

Section Five – Further Information

5.0 Further information

5.1 References and further reading

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5.2 List of supplementary information

Assessment data

Assessments - PDFs

[Invasiveness Assessments – All willow taxa](#)

[Impact Assessments – All willow taxa](#)

Spreadsheets – Excel files

[Willows database](#)

[Willow scores](#)

[Willow distribution scores](#)

Assessment results - Layered PDFs

[Prioritisation matrix for every NRM region, arranged by state, with scientific and common names](#)

[Rankings of priority willows within each NRM](#)

[Ramsar sites prioritisation map](#)

Current and potential distribution maps - Layered PDFs

National map showing the current distribution of all willow taxa

[National distribution of all willow taxa](#)

State maps showing the current distribution of all willow taxa present

[Australian Capital Territory and New South Wales](#)

[Queensland](#)

[South Australia](#)

[Tasmania](#)

[Victoria](#)

[Western Australia](#)

Note: there is no current distribution data for NT

National maps showing the current and potential distribution of each willow taxon

[S. aegyptiaca](#)

[S. alba](#)

[S. alba var. caerulea](#)

[S. alba x matsudana](#)

[S. babylonica](#)

[S. caprea](#)

[S. chilensis](#)

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National maps showing the current and potential distribution of each willow taxon...cont.

[S. cinerea](#)

[S. daphnoides](#)

[S. elaeagnos](#)

[S. eriocephala](#)

[S. exigua](#)

[S. fragilis](#)

[S. glauca](#)

[S. gracilistyla](#)

[S. integra](#)

[S. matsudana](#)

[S. myrsinifolia](#)

[S. nigra](#)

[S. pentandra](#)

[S. purpurea](#)

[S. triandra](#)

[S. viminalis](#)

[S. x calodendron](#)

[S. x mollissima](#)

[S. x pendulina](#)

[S. x reichardtii](#)

[S. x rubens](#)

[S. x sepulcralis](#)

[S. x sericans](#)

Workshop Kit

All the resources required to run a willows identification and mapping workshop

[Willows workshop kit](#)

Mapping tools

Resources required to map willows for the National Willow Database

[Mapping templates – excel spreadsheet](#)

[Mapping attributes – word document describing the attributes in the spreadsheet](#)

Workshop Report

Wadley & Holland Clift (2007)

[Willows workshop report](#)

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GIS data from the willow workshops and willow risk assessment project

The current and potential distribution of willows (Salix spp.) in Australia

A second disk accompanying this report, *The current and potential distribution of willows (Salix spp.) in Australia*, holds an ArcGIS 9.2 Project containing all the present and potential distribution data collated during the *Developing Willow Management Priorities* project. If you do not have access to ArcGIS 9.2 software, the shapefiles may be used in earlier versions of this programme, or converted to compatible file types for use in other GIS environments.

In Microsoft Excel, .dbf files from this disk can be opened to view data also.

An explanation of the fields used in this project can be found in the document accompanying the database, Metadata for the present and potential distribution of willows.

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5.3 Appendices

Appendix One

Legislative Status of willows (Salix spp) in States and Territories across Australia

State/ Territory	Areas where legislation exists	Class/status	Willow species affected	Legal restrictions
Australian Capital Territory	Whole of ACT	Declared Pest Plant	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	A plan must be prepared to control the spread of these plants.
New South Wales	Whole of NSW	Control Class 5	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	Control Objective: to prevent the introduction of those plants into NSW, the spread of those plants within NSW or from NSW to another jurisdiction. The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. (refer to Secs 12, 15, 16, 28, 29, 30, 31, 32, & 40, of the Noxious Weeds Act 1993)
New South Wales	See below*	Control Class 3	Black Willow (<i>Salix nigra</i>)	Control Class 3 Objective: to reduce the area and the impact of those plants in parts of NSW. Must be fully and continuously suppressed and destroyed.
New South Wales	Blue Mountains City Council	Control Class 3	Grey sallow (<i>Salix cineria</i>)	
Northern Territory	Whole of NT	Schedule Class A/C	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	To be eradicated (A) and not to be introduced into the Territory (C).
Queensland	Whole of QLD	Class 1	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> , <i>S. x calodendron</i> , <i>S. chilensis</i> (syn. <i>S. humboldtiana</i>) and <i>S. matsudana</i> .	A Class 1 pest is not commonly present in Queensland and, if introduced, would cause an adverse economic, environmental or social impact. Class 1 pests established in Queensland are subject to eradication from the state. Landowners must take reasonable steps to keep land free of Class 1 pests. It is a serious offence to introduce, keep or supply a Class 1 pest without a permit issued by the Department of Primary Industries and Fisheries. Penalties may apply.
South Australia	Whole of SA	Class 11 Category 3	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	NRM Act (2004) Class 11, Category 3: Cannot sell the plant or any plant material.
Tasmania	Whole of Tas	Declared Weed	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	A person must not import or allow to be imported into Tasmania any willows. A person must not sell or otherwise distribute any willows or any thing carrying willows. An Inspector may, by serving a notice on the owner of any place, require that owner to implement any of the

