



Willow Identification

An essential skill for successful willow management

Willow Resource Sheet : 2

Supported by the State Government of Victoria



Department of
Primary Industries



The art of identification

Willows are an extremely diverse and complex plant group, consisting of more than 300 willow taxa (which includes species, sub-species, varieties, cultivars and hybrids¹) worldwide. Of these, approximately 100 have been introduced into Australia and it is estimated that over 30 taxa have become naturalised (that is, growing and spreading naturally in the environment) in Australia.

Plant features (such as form, bark, stems, leaves, flowers and roots) can vary dramatically among willow species. For example, willows can be either trees or shrubs, weeping or upright and single-stemmed or multi-stemmed. They can have rough or smooth bark, long or short leaves, early or late flowering, fragile or strong branches, and the list goes on.

Willows also have a remarkable ability to form hybrids, making accurate identification difficult. Almost all willows are able to hybridise with one or more other willows (mostly within the same subgenus) if they flower at the same time and fertile male and female plants grow near enough for pollination to occur.

Fortunately, precise identification is not necessarily required when planning willow management. However, a basic level of identification is essential. To most effectively manage willows, it is most important to be able to:

1. determine the sex of a willow (p.4),
2. confirm if it is producing viable seed (p.6),
3. distinguish between 'tree' and 'shrub' willows (p.7), and
4. determine how brittle (or 'fragile') the branches are (p.9).

In addition, it is useful to

5. learn to identify some key willow taxa already naturalised in Australia (p.9 to 16) and
6. collect plant samples, where possible, and send them to a herbarium (p10).

Learning these skills will further enhance our ability to manage willows.

Although willow identification can be difficult, a basic level of identification is essential for effective management.

What's in a name?

All willows belong to the **genus** *Salix*. Within this genus, there are 3 recognised **subgenera** (or major groupings):

- ◆ Subgenus *Salix* - '**tree willows**',
- ◆ Subgenus *Vetrix* - '**shrub willows**',
- ◆ Subgenus *Chamaetia* - dwarf, arctic or alpine willows.

Within each of these 3 subgenera, there are many species, sub-species, varieties, hybrids and cultivars. Willows that are growing and spreading naturally in Australia belong to either the *Salix* ('tree willow') subgenus or *Vetrix* ('shrub willow') subgenus. To date, no plants within the subgenus *Chamaetia* have been recorded as naturalised in Australia, but they have often been sold in nurseries.

A botanical name consists of the name of the **genus**, followed by the name of the **species** – e.g. if the genus is *Salix* and the species is *alba*, the name of the plant is *Salix alba* (or *S. alba* where it is clear that **S.** refers to the genus *Salix*).

A species may be subdivided into **varieties** (e.g. *S. alba* **var.** *vitellina* and *S. alba* **var.** *alba*) and **cultivars** (e.g. *S. matsudana* '**Tortuosa**').

Hybrids may be formed as a result of a male of one species pollinating a female of another – e.g. *S. alba* can cross-breed with *S. fragilis*. The hybrid that results may be identified by its parents (e.g. *S. alba* x *fragilis*) or its own name (e.g. *S. x rubens*), where **x** indicates that it is a hybrid.

Willows are often called by their **common names** (such as **pussy willow** and **crack willow**), as they are easier to remember. However, common names should only be used if the correct botanical name is implied. For example, the common name 'pussy willow' is often used for a number of different willows, including *Salix cinerea*, *S. x reichardtii*, *S. x calodendron* and *S. caprea*. This can become extremely problematic for management, since *Salix cinerea* is considered one of the most invasive willows in Australia, while *S. x calodendron* is excluded from the Weeds of National Significance list.

¹ All willow species, sub-species, varieties, cultivars and hybrids will be referred to generically as 'taxa' in this guide.

Why identify willows? Implications for management

Willow invasion dynamics

Different willows vary in their ability to spread into and thrive in new environments. It is important to understand how different willows spread and to adapt management programs accordingly. Willows can either spread sexually (via seed) or vegetatively (via twigs and branches) or by both of these means. The seeds germinate on bare, wet sediments, while branches, attached or detached, root mainly on wet ground or in shallow water.

◆ Spread by seed

The ability of willows to spread by seed depends mainly on the availability of favourable seedbeds (bare, wet ground) and the overlap in flowering times of compatible female and male plants. A female willow can produce thousands of seeds each spring. However, often these seeds do not germinate or grow, possibly due to the lack of suitable seedbed, rising or rapidly falling water levels and floods that uproot or bury the seedlings.

Suitable conditions for seedling establishment likely occur in most temperate Australian streams every 5 to 20 years². Major disturbances, such as wildfire or the collapse of a swamp can also promote massive seed germination. Thus, while spreading by seed may appear restricted for many years, a catastrophic explosion of seedlings may occur at any time, given the right conditions.

Some willows can spread by seed up to 50-100km. These willows may spread rapidly across regions and states, so even the most remote environments are at risk of invasion.

The ability of willows to spread large distances by seed highlights the need for coordinated action across regions and states to prevent further spread.

◆ Control of seeding willows

Early identification and control of seeding willows is critical and should be made a high priority for management. In some cases, such willows will need to be immediately controlled in areas where they do not currently cause significant impacts, to prevent them from spreading to other, more important environments.

Hybridisation between willows generally only occurs between plants within the same subgenus³. Almost all willows are able to hybridise with at least one or more other willows, so long as they flower at the same time and fertile male and female plants grow near enough for pollination to occur.

We are not sure exactly how far willow pollen can travel (by insects or wind) and successfully pollinate a female plant. Although bees may fly up to 3 or 5 km to collect pollen and nectar, it is thought that cross-pollination is generally restricted to much smaller distances (e.g. 50 m). However, female plants growing 1km from the nearest male have been observed producing viable seeds⁴. It is therefore recommended that male plants be separated from females by at least 2 km and preferably more if possible.

