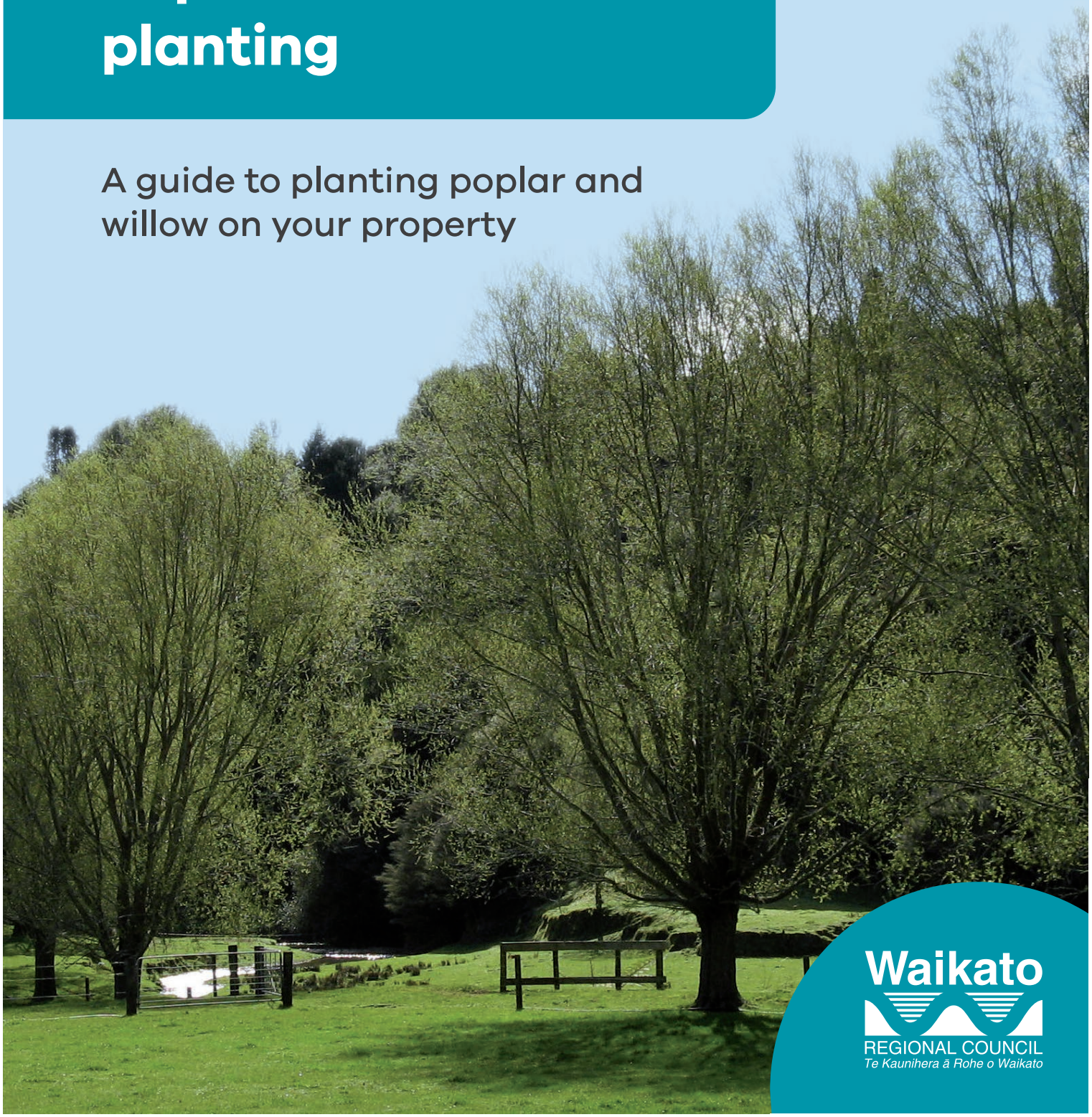
Te whakatō pāpara me ngā wirou
Poplar and willow planting

A guide to planting poplar and willow on your property



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Acknowledgements

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Hort Research Palmerston North

Horizons Regional Council

Taranaki Regional Council

Hawke's Bay Regional Council

For further information on planting trees, contact your local Waikato Regional Council catchment management officer on 0800 800 401.