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State/ Territory	Areas where legislation exists	Class/status	Willow species affected	Legal restrictions
				measures described in the statutory willow management plan or any other measures consistent with it. Any thing found to be contaminated with willows may be removed to storage at an appropriate approved quarantine place. A Regional Weed Management Officer will determine whether removal to storage at any of these facilities or treatment/destruction of material in situ is most appropriate.
Tasmania	Glamorgan/Spring Bay Municipality	Zone A Eradication	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	Management objective for Zone A is eradication.
Tasmania	Whole of Tas except Glamorgan/Spring Bay Municipality.	Zone B Containment		Management objective for Zone B is containment.
Victoria	Whole of Vic	Restricted Weed	All willows (<i>Salix</i> sp.) except <i>Salix alba</i> var. <i>caerulea</i> , <i>Salix alba</i> x <i>matsudana</i> , <i>Salix babylonica</i> , <i>Salix x calodendron</i> , <i>Salix caprea</i> 'Pendula', <i>Salix matsudana</i> 'Aurea', <i>Salix matsudana</i> 'Tortuosa', <i>Salix myrsinifolia</i> , and <i>Salix x reichardtii</i> .	Not to be sold or traded.
Western Australia	Whole of WA	P1	All willows (<i>Salix</i> spp.) except <i>S. babylonica</i> , <i>S. x reichardtii</i> and <i>S. x calodendron</i> .	Entry into the state and the trade, sale or movement of plants or their seeds is prohibited.

*Black Willow (*Salix nigra*) Control Class 3, NSW, in: Albury City, Bellingen Shire, Blue Mountains City, Clarence Valley, Greater Hume Shire, Gundagai Shire, Junee Shire, Narrandera Shire, Tumbarumba Shire, Tumut Shire and Wagga Wagga City Council.

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Appendix Two

The sixteen willow taxa assessed during the Victorian Weed Risk Assessment (2006)

Salix aegyptiaca
Salix alba
Salix cinerea
Salix exigua
Salix fragilis
Salix glaucophylloides
Salix chilensis (syn. *S. humboldtiana*)
Salix matsudana
Salix nigra
Salix purpurea
Salix viminalis
Salix x dasyclados
Salix x pendulina
Salix x rubens
Salix x sepulcralis
Salix x seringiana

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Appendix Three

Invasiveness and Impact criteria for the Victorian Weed Risk Assessment (VWRA)

Invasiveness Criteria

Establishment

1. Germination /propagule requirements?
2. Seedling/ propagule establishment requirements (i.e. light, water, nutrients)?
3. How much disturbance is required for seedling establishment to occur?

Lifeform and competitive ability

4. Life form?
5. Allelopathic properties?
6. Ability to tolerate herbivory pressure and produce propagules?
7. Normal growth rate?
8. Stress tolerance of established plants to frost, drought, water logging, salinity, fire?

Reproduction

9. Reproductive system?
10. Number of propagules produced per flowering event?
11. Propagule longevity?
12. Reproductive period?
13. Time to reach reproductive maturity?

Dispersal

14. Number of dispersal mechanisms?
15. Probability (or chance) that propagules will disperse to a distance greater than one kilometre?