If you find female and male willows from the same subgenus ('tree' or 'shrub') within a few kilometres of each other, remove all female plants immediately.

To stop willows spreading by seed, it is essential to at least identify the gender (male, female or both) and subgenus (shrub or tree) of each willow and whether it is producing viable seed.

² Kurt Cremer, personal observation

³ One exception is *S. x mollissima* – a cross between *S. viminalis* (subgenus *Vetrix*) and *S. triandra* (subgenus *Salix*). *S. triandra* is not yet naturalised in Australia however.

⁴ Kurt Cremer, personal observation

◆ Spread by branches/twigs

Some willows can readily reproduce by twigs breaking off at the base of the stem and taking root downstream. In addition, dense layering of willows can occur where trunks collapse or branches hang down and form new roots where they touch the soil.

The brittleness (or 'fragility') of a branch/twig is the most important feature determining a willow's ability to spread aggressively by vegetative means. Brittleness is determined by the ease with which the branch can break at its base – the rest of the branch may be quite flexible. Many of the tree willows in Australia are easily broken at the base. The shrub willows are generally less fragile and are therefore less likely to spread by this method.

Crack willows (*Salix fragilis*) have extremely 'fragile' branches that snap easily at the base, with an audible 'crack'. *S. fragilis* and related hybrids have spread aggressively and are currently the most widespread and abundant willows, occupying thousands of kilometres of streams across south-eastern Australia.

The brittleness (or 'fragility') of a branch/twig is the most important feature determining a willow's ability to spread aggressively by vegetative means.

◆ Controlling spread by branches

As with seeding willows, careful planning, management, revegetation and follow up weed control are crucial to ensure that these willows are managed effectively. It is important to remember that:

- if willows or other weeds are removed from an area, twigs and branches from upstream may easily spread downstream and reinvade the area where the willows (or other weeds) were just removed;
- when controlling these willows, it is critical to ensure that all branches and other live material are removed - otherwise a multitude of new willows may sprout from the remaining material;
- removing these willows may expose an ideal seedbed for seeding willows to colonise, unless revegetation occurs quickly.

To stop the spread of willows by branches and twigs, it is important to identify willows with brittle branches that are growing along waterways.

Impacts of willows

Willows infest thousands of kilometres of waterways across southeast Australia and cause substantial social, economic and environmental impacts such as:

- ◆ reducing the quality and flow of water,
- ◆ increasing erosion and flooding and causing damage to nearby infrastructure,
- ◆ reducing available habitat for fish, birds, insects and spiders and
- ◆ obstructing access to streams for fishing and aquatic sports.

Willows clearly need to be managed to reduce the current impacts they are causing, as well as to prevent future spread. Many regional Catchment Management Authorities (CMA) or Natural Resource Management (NRM) bodies address the impacts of willows on river health through the implementation of their Regional River Health Strategies.

Current/potential distribution

Willows impact upon thousands of kilometres of waterways, wetlands, drainage lines and other moist areas across Victoria, New South Wales, the ACT and Tasmania. They are also known to occur to a much lesser extent in South Australia, southern Queensland and Western Australia. Information on the current distribution of willows, including the gender, subgenus and, in some cases, species is essential for planning an effective willow management strategy. Such information is seriously lacking in all states/territories.

The extent of willow infestation in Australia has not been well documented and records that do exist often lack key information necessary for effective management.

Willow management priorities

Eradication of willows across Australia is not feasible or desirable. Instead, we need to prioritise the selective removal of undesirable willows. In general, willows should be prioritised for control if they are:

- ◆ female willows growing near male plants (within about 2km) and/or producing viable seed;
- ◆ 'fragile' willows (that is, with branches that easily break off) growing along waterways;
- ◆ causing impacts to river health or other social, environmental or economic values.

To do this, we require information on the gender, subgenus and brittleness of all willows.

1. Is the plant male, female or both?

Most willow plants are either male or female, with a few rare exceptions where both male and female flowers occur on the one plant. If plants of both sexes are present in a locality, pollination can result. It is therefore important to know the sex of willows, as an indication of their ability to spread by seed.

The sex of the plant can be determined in spring when flowering occurs

Willows flower for approximately 3 weeks each year between the months of August and November. Flowering times vary among species and according to climate. In general, if a male and female plant from the same subgenus (i.e. 'tree', 'shrub' or 'alpine') flower at the same time, they can hybridise and form new plants.



Willow catkins

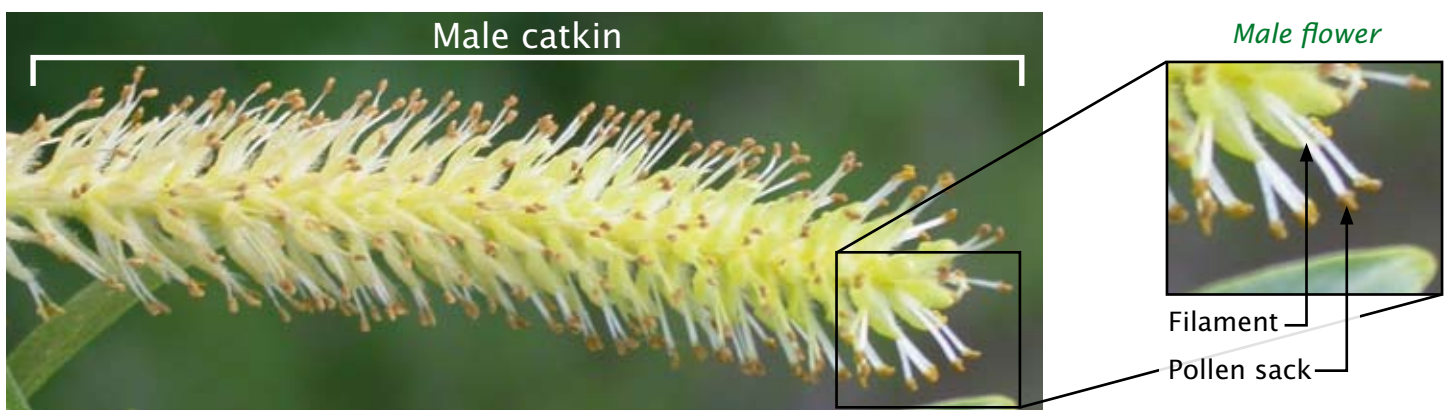
Catkins are inflorescences comprising of 100 or more male or female **flowers**. Female flowers produce **nectar** only, whereas male flowers produce nectar and **pollen**. It is believed that insects mostly pollinate the flowers (attracted by the nectar), but it is possible that some wind pollination may occur.