Ngā ūpoko
Contents

Mō te aha te whakatō pāpara, wirou rānei?
Why plant poplar or willow?

Poplar and willow are ideal to plant on erosion prone hillsides and streams as their extensive root systems bind and hold the soil in place.

Some varieties are also used to provide shelter and wind breaks. Some of the other benefits of poplar and willow are listed below. Waikato Regional Council catchment management staff can provide you with advice and assistance on planting willow and poplar poles/bare rooted plants.

This guide will provide information on various aspects of planting to ensure the best possible strike and survival rates.

Benefits of poplar and willow

- Extensive root system – excellent for stabilising eroding soils.
- Poles can be grown in the presence of stock (if using pole protectors).
- The trees lose their leaves during winter, so light is let through to the pasture when it is needed and provides shade during the hot summer months.
- Some varieties can be grown for timber – depending on market conditions, they can have revenue potential.
- Frost tolerant.
- Rapid breakdown of leaf litter (minimal impact on soil pH).
- Relatively fast growing.
- Eye catching colours in autumn and early spring.
- Excellent for stock fodder.
- Tolerate a range of environmental conditions including flooding and drought.
- Can easily be grown from cuttings.
- Quick and easy to plant.

Poplar planting to help prevent erosion.

FACT

Poplar and willow produce useful stock feed, which can be an extra reserve during droughts.

Common supplements such as silage, lucerne, feed grains (such as barley), and summer feed crops tend to be in short supply and can be very expensive in drought times. Poplar leaves are equal to lucerne hay and silage in terms of their food value per kilogram of dry matter. The table below provides a comparison of various foods.

COMPARATIVE FEED VALUE

	% dry matter (DM)	% digestible DM	Metabolisable energy (Mj/kgDM)
Poplar/willow	90	65	10
Lucerne hay	90	65	10
Pasture silage	30	70	10
Pasture hay	85	53	8

Poplar and willow can be fed to stock by pruning selective branches, pollarding or coppicing (see section on post planting care). Many farmers plant poplar and willow to stabilise areas next to farm assets like fences, bridges and tracks. Poplar and willow have been used for erosion control by regional authorities and land owners since the early 1900s.

Ngā whakaaro matua
Important considerations

Avoid planting pest poplar or willow

Some species of willow and poplar such as crack willow, pussy willow and silver poplar are easily spread and are capable of becoming a pest plant. Crack willow is brittle and grows from small fragments, pussy willow seeds prolifically and silver poplar puts out suckers from its roots. Care should be taken only to plant varieties of poplar and willow especially developed for soil conservation purposes. For example, Salix matsudana x alba hybrid tree willow (see varieties below).

Purchasing poplar or willow poles, or rooted cuttings from a nursery is recommended to ensure you are purchasing non-invasive varieties that have been specially bred for soil conservation.

If planting willows near water, always use male varieties such as Moutere, Adair, Hiwinui, Wairakei, or Hathaway.

Pest willow growing within the stream channel.

Inter-planting with native plants

Consider inter-planting poplar and willow with native plant species. Depending on the variety of willow or poplar, life spans range from 15 to 35 years (unless rejuvenated by coppicing), after which time they can become brittle and less effective for soil conservation purposes. On the other hand, most native plants will survive for hundreds of years with very little long-term maintenance requirements.

Willow and poplar are usually chosen over native plants – they are faster growing and therefore provide land and stream bank stability more immediately, while tolerating a range of soil and environmental conditions.

If stock are excluded from the planting site it can be beneficial to interplant poplar and/or willow with natives to offer long-term soil stabilisation. Once native plants are established (approximately 10 years) willow/poplar trees can be poisoned or cut down, leaving the native species to perform the soil conservation function.

Poplar poles interplanted with native flax.

Te whakatō rakau ki ngā tahataha kōawa
Streamside planting

Poplar and willow planting may be undertaken to aid in stabilising gullies and river and stream banks, or to provide vegetative protection to riparian areas.

Planting densities range from 1 to 20 m apart with consideration given to the severity of the erosion and long-term maintenance. The following information contains some basic types of planting methods that can be adopted.