Impact Criteria

Social (Tourism, Visual aesthetics, Experience, Cultural sites)

1. To what extent does the weed restrict human access?
2. To what level does this weed reduce the 'tourism / aesthetics/ recreational use of the land'?
3. To what level is the plant injurious, toxic, or spines affect people?
4. How much damage is done to indigenous or european heritage sites, and infrastructure?

Natural Resources– Soil, Water & Processes

5. To what extent does this weed impact on water flow within watercourses or waterbodies?
6. To what extent does the weed impact on water quality (ie. dissolved O₂, water temperature)?
7. To what extent does the weed effect soil erosion?
8. To what extent does this weed reduce the biomass of the community? (nb. biomass acting as a carbon sink).
9. To what extent does the weed change the frequency or intensity of fires?

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Vegetation & EVCs

10. To what extent does this weed impact on the vegetation composition on the following:
 - a. High value EVC
 - b. Medium value EVCs
 - c. Low value EVCs
11. To what extent does this weed effect the structure of a vegetation community?
12. What effect does the weed have on threatened flora spp.?

Flora & Fauna

13. What effect does the weed have on threatened fauna spp.?
14. What effect does the weed have on non-threatened fauna spp.?
15. To what extent does this weed provide benefits, or facilitates the establishment of, indigenous fauna?
16. To what extent is the plant toxic, its burrs or spines affect indigenous fauna?

Pest Animals

17. To what extent does this weed provide a food source to assist in success of pest animals?
18. To what extent does this weed provide important habitat or harbour for serious pests (pests for which DPI has a statewide program eg. foxes, rabbits, fire ants)?

Agriculture

19. To what extent does this weed impact on the quantity or yield of agricultural produce?
20. To what extent does the weed impact on agricultural quality (eg. contamination – lower price)?
21. To what extent does this weed affect land value?
22. To what extent does this weed cause a change in priority of land use?
23. To what extent the presence of the weed increases the cost of production?
24. To what extent does this weed act as an alternative host or vector for diseases of agriculture?

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Appendix Four

National Vegetation Information System (NVIS): Habitat types and numbers (DEWR 2007)

#	National Vegetation Information System
1	Cool temperate rainforest
2	Tropical or sub-tropical rainforest
3	Eucalyptus tall open forest with a dense broad-leaved understorey (wet sclerophyll)
4	Eucalyptus open forests with a shrubby understorey
5	Eucalyptus open forests with a grassy understorey
7	Tropical Eucalyptus forest and woodlands with a tall annual grassy understorey
8	Eucalyptus woodlands with a shrubby understorey
9	Eucalyptus woodlands with a grassy understorey
11	Tropical mixed spp forests and woodlands
12	Callitris forests and woodlands
13	Brigalow (<i>Acacia harpophylla</i>) forests and woodlands
14	Other <i>Acacia</i> forests and woodlands
15	<i>Melaleuca</i> open forests and woodlands
16	Other forests and woodlands
17	Boulders/rock with algae, lichen or scattered plants, or alpine fjeldmarks
18	Eucalyptus low open woodlands with hummock grass
19	Eucalyptus low open woodlands with tussock grass
20	Mulga (<i>Acacia aneura</i>) woodlands with tussock grass
21	Other <i>Acacia</i> tall open shrublands and shrublands
22	Arid and semi-arid acacia low open woodlands and shrublands with chenopods
23	Arid and semi-arid acacia low open woodlands and shrublands with hummock grass
24	Arid and semi-arid acacia low open woodlands and shrublands with tussock grass
26	<i>Casuarina</i> and <i>Allocasuarina</i> forests and woodlands
27	Mallee with hummock grass
28	Low closed forest or tall closed shrublands (including <i>Acacia</i> , <i>Melaleuca</i> and <i>Banksia</i>)
29	Mallee with a dense shrubby understorey
30	Heath
31	Saltbush and Bluebush shrublands
32	Other shrublands
33	Hummock grasslands
34	Mitchell grass (<i>Astrebla</i>) tussock grasslands
35	Blue grass (<i>Dicanthium</i>) and tall bunch grass (<i>Chrysopogon</i>) tussock grasslands
36	Temperate tussock grasslands
37	Other tussock grasslands
38	Wet tussock grassland with herbs, sedges or rushes, herblands or ferns
39	Mixed chenopod, samphire +/- forbs