A simple way of determining if the catkin is male or female is to remember that only males produce pollen.

Male flowers have **stamens** that consist of a fine **filament** tipped by two yellow **pollen sacs**, which release yellow pollen when mature. **Female** flowers, on the other hand, each have a single bulbous green **ovary** topped by a **stigma**. This ovary later matures into a capsule that splits open and releases fluffy seed.

Willow seedlings growing along the King River, North East Victoria. The seed of some willows can spread long distances by wind, so even the most remote environments are at risk of invasion.

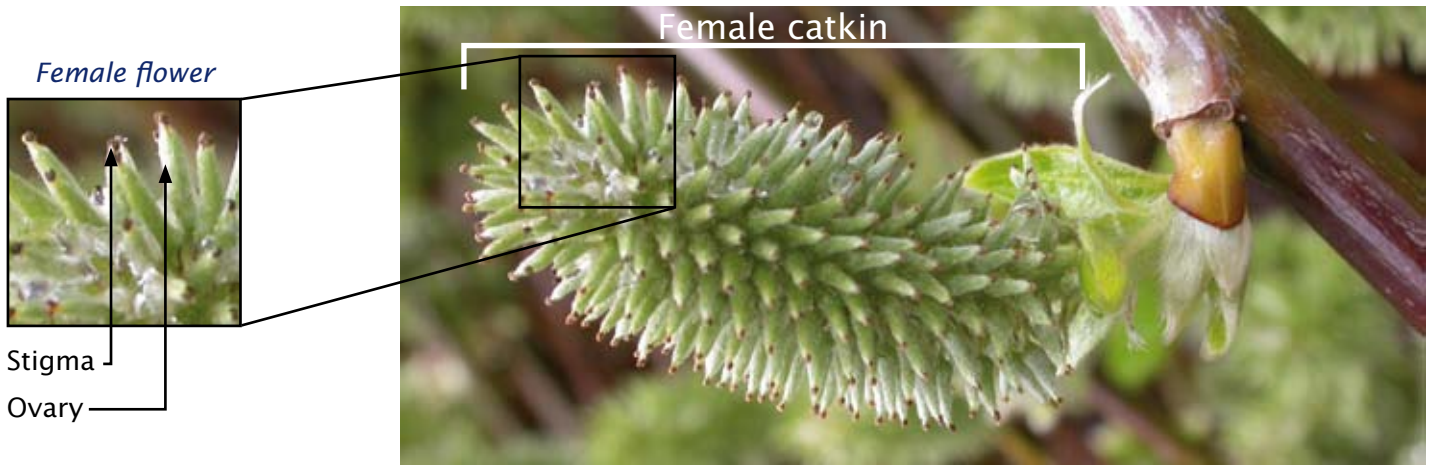
Male: Each flower on a male catkin has several stamens, which consist of fine filaments with **bright yellow pollen sacs** at the tips



Above: Male catkin from a crack willow (*Salix fragilis* var. *fragilis*). Each flower has 2 or more stamens, each consisting of a fine filament and bright yellow pollen sack (Photo: Matthew Baker)

Willow identification

Female: Each flower on a female catkin has a single bulbous green ovary topped by a single stigma.



Above: Female catkin from a grey sallow (*Salix cinerea*). Each flower has a bulbous green ovary and is topped by a single stigma (Photo: Matthew Baker).

Catkins can vary in size and shape between willow species. For example, *Salix cinerea* has egg-shaped catkins, while *Salix alba* has long, slender catkins.



Above: If pollinated, female catkins produce lots of fluffy seeds that can be dispersed long distances by wind.



Above: (left) Male *Salix cinerea* catkins and (right) female *Salix alba* catkins. Note: (right) the 'tree' willow's leaves have emerged with the catkins and (left) there are no leaves on the stem as the 'shrub' willow's catkins have emerged before the leaves.

Male and female flowers on the same catkin!

In some rare instances, male and female flowers can form on the same plant and sometimes even on the same catkin. The golden weeping willow (*Salix x sepulcralis* var. *chryscocoma*) and the New Zealand hybrids (*Salix matsudana* x *S. alba*) can both develop male and female flowers on the one plant. This allows the plant to fertilise its own flowers, enabling a single, isolated tree to set viable seed.



Above: Catkins with both male and female flowers from (left) a golden weeping willow (*Salix x sepulcralis* var. *chryscocoma*) and (right) a New Zealand hybrid willow (*S. matsudana* x *S. alba*).

3. Is the willow a 'tree' or 'shrub'?

If both female and male plants from the same subgenus (either 'shrub' or 'tree') are present in an area and their flowering times overlap, pollination is likely to occur and viable seed produced. Identifying which of these major groupings (or subgenera) the willow belongs to will help prioritise where resources should be allocated for management. The following table outlines some features that can generally be used to distinguish between tree and shrub willows. It is important to note, however, that there are some exceptions to the rules.