Tree willow and poplar

Tree willow and poplar grow into large trees – some up to 20 metres high, nearly always with a single trunk. They have fibrous root systems with excellent soil binding characteristics.

Both poplar and willow will tolerate relatively dry sites with poor soils, but will grow best in well watered fertile soils. Willow are also suited to very wet sites, including partially submerged conditions.

When planting along waterways, plant placement is extremely important to ensure long-term maintenance is reduced. If trees are planted too close to the stream (with the exception of shrub willow) they can become too heavy for the stream bank, fall over and damage the stream bank in the process.

Plantings should be located at least three metres back from the top of the stream bank.

Moutere tree willow planting for stream bank stabilisation.

Shrub willow

Some shrub willow have been specifically developed for river control purposes. These are medium sized, low shrub types that grow with several stems of a slender nature and have flexible branches that are unlikely to break off in high river flows.

If planted at 1-2 m spacing at the base of an eroding bank, shrub willow will bush out into the water helping to deflect the current away from the eroding area. In combination with a technique called willow layering, shrub willow can be used to slow water flow, resulting in deposition of sediment, thus helping to rebuild the eroded bank.

Shrub willow should only be planted on wide streams as it can become very bushy and block the water flow once fully grown. When used together with tree willow or poplar, the two trees are able to complement each other, and once established can provide excellent bank protection in a harsh river environment.

Shrub willow planting to protect an eroding corner on a stream bank.

Willow and poplar inter-planted with native species

Don't forget to consider inter-planting poplar and willow with native plant species for continued bank protection after they reach the end of their life. Native species such as cabbage tree (Cordyline australis), flax (Phormium tenax), ribbonwood (Plagianthus regius) and various pittosporum species can offer long-term soil stabilisation.

Willow planting either side of a floodway.

Maintenance

Because of their vigorous growth and limited lifespan (15-35 years), poplar and willow plantings need to be monitored and managed to ensure their ongoing effectiveness.

This can include the following:

- Thinning, where initial planting densities were high to achieve early protection, but tree health is compromised as they compete with each other. Because of their ability to coppice (re-grow), tree stumps need to be poisoned in areas where stock have been excluded.
- Pruning or trimming back trees where they obstruct stream flow (usually willows). This can also be done as a silvicultural practice where trees (poplar) will be harvested for timber.
- Rejuvenation can be achieved by cutting back trees to promote more vigorous new growth. This can be done at ground level in areas where stock have been excluded, or at a height that is out of stock reach in grazed areas (pollarding).

These trees are at an age where they could be cut back or pollarded to rejuvenate them and promote new growth.

Te whakatō rakau ki ngā hiwi
Hill slope planting

Poplar and willow planting can help stabilise unstable hillsides and slip faces. However, it is best to prevent erosion and plant before erosion strikes. Prevention is better (and definitely cheaper) than the cure!

Planting to protect farm tracks

Damage to tracks is usually caused by drop outs and debris from slips above. Drop outs are difficult and expensive to repair so prevention is best.

Plant two to three rows of poles immediately below the track at spacings of 5-10 m, with the first row about 2 m from the track. In addition to this, plant all fill material below the track. Also, plant obvious slump and unstable areas above the track to help prevent slips occurring above it.

Tree planting to help prevent erosion.

Fence line protection

Fence lines are similar to tracks – they are often damaged during storms, both by slip debris and by drop outs. To protect fence lines, plant poles where drop outs are likely to occur and plant trees on both sides of the fence at 8-10 m spacings. If fence damage continues to occur it may be more practical to relocate the fence.

Planting slip scars

Plant earth flows, slumps and slips with poles at 5 -15 m spacings, using the closer spacing at the toe, and wider spacing towards the head of the erosion. Extend the planting onto stable ground beyond the slip movement. Over time, the tree roots on the unstable ground will link together with those on the more stable ground to help stabilise the area.

Planting for general hill slope stabilisation

Avoid planting on ridges or high spots. Pick the best site for each pole, preferably a small depression or low lying spot where moisture will run during rain. On hillsides, follow small channels and watercourses where summer rain run off is likely to occur. When planting for erosion control, the erosion is often initiated by water concentration. These spots are where poles will thrive the best.

