; Ede *et al*. 2007), with the next steps being focussed on how it can be effectively integrated into current willow management programs.

- **Tracking seed and pollen migration using genetic markers**: A PhD research project is underway to understand the extent and pattern of seed and pollen migration across the landscape using genetic markers. Results of this research will assist in improving our ability to set priorities for management on a landscape scale. Initial results show that seed and/or pollen can spread across catchments, highlighting the need for coordination among regions and states. This research is being conducted by CSIRO Plant Industry, with funding assistance from the Department of Sustainability and Environment and Melbourne Water and in-kind contributions from several Victorian Catchment Management Authorities, the Australian National Botanic Gardens and the Australian National University.

- **Use of decision models to develop a control strategy for grey sallow:** Decision models are being developed to assist in the efficient and effective control of grey sallow (*S. cinerea*), which has invaded alpine bogs in the Australian Alps. This research intends to determine the best management strategies for controlling grey sallow in alpine bogs in Victoria, with consideration of outside populations and management factors. It will also assist in identifying information gaps and assessing whether filling these gaps will directly assist managers in effective decision making. The project is being conducted by the University of Melbourne with funding and in-kind support from Parks Victoria.

- **Quantifying water savings from willow removal:** Ensis (an unincorporated joint venture between CSIRO and New Zealand forest research group Scion), with funding assistance from Water for Rivers, are conducting trials in south central New South Wales (Doody *et al.* 2006). Initial results indicate that there is a potential for water savings of 3-4 ML/ha if the willows situated in the stream bed with permanent access to water were to be removed.

Research completed during 2006/2007

- Development of catchment-scale mapping techniques, Sydney Catchment Authority (Noonan and Chafer 2006; Noonan and Chafer 2007). These techniques can provide a powerful and cost-effective tool for prioritising control programs and monitoring results at a catchment scale.

- Predictors for the recruitment of willows, CSIRO Entomology (Stokes and Cunningham 2006). Results indicate that spread by vegetative means is most influenced by physical characteristics of the river, whereas the availability of mating partners is of greater importance in determining spread by seed.

- Willows along the Lower Murray, South Australia, University of Adelaide (Gehrig *et al.* 2006). Hybridisation between *Salix* taxa may provide a stimulus for increased invasiveness, as hybridisation can lead to new adaptive traits that are more compatible with colonised habitats.

3. Detailed review and establishment of best practice management guidelines

A National Willows Management Guide is under development to assist land managers in planning and implementing willow management. The development of this guide has been extremely difficult, due to the complex nature of waterway management and the diversity of views in terms of best practice willow management.

To resolve these issues, a National Willows Practitioners Workshop was held in May, 2007, with a select group of experienced on ground willow managers from across Victoria, Tasmania and New South Wales, to identify and agree on the format and recommendations to be included in the guide. This was the first time such an experienced group of on ground practitioners have been brought together face to face to discuss and refine willow control techniques. It highlighted that, while there is general consensus on which broad techniques to use in each situation, there is considerable variation in the details of how people employ each technique. Also, there are many specific situations where you may need to adopt an alternative technique or variation on these methods. We need to continue to trial and refine new approaches and promote these to others working on willows across Australia.

One of the key issues highlighted through development of the management guide was the difficulty in adequately explaining different management techniques in a written format. The National Willows Program has therefore secured funding to develop a DVD to visually demonstrate techniques and situations outlined in the manual.

In addition, a national willows survey was conducted to determine the preferred methods of delivering information about willows, the main control techniques used and the costs associated with willow management. Despite the low response to this survey (only 30 respondents), it provided some useful information (Davies and Holland, unpublished).

4. Continued suppression of invasive willows

Major control programs have continued in six regions of Victoria and eight regions of NSW, with a focus on rehabilitation of streams and wetlands. Smaller control programs are being conducted across Tasmania, northern NSW, central and western Victoria, eastern South Australia and in the ACT.

Several regions have conducted significant planning (including detailed mapping) to ensure that willow management is undertaken in a strategic manner. A Lake Burley Griffin Willow Management Plan was developed by Greening Australia and Molonglo Catchment Group and was launched in May 2007. The North Central Catchment Management Authority in Victoria has commenced development of a regional willow management strategy. In addition, the Upper Murrumbidgee Catchment Coordinating Committee, with assistance from Willow Warriors Inc. has continued a project to refine and implement a willow management strategy for the Upper Murrumbidgee Catchment, with funding assistance from the Defeating the Weeds Menace program.

Goal 3: Gain community support

Desired outcome: Increased community support

Key outcomes for 2006/07:

1. Highlighting the nature and national significance of the willow problem through the development and implementation of a national communications strategy
2. Improving communications to States and Territories on National Willows Program outcomes through the development of 6 monthly reports
3. Presenting and implementing solutions to the willow problem through identifying and encouraging management options via regional willows workshops, current research projects and the development of a national management manual
4. Increased investment in cross-border, strategic willow management programs by organisations across Australia
5. Increased access to information relating to willows and their management via the Weeds Australia website and National Willows e-groups.