Shrub willows - osiers vs pussy willows

Both osiers (e.g. common and purple osiers) and pussy willows (e.g. grey sallow and pussy willow) belong to the subgenus *Vetrix* (shrub willows). Osiers are similar to pussy willows in having many stems, flexible branches, generally rather smooth bark and dark flower scales (you will only be able to see flower scales with an eye glass or microscope). However, osiers have several features that resemble tree willows (subgenus *Salix*). Like tree willows, osiers generally have long, narrow leaves and catkins and, in some cases, the catkins of the common osier (*Salix viminalis*) emerge with the leaves, a feature otherwise only seen in 'tree willows'.

Tree willows (subgenus *Salix*)

Includes *Salix fragilis*, *Salix nigra*, *Salix babylonica* and *Salix alba* var. *vitellina*

Form Single to multi-stemmed tree or shrub
10–20 metres tall at full size; weeping or upright



Shrub willows (osiers and pussy willows) (subgenus *Vetrix*)

The pussy willows include *Salix cinerea*, *Salix x reichardtii*. The osiers include *Salix purpurea* and *Salix viminalis*

Multi-stemmed low shrub to small tree
4–9 metres tall at full size

Stems

- ◆ Generally break easily at the base – some may crack more easily than others

Bark

- ◆ Do not break easily – branches flexible at the base
- ◆ Generally rather smooth, but can become somewhat fissured with age



Leaves

- ◆ Long and narrow, shaped like a canoe when seen from above
- ◆ Toothed margins
- ◆ Length usually more than 3x the width
- ◆ Silky or hairless



Osiers:

- ◆ Thin, long and narrow, usually 5-10 times longer than wide
- ◆ Margins usually smooth, sometimes irregularly toothed



Osier

Pussy willows:

- ◆ Thick, generally oval to elliptic in shape
- ◆ Irregularly toothed margins, hairy with conspicuous veins beneath
- ◆ Usually less than 3 times longer than wide



Pussy willow

Catkins

- ◆ Emerge with the leaves, hence leaves and catkins both present on the stems
- ◆ Slender and cylindrical, upright or sometimes drooping
- ◆ Flower scales pale green or yellow



Yellow flower scale

Osiers:

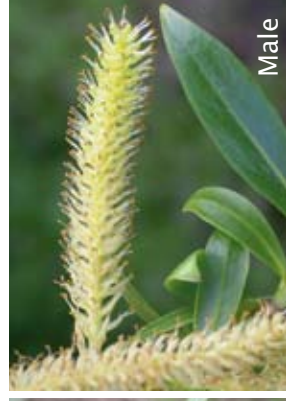
- ◆ Long, cylindrical, 1.5-5cm long, closely spaced along one-year-old shoots, may emerge before or with the leaves

Pussy willows:

- ◆ Short and oval-shaped and produce lots of fluffy seed
- ◆ Emerge well before the leaves, hence no leaves are seen on the stems; flower scales dark



Female



Male



Pussy willow

4. How brittle are the branches?

Determining how brittle (or fragile) the branches are will indicate how easily a willow can spread by branches breaking off and rooting downstream.

Do the crack test! Break a twig off at its base. If it cracks or breaks easily, then it has brittle branches and will spread easily by vegetative means.

Try to break the twig off here at the base



5. What is the willow species, subspecies, variety or hybrid?

The following is a guide to identifying key willows that are recognised as being invasive in Australia. This is by no means a comprehensive list and other species not listed may also be extremely invasive. This list will need to be updated as we gain further information on the invasiveness, risk and current and potential distribution of different willows in Australia.

What features do I look for, at what time of year?

The following plant features will help you identify the willow or group of willows you are looking at. Some of these features can only be seen at a certain time of year, whereas others can be seen all year round. Also, certain characteristics (such as leaf hairiness, bark colour/texture and leaf shape) can vary depending on the time of year, growing conditions and tree or shrub age.

Even if you are unsure which willow you are dealing with, record information on the following features, so that someone else may be able to later identify it.



(Left) Some characteristics of a willow can vary depending on tree or shrub age. E.g. black willow (*Salix nigra*) has a conical shaped crown when young but forms a broader crown when old.

Feature of the plant

Form – tree or shrub; narrow or wide crown; single-stemmed or multi-stemmed; weeping, contorted or upright branches

Stems/branches – colour; degree of brittleness or flexibility (do they snap when broken); straight or curvy; are there ridges under the bark

Bark – colour and texture (rough or smooth) along the trunk

Roots – colour of exposed roots (pink or white)

Leaves – size, shape, colour on both sides, degree of hairiness, edge shape (smooth or jagged) and number of veins.

Flowers/catkins – shape, size, sex, number of flowering parts and flowering time

Time of year

Any time of year

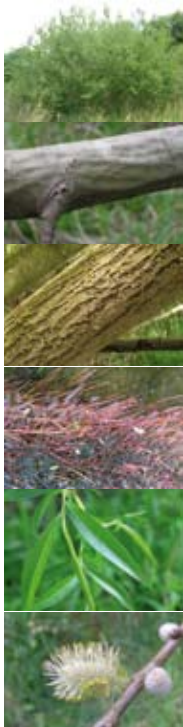
Any time of year

Any time of year

Any time of year

Summer to Autumn

Spring



6. How to collect a willow specimen?

If you are uncertain about the willow species (or variety or hybrid) you are dealing with, collect a specimen and send it to your local herbarium or expert for advice (see Further Information for contact details). Sending a plant sample to the herbarium has the added benefit of establishing a permanent record of that plant at a particular location and time. This assists our understanding of the distribution and ecological preferences of that species.

