MANAGING WILLOWS ALONG VICTORIAN WATERWAYS

A.R. Ladson and G. Gerrish
Centre for Environmental Applied Hydrology, University of Melbourne, Parkville, Victoria 3052, Australia

Summary Willows (*Salix*) have been widely planted along waterways in Victoria. They have been considered a cheap and effective form of erosion control. However there are increasing concerns about the environmental and river management problems caused by excess willow growth. Use of willows is being reassessed in light of these problems. This paper discusses the issues associated with willows along waterways and provides recommendations for a state government policy.

INTRODUCTION

The Department of Natural Resources and Environment is preparing a policy to guide the management of willows along waterways. As part of this process the Department commissioned a study to review and summarize available information including:

- influence of willows on streams,
- type and distribution of willows along waterways in Victoria,
- the management of willows, and
- alternatives to willows for erosion control.

This paper documents the findings of that study and provides recommendations for a state government policy for managing willows along waterways. Further information is available in the full report (Ladson and Gerrish 1996).

INFLUENCE OF WILLOWS ON STREAMS AND LANDSCAPE VALUES

Willows are not native to Australia and they have different properties from native vegetation. Because of these different characteristics, willows along waterways can adversely affect:

- stream ecology,
- the riparian environment, and
- stream morphology.

Impact of willows on stream ecology Where willows dominate the riparian zone, or grow in streams, there may be impacts on stream ecology. In comparing areas with native riparian vegetation to those dominated by willows, the following effects have been reported in the literature:

- denser shade in summer and greater variation in shade between summer and winter,
- changes in timing of leaf fall,
- increased breakdown rates of leaf litter,
- increased breakdown rates of large woody debris,
- fewer insects fall into the stream,
- slower water flow and increased sedimentation,
- reduced dissolved oxygen concentrations, and
- decreases in the size of bed material.

These physical effects may adversely effect stream ecology. For example, work at the University of Tasmania (Read personal communication) showed that in small streams in Tasmania, invertebrate abundance and richness was significantly lower (in summer) at willowed sites than at sites dominated by native vegetation.

Impact of willows on riparian vegetation The riparian environment can be adversely affected if willows replace native riparian species.

Important effects include:

- reduced habitat and food supply,
- reduced diversity of vegetation, and
- fewer feeding and breeding opportunities for native fauna.

Willows can come to dominate the riparian zone because:

- they can spread rapidly by seed or vegetatively (i.e. branches and twigs breaking off and taking root), and
- their dense shade and thick root mat restricts the growth of the understorey.

Frankenberg (1995) reports that the impact of willows on the riparian environment is evident from field observations but that rigorous quantification is lacking. The heavy shade cast by willows and their dense root systems, reduces understorey species. This makes the plant community less diverse. The alien habitat provided by willows supports fewer insects (Frankenberg 1995).

Willow dominated riparian vegetation provides less effective corridors for movement of fauna. Riparian corridors are particularly important in otherwise cleared agricultural landscapes (Frankenberg 1995).

Impact of willows on stream morphology Willows along waterways can increase erosion resistance of the stream bed and banks and change channel shape and capacity. Many of the effects of willows were seen as positive and they have been widely planted by River Management Authorities, land holders, local governments, and state government agencies for erosion control.

More recently, in areas where willow growth is excessive, there are increasing concerns about adverse effects. In reviewing the literature and surveying river

management authorities by questionnaire, Ross (1994a, 1994b) reports that willows contribute to:

- flooding problems,
- accelerated bank erosion,
- course changes, and
- river changes because of regulation.

Impact of willows on landscape values Willow's autumn display is a significant feature of some northeast and Gippsland Valleys, e.g. King, Ovens, Mitta Mitta, Goulburn and Mitchell Rivers. Although willows have been described as an unnatural feature of the Australian landscape, many people value this feature and will resist its replacement.

Consulting with and influencing communities about willows and willow control will be important.

DISTRIBUTION AND SPREAD OF WILLOWS

There are 14 species of willows commonly found on waterways in Victoria. The most common being crack willow (*Salix fragilis*), gold crack willow (*S. rubens*), and white willow (*S. alba*) (Carr *et al.* 1994).

Many of the willows along waterways in Victoria are spreading vegetatively or by seed. The occurrence of spreading populations of willows and their rate of spread is a major issue to be addressed in the development of a strategy on willows.

It is now acknowledged that willow seeding, which was first recognised in 1993, is widespread (Cremer *et al*. 1995). Seed production can result in rapid spread of willows. For example, ideal seedbeds provided by the Tamar settling ponds near Launceston, Tasmania in 1990 resulted in about 700 000 seedlings 2–3 m tall in 1992. Similarly, a few dozen seeding willows on the Numeralla River, New South Wales produced about 1000 established offspring around 1980, which probably accounted for the bulk of the 10 000 seedlings established in 1993 (Cremer *et al.* 1995).

MANAGING WILLOWS

It may be desirable to manage willows where they are causing:

- stream management problems such as bank erosion and flooding,
- problems for recreation such as preventing access to streams, or
- ecological problems for example where willows are dominating the riparian zone.

Willow management could consist of removing or poisoning trees or containing their growth and spread.

It is important to identify the influence of willows on the river system when planning works. If willows are important for bed or bank stability then it will not be appropriate to remove them without ensuring stability is maintained. This could be achieved by, for example, retaining willows in key areas or constructing erosion control works such as groynes, retards or rock beaching.