Poles planted in exposed windy areas should be sheltered from the prevailing wind. Place them part-way down the slope, rather than on the ridge top. Plant poles at 8-10 m spacing across the lower half of exposed windy slopes and plant only the sheltered, moist sites on the upper part of slopes.

When planting on very steep slopes, put the poles away from steep banks and angled out from the vertical. This prevents stock from eating the growing tips from the upslope side.

Space-plant on gentle slopes 10-12 m apart. Close-plant particularly unstable slopes 5-6 m apart. Some thinning will be required to reduce pasture shading by closely planted trees once the trees have matured.

Read page 14 on post-planting care as this is essential to ensure long-term survival and effectiveness of poplar and willow planting.

Planting for general hillslope stabilisation.

Newly planted poles to stabilise a slip area.

Te whakatō rakau ki ngā awaawa
Gully planting

Planting to stabilise gullies

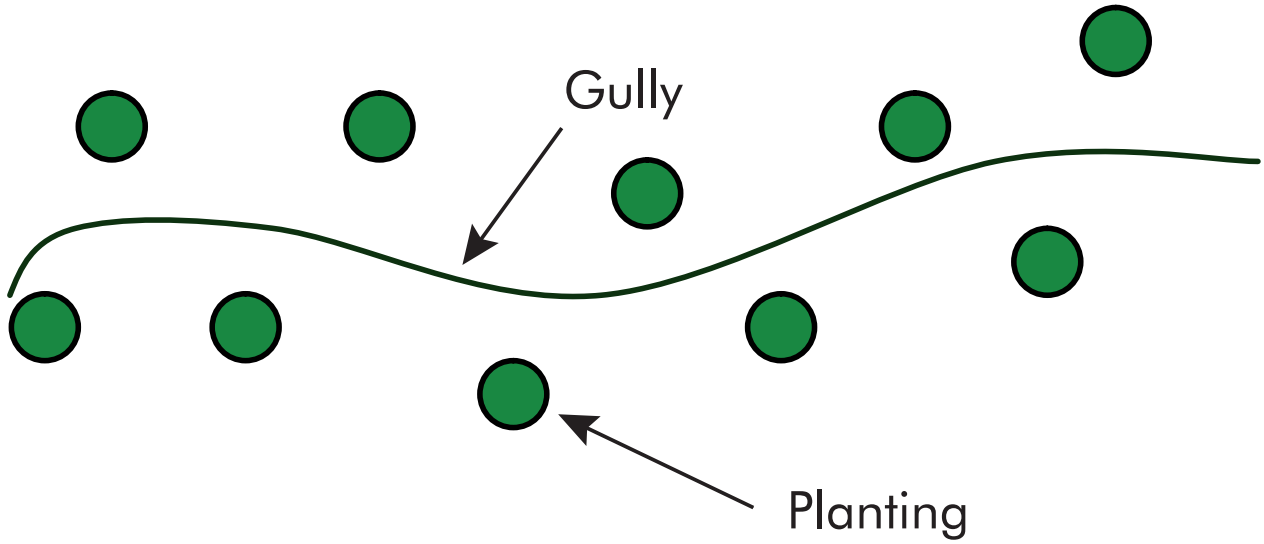
If erosion is a problem along a narrow gully or waterway, poles can be 'pair planted' as shown in the photo below and in figure 1.

Pair planting results in an overlapping of root systems across the gully and provides valuable soil strengthening to prevent or reduce down cutting of the gully bottom and slumping of gully sides (gully erosion).

This practice is typically undertaken on the soils derived from mudstones, siltstones and pumice and may be associated with other structural control measures such as diversion bunds and detention dams.

Diversion bunds are generally constructed to divert water run off away from an unstable area, while detention dams are constructed to collect water and discharge it down a channel in a controlled way.

FIGURE 1 – *Diagram illustrating the concept of pair planting*



Pair planting along an eroding gully.

Te kōwhiti rakau
Plant selection

Many species of poplar and willow that were formerly used for soil conservation planting are today regarded as unsuitable. This is because they are susceptible to plant diseases, palatable to possums or other pests, or liable to spread to areas where they're not wanted, by regrowing from easily broken off branches and twigs (such as crack willow), suckering from roots (such as silver poplar) or seeding (female varieties).