Remember, it takes almost as much effort to prepare a poor specimen as it does to prepare an excellent specimen.

For accurate identification of willows, complete specimens should be collected at two periods of the year - in the spring for catkins (or flowers) and in the summer or early autumn for mature foliage. If a site can only be visited once, collect material in the summer or early autumn, as leaves provide more valuable information for identification than catkins do.

If you discover willow seedlings in an area, collect specimens of likely parents growing in the neighbourhood also, to aid identification and management.

1. Complete a label that includes the information outlined on the right;
2. Collect a healthy specimen (approx. 30cm long), with leaves and twigs. If possible, return in spring to collect catkins and/or seed bearing capsules;
3. Take a photo of the tree form and bark;
4. If specimen is dirty, gently clean it with water and dry;
(Note: if you do not have paper with you when collecting, place specimen in a dry plastic bag and press within 24 hours)
5. Place specimen between several sheets of newspaper;
6. Arrange the specimen so that all parts can be clearly seen (stems and both sides of leaves);
7. Place weights on specimen to apply pressure and flatten the specimen;
(Note: this can be done with objects such as books or boards with bricks on top);
8. Change newspaper daily for the first few days, then weekly until dry;
9. When dry, put specimen between 2 sheets of newspaper, then 2 sheets of firm cardboard;

10. Place catkins and/or seed in a labelled envelope with specimen;
11. Check that the specimen is correctly labelled;
12. Securely wrap package;
13. Attach a letter with your contact details and request for identification.

Label

The information recorded on the label is as important as the specimen you collect.

For each specimen collected, attach a label with the following information.

Example only: Four Specimen Information labels are available on the back of this booklet for photocopying.

Specimen information	
Number (year/month/day/sequential number):	_____
Name:	_____
Date:	_____
Precise location (on a map or latitude/longitude or easting/northing):	_____
Town:	_____ State: _____
Growth form (e.g. tree, shrub; weeper, non-weeper):	_____
Number of trunks (emerging from base):	_____
Height (m):	_____
Bark texture (rough or smooth) & colour:	_____
Colour:	
fresh stems	_____
leaves – upper	_____
leaves – under	_____
catkins (flowers)	_____
roots (if visible)	_____
Habitat (e.g. riverbank, wetland, grazed paddock, drainage line, riparian forest etc.):	_____
Abundance of mature plants (no./ freq. of plants) and presence of seedlings:	_____
Other info (e.g. damage to tree, growing in stream or along bank etc.):	_____

Tree Willows - Upright

Salix nigra Black willow

Deeply fissured grey bark on stems over 10cm diameter and leaves almost equal bright green on both sides. Spreads aggressively by seed and branches in NSW and Vic.

- ◆ Up to 20m tall
- ◆ Crown conical when young, broad when old in isolation
- ◆ Usually with a single prominent stem



Salix fragilis Crack willow

Distinctive glossy, greenish brown, hairless twigs snap off at base very easily with a loud crack. Bright red/pink rootlets in water. *S. x rubens* can look very similar.

- ◆ Up to 20m high
- ◆ Broad rounded crown, wide spreading branches
- ◆ Trunk divides into major branches at ground level



Salix x rubens Gold-crack willow

A hybrid of *S. fragilis* and *S. alba*, with appearance intermediate between. One of the most abundant and widespread willows. Both sexes often present, rootlets pink or partly pink in water.

- ◆ Up to 20-25m high
- ◆ Broad rounded crown, spreading branches
- ◆ 10-20+ apparently independent stems, which are actually low branches emerging from the accumulating sediment



Salix alba var. *vitellina* Golden willow

Yellow or orange-yellow twigs, wide spreading crown, slightly hairy on underside of mature leaf and distinctive white rootlets in water. Older twigs not brittle at point of attachment.

- ◆ Up to 15-20m high
- ◆ Open crown and spreading branches; may weep in lower crown
- ◆ Usually with a single stem



Distinguishing features

- Habit/form
- Height
- Shape of crown
- Number of stems

Bark

- Roughness
- Colour

- ◆ Usually deeply fissured on stems >10cm in diameter



- ◆ Rough and fissured with age
- ◆ Greyish-brown



- ◆ Rough and fissured with age
- ◆ Greyish-brown



- ◆ Rough and fissured with age
- ◆ Greyish-brown



Shoots/twigs

- Colour
 - Brittleness/flexibility
 - Hairiness
 - Other
- ◆ Shiny red-brown
 - ◆ Brittle at base
 - ◆ Predominantly hairless
 - ◆ Rough on stems down to 10cm diameter; scaly when older; slender but not drooping



- ◆ Shiny; grey-green in summer, yellow-brown in winter
- ◆ Very brittle at point of attachment to branch (twigs snap off easily at base, without stripping any bark)
- ◆ sparse short hairs when young, becoming hairless
- ◆ Never weeping



- ◆ Colour variable, red, yellow-orange, olive-green or brownish-green
- ◆ Slight to very brittle at base
- ◆ Thinly hairy at first, becoming hairless



- ◆ Very orange-yellow to more than 1m from tips, later yellowish brown
- ◆ Not very fragile – when twig is broken off, it will peel bark away with it
- ◆ Fine, short hairs at first, soon becoming hairless



Leaves

- Size and shape
 - Colour on both sides and degree of hairiness
 - Time it emerges
- ◆ Thin, linear
 - ◆ Equally bright green on both sides, hairless

- ◆ 7-13cm long (mostly over 8cm) and slender
- ◆ Shiny, dark green, hairless above. Paler, bluish-whitish, soon hairless below
- ◆ Emerge 1 month later than *S. alba*.