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#	National Vegetation Information System
40	Mangroves
41	Saline or brackish sedgelands or grasslands
42	Naturally bare, sand, rock, claypan, mudflat
43	Salt lakes and lagoons
44	Freshwater, dams, lakes, lagoons or aquatic plants
46	Sea, estuaries (includes seagrass)
47	Eucalyptus open woodlands with shrubby understorey
48	Eucalyptus open woodlands with a grassy understorey
49	Melaleuca shrublands and open shrublands
50	Banksia woodlands
51	Mulga (<i>Acacia aneura</i>) woodlands and shrublands with hummock grass
52	Allocasuarina woodland and open woodland with hummock grass
53	Eucalyptus low open woodlands with a shrubby understorey
54	Eucalyptus tall open forest with a fine-leaved shrubby understorey
55	Mallee with an open shrubby understorey
56	Eucalyptus low open woodlands with a chenopod or samphire understorey
57	Lignum shrublands and wetlands
58	Leptospermum forests
59	Eucalyptus woodlands with ferns, herbs, sedges, rushes or wet tussock grassland
60	Eucalyptus tall open forests and open forests with ferns, herbs, sedges, rushes or wet tussock grasses
61	Mallee with a tussock grass understorey
62	Dry rainforest or vine thickets
63	Sedgelands, rushes or reeds
64	Other grasslands
90	Regrowth or modified forests and woodlands
91	Regrowth or modified shrublands
92	Regrowth or modified graminoids
93	Regrowth or modified chenopod shrublands, samphire or forblands
97	Unclassified native vegetation
98	Cleared, non-native vegetation, buildings
99	Unknown/No data

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Appendix Five

National Vegetation Information System (NVIS): Habitat types (DEWR 2007) used to refine the potential distribution of the willow taxa.

Taxon	Habitats	NVIS numbers	Riparian?
<i>S. aegyptiaca</i>	Rocky volcanic slopes (Davis, 1982). Lighted forests on slopes and banks of streams; secondary postforest plant communities at clearings, forest edges, and residential lots...grows only at levels lower than 1500m (Skvortsov, 1999).	17	y
<i>S. alba</i>	Riverbeds, along drains, riverbanks, lakesides, around ponds (Webb <i>et al.</i> 1988); Invades riparian vegetation and seasonal and permanent freshwater wetland; warm and cool temperate rainforest, alpine and subalpine vegetation (Carr <i>et al.</i> 1992); edges of lakes, river and streams (Davis, 1982); 50-1400m (Guest, 1980). Often part of lowland fen or marsh communities (Sommerville, 1992). "The most tolerant of all willows to brackish water" (Zallar).	38, 41, 44	y
<i>S. alba</i> var. <i>caerulea</i>	Low lying or hilly ground, usually on wet soils (PFAF, 2006).		y
<i>S. alba x matsudana</i>	Streambanks, drainage lines, offstream wetlands and roadside ditches (Carr pers. comm. 2007).	44	y
<i>S. babylonica</i>	In Australia this species is only naturalised along water ways (G. Carr pers. comm. 2007), however, elsewhere in the world it is found in grassland, shrubland, roadsides, wasteland, riverbanks, rocky outcrops (Henderson, 1995); along rivers, on damp valley bottoms (Skvortsov, 1999); heath- and shrubland, riparian habitats, freshwater wetlands (Weber, 2003).	17, 30, 32, 38, 44, 49, 57, 59, 60, 63, 64, 91, 92	y
<i>S. caprea</i>	Streamsides, open deciduous forest (Davis, 1982) woods, scrub and hedges (Clapham <i>et al.</i> 1952); Woods on well-drained soils as well as a vast variety of secondary postforest habitats, such as clearings, forest edges, residential lots, roadsides..occurs exclusively high up in the mountains (not lower than 1,500–1,600 m), (Skvortsov, 1999). Found on a fen reverted from agriculture (Wilson). Able to grow on drier ground, on the edges of woods (Sommerville, 1992).	38, 44, 49, 57, 59, 60, 63.	y
<i>S. chilensis</i>	On banks of watercourses or in moist locations (Howard, 1988); along streams or in swamps and marshes in both the hot plains and cool highlands from sea level to about 1900m (Standley & Steyermark, 1958) both in its native range.	38, 44, 57	y