Expert assistance may be required to assess current stream conditions and recommend an appropriate approach to willow control works. A conservative approach would be to treat a small section of the stream at any one time then observe what happens and modify the approach if there are problems.

Replacing willows with native species is likely to be an important part of willow management. However native species are not as effective at preventing bank erosion as willows. Work by the NSW Department of Water Resources (Hader personal communication) reports that willows can resist more than twice the eroding force that can be withstood by native species. Therefore in high stress areas willow removal should be avoided or undertaken with care.

Willow control methods Various willow control methods have been developed and trialed along streams in Australia. The recommended procedure includes killing willows by poisoning. The willows can then be left standing, lopped or removed.

Herbicide based control methods include:

- stem injection/frilling bark,
- drill and fill,
- foliar spraying, and
- cut and paint stump.

The selection of the appropriate poisoning method and herbicide depends on the equipment available and the site conditions. In Victoria there is a system of chemical registration and operator licensing to ensure that only appropriate chemicals are used in an environmentally responsible way.

Physical control methods include:

- whole tree removal, and
- lopping and pollarding.

When physically removing willows it is important to avoid the spread of live twigs and branches that can then grow. If possible willows should be poisoned before they are physically removed.

There are several other possible methods of willow control that may be appropriate in some cases. These are likely to be less applicable than herbicide and physical removal procedures discussed above. An example is the manipulation of water levels in regulated rivers. High water levels could be used to drown seedlings or extended low water levels may prevent formation of a suitable seedbed.

ALTERNATIVES TO WILLOWS FOR EROSION CONTROL

Willows have traditionally been seen as a cheap and effective form of bank protection. Banks protected by willows can resist about twice as much erosive force as banks protected by native vegetation. Willow planting is also cheaper than structural erosion control measures. The cost of willows comes later because of the need to control excess growth, environmental degradation, blocking of streams and other problems.

Alternatives to willows should be chosen as part of an overall stream management program. Effective stream management requires an understanding of physical processes governing the current state of a river.

This is no single, simple alternative to willows. Instead a range of methods must be considered. These include:

- doing nothing,
- planting native vegetation, and
- building structural erosion control works.

Do nothing Where erosion is progressing slowly or the consequences are not great then it may be appropriate to do nothing rather than treat the erosion.

Revegetate stream banks with native species In Victoria standard revegetation techniques consist of fencing to exclude stock, followed by planting, seeding, or natural regeneration of vegetation that may include: trees, shrubs, grasses, sedges, reed and water plants (Standing Committee on River and Catchments 1993). As a stream bank protection method, native vegetation is best suited to places where erosion forces are not severe. Plantings are subject to an erosion hazard particularly in their first few seasons and do not provide the same degree of erosion resistance as willows.

Plantings must include a range of appropriate species. Selection of species depends on the location of the stream reach and specific objectives of the planting program. Local revegetation guides should be consulted.

Structural erosion control works There are a large number of structural erosion control alternatives that may be appropriate to provide bank protection. Details on techniques and guidelines for use are provided in *Guidelines for stabilizing waterways* (Working Group on Waterway Management 1993) and *Environmental guidelines for river management works* (Katsantoni 1990).

RECOMMENDATIONS FOR A GOVERNMENT POLICY FOR MANAGING WILLOWS ALONG WATERWAYS

Based on the information that was collected and reviewed, four key recommendations were provided to the Department of Natural Resources and Environment. These are to:

- raise awareness of the stream management and environmental problems that can be caused by willows,
- reduce willow planting,
- manage existing willows, and
- encourage research to fill knowledge gaps and provide additional information.

Raise awareness about willows Any policy relating to willows along waterways will only be successful if there is more widespread recognition of problems caused by willows. Therefore a program of raising awareness about problems caused by willows and alternatives to willow planing is recommended. The program should be targeted at River Management Authorities, and through them, to Landcare groups and landholders.

Reduce willow planting Directly approach River Management Authorities currently planting willows, inform them of the consequences of willow growth and request they stop planting.

Encourage development and adoption of native revegetation strategies by all River Management Authorities. Revegetation strategies should include guidelines for the use of native plants for erosion control.

Sponsor a review of structural design guidelines and construction practice and modify as necessary so that structural erosion control works do not need to include willow planting to ensure their success. Update published guidelines to include alternatives to willow planting.

Manage existing willows Encourage River Management Authorities to incorporate willow management objectives and targets into their usual strategic, business, and operational planning and reporting. Planning and management should include consideration of:

- river management problems caused by willows,
- effects of willows on stream ecology, riparian habitat and stream morphology,
- rate of spread of willows,
- occurrence of seeding willows,
- impacts of willows on recreation particularly angling and canoeing,
- willow invasion of high conservation value areas,
- changes in community values and attitudes about willows, and

- new control techniques or herbicides that may become available.

Fill knowledge gaps and provide additional information Establish contact with researchers investigating the affects of willows on stream ecology particularly the groups lead by Dr. Leon Barmuta at the University of Tasmania and Dr. Keith Walker at the University of Adelaide.

Establish contact with other agencies managing willows. Jointly develop and distribute best practice guidelines for willow control and monitoring, and alternatives to willows for erosion control.

Investigate the distribution of willow species along Victorian waterways, their rate of spread and the extent of seeding. Maintain an up to date data base on willow species and distribution.

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