- ◆ 7-12cm long, 1.5-3cm wide; narrow and long or elliptical; serrated edges
- ◆ Usually shiny green above. Bluish grey below, soon becoming hairless

- ◆ 8-12cm long; 1.5-2cm wide; fine serrations on edges
- ◆ Lustrous green and slightly hairy above, bluish grey and thinly hairy below
- ◆ Emerge August-September

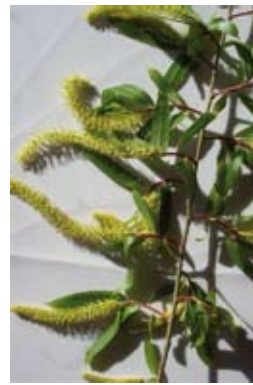
Catkins/flowers

- Male and female trees equally common
- 6-12 cm long with widely spaced 6mm long flowers, with 4-7 stamens per flower; ovary on 2mm long stalk

- ◆ Mostly male, females rare
- ◆ 4-9cm long, slender and cylindrical, drooping on hairy stalks
- ◆ appears with or after leaves; flowers September-October

- ◆ Male or female
- ◆ 3.5-6cm long; narrowly cylindrical; usually spreading
- ◆ Appears with or after leaves; flowers September-October
- ◆ Similar to *S. fragilis* (left) or *S. alba* (right)

- ◆ Female or male
- ◆ 4-6cm long; narrow, cylindrical and curved
- ◆ Late flowering September-October



Tree Willows - Upright and Weeping

Salix matsudana x *alba* New Zealand hybrid

Single-stemmed, erect, steeply branched, narrow crown, culminating in a tip. Twigs flexible and not readily detaching. Not yet common. Spreads easily by seed

- ◆ Tall tree to 25m high
- ◆ Narrow or moderately spreading apical-shaped crown; erect branches
- ◆ Single prominent stem to top of tree



Salix matsudana 'Tortuosa' Tortured willow

Strongly twisted outer branches, twigs and leaves. Bright green foliage and very short cylindrical catkins. A cultivar of *S. matsudana*.

- ◆ Tree to 15-20m high
- ◆ Narrow rounded crown, erect but outer most branches sometimes slightly weeping.



Salix x *sepulcralis* var. *chrysocoma* Golden weeping willow

Golden or greyish yellow twigs and sometimes both sexes on same catkins. Catkins on stalks 1-5mm long. Long weeping branches and river narrowing habit.

- ◆ Tree to 15-20m high; equal height to width
- ◆ Wide-spreading rounded crown; long weeping branches



Salix babylonica Weeping willow

Dense foliage and long, slender, weeping twigs that often touch the ground in mature plants. Earliest flowering tree willow. Can form hybrids with *S. alba* and *S. fragilis*.

- ◆ Tree to 15-20m high; taller than it is wide
- ◆ Wide-spreading, rounded crown, very weeping branches



Distinguishing features

- **Habit / form**
- Height
- Shape of crown
- Number of stems

Bark

- Roughness
- Colour

- ◆ Fissured
- ◆ Grey-brown to dark brown



- ◆ Moderately fissured with age
- ◆ Grey-brown to dark brown



- ◆ Fissured with age
- ◆ Grey-brown to dark brown



- ◆ Moderately fissured with age
- ◆ Grey



Shoots/twigs

- Reddish green, becoming grey-green or reddish-brown
- Slender; spreading or erect; slightly to moderately brittle
- Becoming hairless

Leaves

- Size and shape lanceolate; serrated edges
- Colour on both sides and degree of hairiness light green to bluish green; silky hairy when young, becoming sparsely hairy above
- Time it emerges

Catkins/flowers

- Male/Female/both same catkin
- Size and shape of catkins narrow, cylindrical, 2-3.5cm long and 6-12mm wide
- Time it emerges appears with or after leaves in September-October, similar to *S. babylonica* and *S. alba*

- ◆ Lustrous green to dark reddish, finally brown
- ◆ Moderately brittle, slender, spreading or erect
- ◆ Hairy at first, becoming hairless

- ◆ 8-13cm long, 1-2.5cm wide, narrow and long, tapering to a thread; margins finely serrated, blades markedly twisted and buckled
- ◆ Bright green above, often blue-green below; silky hairy at first, soon becoming hairless

- ◆ Female only
- ◆ Short, cylindrical, 2cm long
- ◆ Very dark bud scales
- ◆ Flowers late Sept-Oct with or after leaves. Hybridises with *S. fragilis* and *S. matsudana* x *alba*
- ◆ Seed produced has low viability

- ◆ Greenish or brownish green
- ◆ Long, slender, weeping
- ◆ Hairs when young, becoming hairless

- ◆ 7-18cm long, 0.5-2.5cm wide; fine serrations (or bumps) on margins; leaf tips drawn out and wavy
- ◆ Slightly shiny, medium green above; bluish grey below; hairs at first, becoming hairless

- ◆ Female only
- ◆ Narrow, cylindrical and often curved; 0.6-2.8cm long, almost stalkless
- ◆ Usually appears with but sometimes after leaves; flowers early in August-September

- ◆ Golden yellow to greenish yellow for more than 1m from tips
- ◆ Slender, moderately brittle
- ◆ Silky when young then hairless

- ◆ 7-18.5cm long, 0.8-2.9cm wide; narrow-long to narrow-elliptical; pointed but not drawn out; fine serrations on edges
- ◆ Bright green above; bluish-grey below; silky on both sides at first, becoming hairless

- ◆ Male, female or both sexes on same catkin
- ◆ 2-5cm long, narrow, cylindrical and slightly curved; distinctly stalked (1-5mm); ovary not much longer than pale yellow catkin scale
- ◆ Flowers September-October