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Taxon	Habitats	NVIS numbers	Riparian?
<i>S. cinerea</i>	Able to establish on drier soils (Cremer, 1999); Swamps, riverbanks, wet areas behind coastal dunes (Webb <i>et al.</i> 1988); "Occurs along streams or near seasonal to permanent swamps and bogs, from sea-level to above the treeline, invasive in both disturbed and undisturbed situations" (Carr, 1996); Invades riparian vegetation, and seasonal and permanent freshwater wetland, alpine and subalpine vegetation (Carr <i>et al.</i> 1992). "Can invade undisturbed herbaceous wetlands...even under dense wet sclerophyll forest...Has invaded steeply sloping, mature pine forest, not just along water courses [and can] establish in undisturbed herbaceous communities above the tree line in National Parks" (Cremer, 1999). "In the Australian Alps...following disturbance by cattle in alpine and subalpine bogs" (Ladson <i>et al.</i> 1997). "base-rich swamps and fens..by streamsides, woodland margins and hedgerows, on acid or alkaline soils, often in relatively dry, well-drained situations" (Meikle, 1992). Best on fens and seepage slopes (White, 1992). Wet forests and alpine bogs (Cremer, 2003).	3, 17, 38, 44, 49, 57, 59, 60, 63.	y
<i>S. daphnoides</i>	Lowlands to mountains, banks of mountain rivers, loose dune sand (Skvortsov, 1999). Prefer drier sites (than <i>S. cinerea</i>) (White, 1992).		y
<i>S. elaeagnos</i>	700-1900m (Skvortsov, 1999), by streams in river beds 400-1900m (Davis, 1982). Riverbanks, generally uncommon or rare. (Webb <i>et al.</i> 1988).		y
<i>S. eriocephala</i>	Predominantly riparian (Argus, 1986); 2-200m, River and stream banks and flood plains, in marshy fields, and in mixed mesophytic woods on alluvium (Argus, 2003).	38, 57, 59, 60, 63.	y

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Taxon	Habitats	NVIS numbers	Riparian?
<i>S. exigua</i>	600-2800m (Argus, 2003); Able to establish on drier soils (Voss, 1972); Wet places below 2000ft, sagebrush scrub, creosote bush scrub, deserts (Munz, 1963), riverbanks (Hitchcock & Cronquist, 1964), shores, dunes, stream margins, ditches, only rarely on dry ground (Voss, 1972).		y
<i>S. fragilis</i>	Waterways, ponds, lakesides and other wet habitats (Webb <i>et al.</i> 1988), streambanks (Carr, 1996), riverbeds (Maloney <i>et al.</i> 1999). Often part of lowland fen or marsh communities (Sommerville, 1992). tolerate high levels of salinity (Crouch & Honeyman, 1986).	38, 41, 59, 60, 63	y
<i>S. glauca</i>	2-3810m Wet to mesic thickets, treed bogs, woods, river floodplains, fens, swamps, subarctic thickets, alpine tundra (Argus, 2003); along rivers, rocky mountains, boreal forest (Looman & Best, 1979); Habitats are greatly variable: depressions, lowlands, river valleys, wetlands, bog edges; tundras of various types from paludal to rather dry; stone-fields, rocks, various outcrops, glacial moraines; banks of mountain and tundra streams, bypasses and channels with sluggish water flow (Skvortsov, 1999).	3, 17, 38, 44, 49, 57, 59, 60, 63, 64, 91, 92	y
<i>S. gracistyla</i>	To 900m, banks of streams and rivers (Skvortsov, 1999)		y
<i>S. integra</i> 'Hakuro-nishiki'	Occupies damp lowlands, never found close to flowing water (Skvortsov, 1999).	38, 44, 57, 59, 60, 63	N
<i>S. matsudana</i>	Riverbeds, lakesides, swamp margins, outskirts of towns and cities near rubbish dumps (Webb <i>et al.</i> 1988).	44, 57	y
<i>S. myricoides</i>	Streamsides (Webb <i>et al.</i> 1988); sandy shores, calcareous slopes & swamps (Newsholme, 1992); interdunal hollows (Haines, 2003).	44, 57	y
<i>S. myrsinifolia</i>	500-2400m, Moist forests, edges of wetlands (Skvortsov, 1999) by lakes and streams and on damp rock ledges (Clapham <i>et al.</i> 1952)	44, 57	y
<i>S. nigra</i>	Primarily of river margins and floodplains, alluvial soils; edges of ponds and lakes, swamps, marshes, bogs, wet meadows, open fields and roadside ditches, mixed upland deciduous woods along rivers (Argus, 1986); "Streams in pastoral country...opening in pine and eucalypt forest" (Cremer, 1999). Offstream wetlands (Ladson <i>et al.</i> 1997) as well as onstream wetlands and roadside ditches (G. Carr pers. comm. 2007). moderately high tolerance of salt (Swift, 1997)	38, 41, 44, 57, 59, 60, 63	y