Today it is possible to select from a short list of varieties with low susceptibility to these problems.

When selecting poles for planting on your farm, it's important to take into consideration the purpose of the planting, planting site and prevailing climatic conditions. There are a wide variety of poles available with specific characteristics and site requirements. For instance, most poplar and willow are not suitable for planting on very exposed or dry sites. However, some varieties will handle windy and dry sites reasonably well. The list below identifies poplar varieties suitable for different sites.

Willow are generally better for wetter sites as in general they are more tolerant of wet conditions than poplar. See page 5 for recommended varieties.

Poplar varieties suitable for different sites:

- Veronese, Argyle, Margarita and Dudly for drier sites.
- Otahuao, Weraiti, Pakaraka and Selwyn or the above for lower slopes.
- Kawa, Toa and Tasman for moist areas.
- Eridano, Kawa and Toa for possum resistance.
- Veronese and Argyle for windy, exposed slopes.
- Kawa, Toa and Eridano for wet sheltered valleys.
- Veronese, Kawa, Toa and Tasman for timber.
- Tasman, Crowsnest and Veronese for shelter.

Pole sizes

A poplar or willow pole is a young tree cutting which roots and sprouts when planted in the ground. Poles have a 'head start' over seedlings and are less likely to be damaged by browsing animals.

Poplar and willow poles come in lengths from 3.5 m down to 1 m (stakes). Generally, larger poles are planted where there's large stock (such as beef cattle), but should be protected with a sleeve to stop ring-barking. Shorter 2-2.5 m poles are generally used where there are sheep only, while stakes can be used to quickly revegetate unstable sites that have been fenced to exclude stock.

Classes of pole with approximate dimensions

Length	Grade	Small end diameter
2.5-3.5 m	Cattle	25+ mm
2-2.5 m	Sheep poles	25 mm
1-1.2 m	Stakes	15-20 mm

For site specific advice on what sort of planting may be suitable for you, contact your local Waikato Regional Council catchment management officer on 0800 800 401.

Female Salix matsudana willow trees. Female willows should not be planted on the margins of streams or wetlands.

Ngā mōhiohio whakatō rakau
Planting information

Timing

The best time to plant poplar and willow poles is during the winter months – June, July and August – when willow are generally dormant. If you need to control erosion in a pastoral situation, you need to plan which paddocks to plant and how many poles they'll take.

Post-delivering and soaking

Poles should be planted soon after harvesting. If this is delayed, the survival rate can be increased by soaking the poles in water for 1-2 weeks. This lets the pole build up a reservoir of water, which it uses to continue growing roots in the following months. Plant the poles before root growth occurs.

To soak poles, place them in about half a metre of clean, running water or dam water, or keep them moist under a sprinkler. If it's not possible to soak your poles, put them in a cool shady place away from stock.

Be careful not to over-soak poles, as small roots can grow which break easily during planting and reduce the chance of survival. Willow poles can be soaked for longer periods than poplar poles. Poles left in the sun or exposed to wind for several days before planting, have little chance of survival when planted.

Transporting your poles

When transporting poles, check that the bark is not bruised or damaged. Damaged bark makes it easier for the pole to become diseased and dry out. When securing your load of poles, use straps or ropes and protective pads rather than chains. When unloading, remember to take care to avoid damaging the bark.

Using tree protectors

All poles planted where stock will graze should be protected by a tree protector to help prevent stock damaging the trees. A common type of tree protector – smooth, usually grey, plastic tubes known by the brand name Dynex sleeves - are approximately 1.7 m long.

Note: Cattle can damage fragile new roots by rubbing on the pole, even when it's protected with a sleeve. Stock rubbing on the poles causes substantial movement at the base.

Damage to the roots is hard to detect and may not show until the pole eventually dries out and dies. This is most commonly seen in the second spring when the pole fails to leaf up. Some stock exclusion is therefore desirable (see page 12).

Poles planted with Dynex tree protectors.