Shrub Willows - Pussy Willows and Osiers

	<i>Salix cinerea</i> Grey sallow	<i>Salix x reichardtii</i> Pussy willow	<i>Salix viminalis</i> Common osier	<i>Salix purpurea</i> Purple osier
Distinguishing features	Longitudinal ridges on the wood beneath the bark (sometimes visible on the outside of smooth branches also). Wide rounded crown (wider than it is high). Oval shaped leaves. Branches flexible. Can spread by seed 10's of kilometres from the initial source.	Hybrid between <i>S. caprea</i> and <i>S. cinerea</i> . Variable in its characteristics but generally differs from <i>S. cinerea</i> in having longer leaves with more pointed tips, very showy, silver catkins and being taller than it is wide when mature.	Long, narrow leaves, dark green above, pale silky below, with toothless inrolled margins. No ridges beneath bark. Stigma cut in two for about half its length. Leaves not bitter to taste.	Many leaves opposite or semi-opposite, especially near shoot tips; leaves wider above the middle (kite shaped) and bitter to taste. Clumped, multi-stemmed habit, young twigs sometimes purplish. Mainly occurs in the Snowy Mountains region.

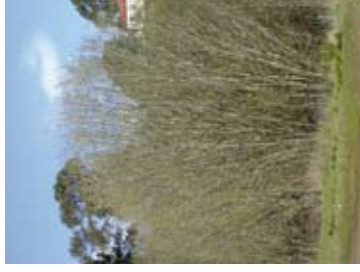
Habit / form

- Height
- Shape of crown
- Number of stems

- ◆ 6-12m high
- ◆ Wide, rounded crown (much wider than high in mature trees)
- ◆ Several sturdy branches arising near ground level



- ◆ 6-12m high, significantly higher than it is wide
- ◆ Several upright stems arising from a short trunk



- ◆ To about 8m high, but usually 3-6m high
- ◆ Erect form
- ◆ Several upright stems



- ◆ To about 8m high
- ◆ Variable in habit, from erect to spreading, often with slender, graceful branches

Bark

- Roughness
- Colour

- ◆ Rather smooth at first, becoming fissured with age



- ◆ Rather smooth, shallowly fissured near base
- ◆ Greyish-brown



- ◆ Rather smooth
- ◆ Greyish-brown

- ◆ Rather smooth
- ◆ Grey, inner bark yellow

Shoots/twigs

- Colour
 - Brittleness/flexibility
 - Hairiness
- ◆ Greenish, greyish, redish or purple
 - ◆ Not brittle, long striations/ridges visible on wood beneath bark (may need to peel the bark to see the ridges)
 - ◆ Usually hairy at first, becoming hairless



- ◆ Olive to reddish-brown
- ◆ Not brittle; smooth with a few short striations/ridges beneath bark
- ◆ Very hairy when young



- ◆ Green to yellowish green; sometimes yellowish brown to reddish brown, especially when exposed to the sun
 - ◆ Slender and very tough and flexible; no striations beneath bark
 - ◆ Densely hairy at first, becoming hairless
- ◆ Grey-green to yellowish green; sometimes yellowish brown, reddish brown or purple when young
 - ◆ Long, straight, very tough and flexible
 - ◆ Densely hairy at first, becoming hairless

Leaves

- Size and shape
- Colour on both sides and degree of hairiness
- Time it emerges

- ◆ 2-7cm long, 1.5-3.5cm wide, generally oval, broadest in middle, sometimes elliptic; tip short, pointed; margins sparsely and irregularly toothed.
- ◆ Hairy both sides; dense grey hairs below or sometimes sparsely covered in reddish brown hairs
- ◆ Emerge late September after catkins

- ◆ 4-10cm long, 2.5-5.5cm wide; oval to elliptic; margins rippled and sparsely toothed, leathery, broadest above middle
- ◆ Mid-green above, becoming hairless except for midribs

- ◆ Rather erect, long and narrow, 6-18cm long, 0.5-2cm wide; margins not toothed and often recurved
 - ◆ Dark shining green above; usually covered with whitish or greyish silky down below
 - ◆ Juvenile leaves often longer and narrower than older leaves
- ◆ Long and narrow, 2.5-11cm long, 0.5-2cm wide; often opposite towards the tips of the shoot; mostly broadening above the middle and minutely toothed towards the tip
 - ◆ Dark glossy green above; bluish green or glaucous below; sometimes hairy when young, becoming hairless

Catkins/flowers

- Male/Female/both
 - Size and shape of catkins
 - Time it emerges
- ◆ Male only, but may hybridise with female *S. cinerea*
 - ◆ Broad, oblong catkins, 2-3.5cm long with red buds
 - ◆ Emerge before leaves
- ◆ Male or female or both
 - ◆ Male flowers ovate in shape and white with yellow tips; female flowers green and cylindrical-ovate in shape
 - ◆ Begin to emerge in late August before the leave (earlier than most other willows) and shed lots of seed 4 weeks after flowering

- ◆ Male or female
- ◆ Cylindric, 1.5-6cm long and 0.5-1cm wide, stigma cut in two for about half its length (bifid)
- ◆ Appear before or as leaves emerge in August to October, depending on altitude

- ◆ Male or female
- ◆ Narrowly cylindric, often curved; male catkins 1.5-3cm long; female catkins 2-4cm long; often in semi-opposite pairs
- ◆ Emerge before leaves in August to September

Female



Male



Further information

Relevant weblinks:

For further information on willows and links to other willow-related websites go to:

www.weeds.org.au/WoNS/willows

Australia's Virtual Herbarium provides links to State and Territory herbarium websites:

www.anbg.gov.au/avh

Acknowledgements:

Thank you to the following people for generously supplying pictures; Matthew Baker, Kyla Finlay, Fiona Ede, Terry McCormack, Jamie Davies, Robin Adair, Sarah Holland Clift. Geoff Carr for his invaluable scientific key to willows in Australia.