Future activities required:

The following activities have been identified by the National Willows Taskforce as still being required to fully achieve this goal. A proposed time frame for the completion of each activity has also been given.

- Short term (by December 2007): Develop a brief on the 'science of willows' to address the potential issue of willows being used as biofuels in Australia and the promotion of willows in natural sequence farming methods.
- Medium term (by December 2008): Appoint a national willows communications officer to focus on the implementation and review of the national willows communications strategy, including management training workshops, two-way communications with the national willows e-network and active engagement with the broader community. Continue to strengthen regional partnerships, particularly with public land managers. Document current alternatives to willows for various scenarios and conduct further research to develop additional alternatives. Develop project proposals for high priority research projects identified at the National Willows Research Forum and hold a second forum in August 2008. Distribute resource materials to all schools, TAFEs and universities.
- Long term (next 2-5 years): Conduct an international willows conference (possibly in connection with the International River Symposium held in Brisbane) to discuss shared issues and potential for collaboration on willows.
- Ongoing: Circulate dot point achievements and activities of the National Willows Program every 6 months to key contacts in each State / Territory. Continue to develop proposals and identify potential sponsors, consistent with the investment goals of regional and statewide organizations.

Analysis of key outcomes for 2006/2007:

1. Highlighting the nature and national significance of the willow problem

Through the National Willows Survey, respondents indicated that their preferred methods of receiving advice and information were brochures, management manual, website, field days/shows and email. The National Willows Program has therefore focused on these methods of communication during 2006/2007.

- **Brochures**: a national willows brochure titled 'Willows: friend or foe' was published and more than 2000 copies distributed to people across Australia. In addition, a willows weedeck has been developed and will be published and distributed during 2007/2008, with funding support from Department of Sustainability and Environment, Parks Victoria, Melbourne Water and Glenelg Hopkins and North Central Catchment Management Authorities.
- **Management manual**: as mentioned in goals 1 and 2 above, a Resource Kit was developed and distributed to over 600 people across Australia and a national management manual is currently under development. The resource kit received enormous praise and a reprint was necessary to accommodate the large number of additional requests.
- **Website**: all resources of relevance to the National Willows Program have been posted on the willows webpage on the Weeds Australia website, including the brochure, resource kit, research forum proceedings and relevant research papers and reports. See www.weeds.org.au/WoNS/willows.
- **Email**: the National Willows Network, Taskforce and Research e-groups continue to be actively used for promotion of new information and updates. Currently, however, these networks primarily act as a one-way flow from the National Coordinator to each network. The future challenge is to foster a more 2-way flow of communications via these networks.

2. Improving communications to States and Territories on National Willows Program outcomes

The National Willows Taskforce has developed a process for communicating key outcomes of the national program via a six monthly report to be sent to all relevant States and Territories and NRM regions. This report will be a two-sided page, with one page on national outcomes and the other on specific state outcomes relating to the national strategy. This will help streamline communications from the taskforce to key organisations across Australia.

6. Presenting and implementing solutions to the willow problem

Management options have been identified and encouraged via regional willows workshops, current research projects and the development of a national management manual, as outlined in goals 1 and 2.

7. Increased investment in cross-border, strategic willow management programs by organisations across Australia

Significant cross-regional projects have been made possible through funding assistance from the Defeating the Weeds Menace Program, including the statewide eradication of seeding willows in Tasmania, updating a willow management strategy for the Upper Murrumbidgee Catchment and willow control in the Genoa River catchment.

The Victorian Department of Sustainability and Environment (DSE) and Melbourne Water have provided significant investment into statewide research projects being conducted by the Department of Primary Industries and CSIRO. In addition, the DSE has offered seed funding to initiate a biological control program for willows in Australia.

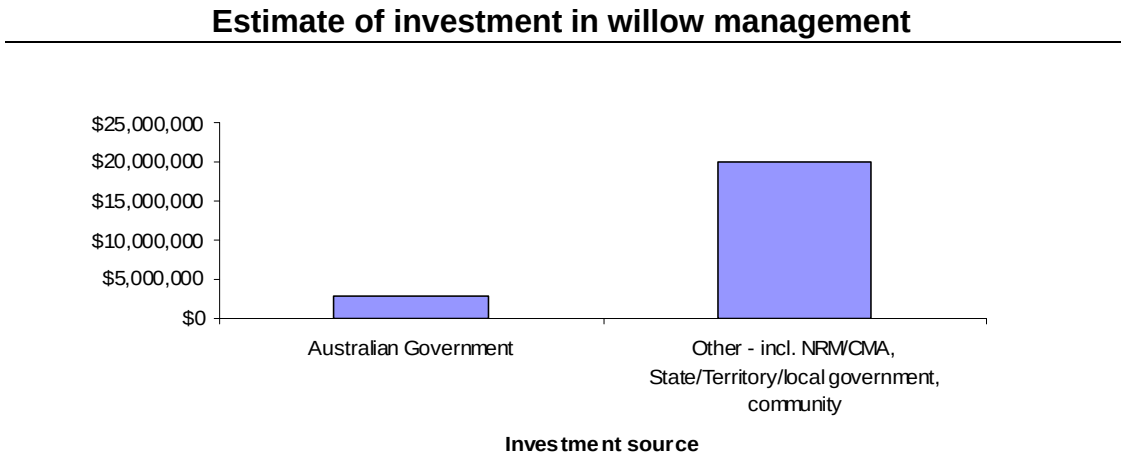

Figure 3: Estimate of investment made in willow management across Australia in 2006-2007 by the Australian Government and other sources.