DYNEX

Dynex (smooth) sleeves
Costs approximately $5.70 exclusive GST for 1.7 m long sleeve (wholesale).
Deflects debris in floods.
Smooth material deters possums climbing up.
Less susceptible to rubbing by stock.
Bark cannot be chewed by stock.
Bark remains soft inside protector, ring barking by stock may occur when protector comes off at later age.
If not kept off the ground it can collect water, leaves and dirt inside and start rotting the base of the pole. This can be avoided by securing the sleeve with two small staples so it sits 5 cm above the ground.

Securing sleeves

- Prior to planting pull sleeves onto the base of the pole so the bottom of the sleeve is approximately 70 cm from the butt of the pole. This will indicate the correct planting depth.
- Dynex sleeves do not necessarily need to be secured, unless there is a problem with drainage in the sleeve (see table above).

Stock management

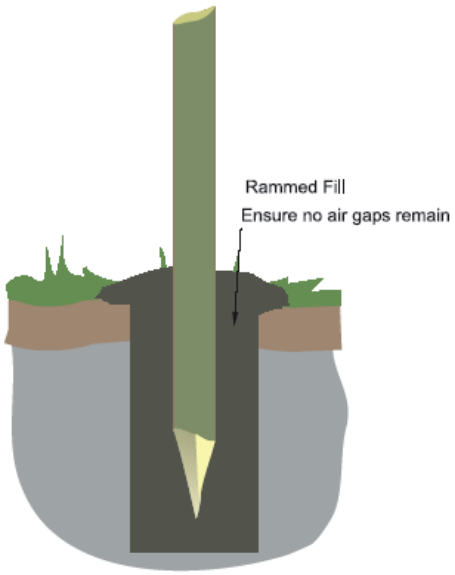
- On beef or dairy farms exclude cattle from the paddock where poles are planted for at least a year, but preferably two or three years.
- Do not plant poles in paddocks that are likely to have goats or deer.
- If stock grazing can't be avoided, try isolating the planted poles from the balance of the paddock with a temporary electric fence. You can also try removing individual cattle or sheep worrying the poles, and treating stock for lice so that they are less likely to rub against poles.
- On mixed livestock farms, exclude cattle from the paddock for 1-3 years, and graze around protected poles with sheep. Sheep are unlikely to damage 2-2.5 m poles, but 1 m stakes should not be planted where they are still grazed.
- On sheep farms, simply plant 2-2.5 m poles with protective sleeves if required, and continue normal grazing management.
- Check poles in the first year to ensure they are firmly planted and if necessary use a post rammer to firm the ground around them.

For assistance sourcing trees and tree protectors, contact your local Waikato Regional Council catchment management officer on 0800 800 401.

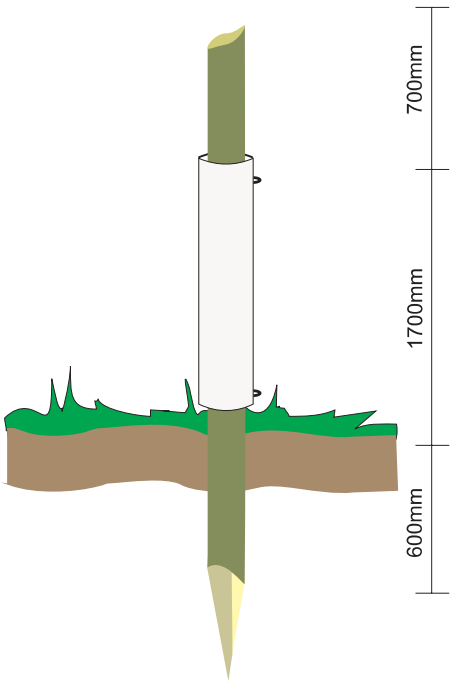
Poplar planting fenced with a temporary fence to exclude cattle.

Pole planting

The key to healthy survival of poles and stakes is planting them deep and firm. The most effective ways of planting poles is ramming and digging.



Pole 'dug' and 'rammed'.



Pole with 1.7 m sleeve. Ensure poles are planted deep – at least 60-70 cm.

Ramming

A pole rammer or pole bar can be used to drive the pole as tightly as possible into the ground, with the base of the pole anchored into undisturbed soil.

It may be helpful to prepare a pilot hole with a hand auger, crow bar or attachment on a rammer which should be slightly smaller than the diameter of the pole.