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Taxon	Habitats	NVIS numbers	Riparian?
<i>S. pentandra</i>	In fields and on dunes, streamsides, borders of woods (Voss, 1972) marshes, fens (Clapham <i>et al.</i> 1952); transitional graminoid wetlands and palludial open woodlands (Skvortsov, 1999). Swampy forests, on grassy bogs and wet meadows and along the shores of marshy rivers and lakes (Pohjonen, 1991).	15, 38, 44, 57, 59, 60, 63	y
<i>S. purpurea</i>	Streamsides (Webb <i>et al.</i> 1988). Wet sands and alluvial soils of the Ribble estuary and the Fenland peats (Stott, 1992). "considerable tolerance for salt water" (Newsholme, 1992)	38, 41, 44	y
<i>S. triandra</i>	Sandy inundated river beds (Niemi, 2006), banks of rivers and streams, bayou banks on flood plains, lowlands to 2100m (Skvortsov, 1999) sides of rivers, ponds, marshes (Clapham <i>et al.</i> 1952). Often part of lowland fen or marsh communities (Sommerville, 1992). Usually in marshes 100-1950m (Davis, 1982). May have some salt-resistant properties (Skvortsov, 1999).	38, 41, 44	y
<i>S. viminalis</i>	Always along river banks from forest tundra to desert steppe (Meikle, 1984). Naturalised along streams in the Snowy Mountains (Jacobs & Murray, 2000). Grows on the banks of streams, rivers and lakes and on floodplains and marshes (Pohjonen, 1991). resistant to salt spray and/or saline soil (Braun <i>et al.</i> 1987)	38, 41	y
<i>S. x 'Boydii'</i>	Eastern highlands (Tennant, 2004).		
<i>S. x calodendron</i>	along streamsides or in swamps (Webb <i>et al.</i> 1988).	44	y
<i>S. x mollissima</i>	Banks of the Yarra River (Carr pers. comm. 2007). Damp places.		y
<i>S. x pendulina</i>	Naturalised along streams in Victoria (Carr, 1996).		y
<i>S. x reichardtii</i>	On streambanks (Carr, 1996) & moist, low-lying ground (Webb <i>et al.</i> 1988)	38	y
<i>S. x rubens</i>	Riverbeds (Webb <i>et al.</i> 1988). Abundant along streams (Carr, 1996). Grows in riverbeds (Cremer, 1995). Invades riparian vegetation, and seasonal and permanent freshwater wetland, warm and cold temperate rainforest (Carr <i>et al.</i> 1992).	44	y
<i>S. x sepulcralis</i>	Riverbanks, lakesides, pond margins (Webb <i>et al.</i> , 1988).	44	y
<i>S. x sericans</i>	Vegetation types based on those common to both parents (<i>S. caprea</i> x <i>S. viminalis</i>)	38	Y