Further reading/references:

Cremer, K.W. (1995). *Willow identification for River Management in Australia*. Technical Paper No. 3., CSIRO Division of Forestry, Canberra, Australia.

Willow identification contacts by state/territory:

Note: Some herbaria charge a fee to identify specimens. Please refer to the relevant website or contact the person directly to determine costs.

Australian Capital Territory

Plant Enquiry Service
Australian National Botanic Gardens
GPO Box 1777
Canberra ACT 2601
Ph: (02) 6250 9540

New South Wales

Botanical Information Service
National Herbarium of NSW
Botanic Gardens Trust
Mrs Macquaries Road
Sydney NSW 2000
Fax: (02) 9251 1952

Queensland

Botanical Information and Advisory Service
Queensland Herbarium
Brisbane Botanic Gardens, Mt Coot-tha
Mt Coot-tha Rd
Toowong QLD 4066
Ph.: (07) 3896 9326 Fax: (07) 3896 9624
Queensland.Herbarium@epa.qld.gov.au

South Australia

Plant Biodiversity Centre
PO Box 2732
Kent Town SA 5071
Ph: (08) 8222 9307 Fax: (08) 8222 9353

Tasmania

Matthew Baker
Curator, Weed Taxonomy
Tasmanian Herbarium
Private Bag 4
Hobart TAS 7001
Ph: (03) 6226 1029 Fax: (03) 6226 7865
Matthew.Baker@tmag.tas.gov.au

Victoria

Geoff Carr
Director, Principal Botanist
Ecology Australia Pty. Ltd.
88b Station St
Fairfield VIC 3078
Ph: (03) 9489 4191 Fax (03) 9481 7679
gcarr@ecologyaustralia.com.au

Identifications and Information Service
Royal Botanic Gardens Melbourne
Private Bag 2000
South Yarra
Victoria 3141
Ph: (03) 9252 2300 Fax: (03) 9252 2442

Western Australia

Western Australian Herbarium
Department of Environment and Conservation
Locked Bag 104
Bentley Delivery Centre WA 6983
Ph: (08) 9334 0500 Fax: (08) 9334 0515
herbarium@dec.wa.gov.au

Compiled by Sarah Holland Clift from:

Cremer, K. W. (1995). Willow identification for River Management in Australia. Technical paper No. 3. CSIRO Division of Forestry, Canberra, Australia.

Van Kraayenoord, C. W. S., Slui, B. and F. B. Knowles (1995). Introduced Forest Trees in New Zealand: Recognition, role and seed source, 15. The Willows *Salix* spp. New Zealand Forest Research Institute Limited.

Meikle, R. D. (1984). Willows and Poplars of Great Britain and Ireland. Botanical Society of the British Isles, London.

Specimen information

Number (year/month/day/sequential number): _____

Name: _____

Date: _____

Precise location (on a map or latitude/longitude or easting/northing): _____

Town: _____ State: _____

Growth form (e.g. tree, shrub; weeper, non-weeper): _____

Number of trunks (emerging from base): _____

Height (m): _____

Bark texture (rough or smooth) & colour: _____

Colour:

fresh stems _____

leaves – upper _____

leaves – under _____

catkins (flowers) _____

roots (if visible) _____

Habitat (e.g. riverbank, wetland, grazed paddock, drainage line, riparian forest etc.): _____

Abundance of mature plants (no./ freq. of plants) and presence of seedlings: _____

Other info (e.g. damage to tree, growing in stream or along bank etc.): _____

Specimen information

Number (year/month/day/sequential number): _____

Name: _____

Date: _____

Precise location (on a map or latitude/longitude or easting/northing): _____

Town: _____ State: _____

Growth form (e.g. tree, shrub; weeper, non-weeper): _____

Number of trunks (emerging from base): _____

Height (m): _____

Bark texture (rough or smooth) & colour: _____

Colour:

fresh stems _____

leaves – upper _____

leaves – under _____

catkins (flowers) _____

roots (if visible) _____

Habitat (e.g. riverbank, wetland, grazed paddock, drainage line, riparian forest etc.): _____

Abundance of mature plants (no./ freq. of plants) and presence of seedlings: _____

Other info (e.g. damage to tree, growing in stream or along bank etc.): _____

Specimen information

Number (year/month/day/sequential number): _____

Name: _____

Date: _____

Precise location (on a map or latitude/longitude or easting/northing): _____

Town: _____ State: _____

Growth form (e.g. tree, shrub; weeper, non-weeper): _____

Number of trunks (emerging from base): _____

Height (m): _____

Bark texture (rough or smooth) & colour: _____

Colour:

fresh stems _____

leaves – upper _____

leaves – under _____

catkins (flowers) _____

roots (if visible) _____

Habitat (e.g. riverbank, wetland, grazed paddock, drainage line, riparian forest etc.): _____

Abundance of mature plants (no./ freq. of plants) and presence of seedlings: _____

Other info (e.g. damage to tree, growing in stream or along bank etc.): _____

Specimen information

Number (year/month/day/sequential number): _____

Name: _____

Date: _____

Precise location (on a map or latitude/longitude or easting/northing): _____

Town: _____ State: _____

Growth form (e.g. tree, shrub; weeper, non-weeper): _____

Number of trunks (emerging from base): _____

Height (m): _____

Bark texture (rough or smooth) & colour: _____

Colour:

fresh stems _____

leaves – upper _____

leaves – under _____

catkins (flowers) _____

roots (if visible) _____

Habitat (e.g. riverbank, wetland, grazed paddock, drainage line, riparian forest etc.): _____

Abundance of mature plants (no./ freq. of plants) and presence of seedlings: _____

Other info (e.g. damage to tree, growing in stream or along bank etc.): _____