Basis for estimates:

It is difficult to obtain accurate data on investment in willow management, as good projects often have multiple actions that lead to broader outcomes, such as complementary rehabilitation activities and water quality monitoring. Based on a survey conducted in 2005/2006 (Davies and Holland-Clift 2007), initial willow control on average constitutes just over half the costs associated with willow management, with follow up control and rehabilitation constituting most of the remaining funds. In addition, the cost of initial control decreases considerably with decreasing density, with large infestations costing over 5 times more than scattered stands per kilometre and scattered stands costing 16 times more than individual trees.

Estimates for Australian Government funding are based on data provided by Department of Environment and Water. During 2006-2007, the Australian Government invested a total 2,831,996 in projects involving willows, including three projects funded via the Defeating the Weeds Menace Program, 16 via Envirofund, one via NAP regional, three via Natural Resource Management funding and two via Regional Rivercare. For each of these projects, a minimum of matching in-kind contributions would have been provided by applicants.

Estimates for other contributions in willow management are especially difficult given the plethora of organisations and groups active in willow management across Australia. Current estimates are based on a survey conducted in 2006 on willow management costs and techniques (Davies and Holland 2007) and on discussions with regional staff.

Attachment A - National Willows Taskforce members

Members	Corresponding members
Community Chair - Drew English Regional Manager, Conservation Volunteers Australia ACT and southeast NSW branch	**NSW Local Government - Paula Ash** Riverina Noxious Weeds Project Officer, Eastern and Western Riverina Noxious Weeds Advisory Groups
Community Representative - Jeff Cottrell Chair, Willow Warriors Inc.	**Nursery and Garden Industry of Australia (NGIA) - Robert Chin** Nursery Industry Development Officer, Nursery & Garden Industry Victoria
Vic State Government – Andrew Hodges Policy Officer, Pest Plants, Department of Sustainability and Environment	**QLD State Government - Phil Maher** Senior Project Officer (Strategic Weed Control) Department of Primary Industries
NSW State Government - Sydney Lisle State Weed Control Coordinator, Department of Primary Industries	**WA State Government - Greg Keighery** Principal Research Scientist, Department of Environment and Conservation
Tas State Government - Karen Stewart Regional Weed Management Officer, DPIW Land Management Branch	**Australian Government – Robyne Leven** Vegetation Policy Section, Department of Environment and Water Resources
ACT Government - Stefanie Straub Acting Manager Environmental Management, Parks and Places	**National Weeds Management Facilitator – John Thorp**
SA State Government – Dennis Gannaway Bridal creeper (National) and WoNS (SA), Department of Water, Land and Biodiversity Conservation	
Vic Catchment Management Authorities - Malcolm Gibson Operations Manager, West Gippsland CMA	
Weeds CRC - Eligio Bruzzese Retired, ex – Research Director, Department of Primary Industries Victoria	
National Coordinator - Sarah Holland Clift Department of Primary Industries Victoria	

*Corresponding members receive all correspondence, but are not required to attend all meetings

Attachment B – References and publications for 2006/07

** denotes documents that can be found at www.weeds.org.au/WoNS/Willows

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Appendix C – Locations of willows training and awareness workshops held across Australia during 2006/07

Appendix D: Statement of expenditure of funds for national coordination

	2005-06	Planned budget		Actual Expenditure	
	Employees & Positions Held	**Recipient's Contributions** (without GST)	**Funds paid by the Commonwealth** (without GST)	**Recipient's Contributions Expended** (without GST)	**Commonwealth Funds Expended** (without GST)
	Co-ordinator salary and on-costs		75,823		83,306
	Management, admin support, research officers	15,447		15,447	
	NRM groups, state/territory community support inputs	48,338		50,000	
	National willows taskforce	50,400		34,966	
A	**Total Employment Costs**	**$114,185**	**$75,823**	**$100,413**	**$83,306**
	Operating Cost Items	**Recipient's Contributions** (without GST)	**Funds be paid by the Commonwealth** (without GST)	**Recipient's Contributions Expended** (without GST)	**Commonwealth Funds Expended** (without GST)
	Co-ordinator travel and meeting expenses	4,453	22,300	6,600	24,339
	Education and awareness		6,000	20,000	6,301
	National Willows Taskforce travel and meeting expenses and regional and national forums	20,100	18,700	12,600	8,877
B	**Total Operating costs**	**$24,553**	**$47,000**	**$39,200**	**$39,517**
C	**Total Cost (without GST) (A+B)**	**138,738**	**$122,823**	**$139,613**	**$122,823**
D	**GST (10%)**	**$13,874**	**$12,282**	**$13,961**	**$12,282**
E	**Total Cost (including GST)**	**$152,612**	**$135,105**	**$153,574**	**$135,105**