Drive approximately a third of the pole into the ground. If the pole is 2.3 m long, drive it into the ground at least 60 cm. If you are planting with a protective sleeve remember to put the sleeve onto the pole before ramming.

Digging or using a post hole borer

A post hole borer or spade can also be used to create a hole. However, ensure poles are rammed tightly into the bottom of the hole. It is recommended that poles are rammed both at planting and again during summer to prevent loosening.

Planting depth recommendations:

- Plant 3 m poles at least 70 cm deep but make sure the top is out of reach for stock.
- 2.5 m poles need to be planted at a minimum 60 cm deep.
- If planting stakes, make a hole about 50 cm deep with a length of reinforcing rod or light bar, then force the stake in until about half its length is buried. Use your heel to compact the top of the hole so it is tight.

Normally the pole driving exercise will not damage the upper end of the pole, but if shattered, this portion should be removed to prevent the possibility of die-back.

Te tiaki i ngā rakau
Post planting care

After winter planting of poplar and willow poles, follow-up work is important to ensure the trees have the best chance of survival and good growth form. Over the years silviculture may be required to enhance shape and prolong life.

Re-ramming poles

The first spring and summer after planting, check poles a few times to make sure they are still tight in the ground. Some soils shrink as they dry, leaving poles loose. The young roots of a loose pole break easily if it wobbles, so it dries and dies. Planting failure can be reduced by re-ramming the soil around any loose poles, taking care not to damage the bark and established roots. Try ramming the ground in towards the pole, rather than compacting the soil down the pole. A safer option, particularly in dry areas, is to first filter sand or fine soil down the newly developed cracks before ramming.

If the top of a pole has died, saw off the dead wood before fungal infection sets in, and paint the cut with fungicide. This should enable fresh shoot growth from live tissue further down the pole, and avoid total loss.

Removing tree protectors

Dynex sleeves are designed to split as the tree grows, but this sometimes doesn't happen because of the varying strength of the recycled plastic used.

Check poles with Dynex sleeves regularly, and when about 20 per cent of the sleeves are tight or begin to split, it's time to remove all the sleeves in that paddock (except on poles that are clearly too small). In most cases this is between years three and five. If the sleeves fall off themselves, then grazing animals can damage the soft bark underneath.

To avoid damaging the bark, remove Dynex tree protectors on a paddock by paddock basis. Once the sleeves are removed, relieve the paddock from cattle and intensive sheep grazing. This protects the bark while it hardens, and takes one to two months.

Blanking

Not all of the poles planted will strike. One hundred per cent survival of a planting is rare, 90 per cent after the first year is a good survival rate. Sometimes, due to adverse conditions such as cattle damage, possum browsing or summer drought, survival drops to 50 per cent or less.

Where mortality is heavy, it's essential to blank (re-plant) next winter. If this isn't done, tree spacing won't be sufficiently dense for roots to interlock, and slips or flows may open up in the gaps. This cause of partial planting failure is usually identifiable, so can be taken into account when blanking. For instance, plant a heavier pole, use a variety that is less palatable to possums, or one that's more drought resistant.

Pruning

Silviculture is still a good idea regardless of whether you are growing for timber or not. Start pruning in the third year by selecting a dominant leader branch and removing other leaders – keeping in mind the overall form of the tree. Leave side branches on the dominant leader. In the fourth and fifth years, remove all side branches up to four metres or 50 per cent of total height of the tree.

By year 10, the tree will have developed a good shape, less likely to suppress pasture around its base or to split in a strong wind.
Note: Never remove more than 50 per cent of the total height of the tree. Poplar and willow may be pruned in summer to provide stock feed where needed (see page 4).

Coppicing and pollarding

Coppicing and pollarding are techniques used to encourage new growth on trees or shrubs. When coppicing, the trees are cut off just above ground level (usually where stock are excluded). Pollarding involves cutting the tree at a higher level (such as 2 m) and can be undertaken in areas where stock are grazed. Coppicing and pollarding can occur any time from year four, depending on the purpose of the planting.

Although these practices have been used in the past to provide material for thatching, weaving and firewood, they can also be used with willows and poplars to rejuvenate the trees by encouraging more vigorous new growth and therefore extending their lifespan. Coppicing or pollarding can also be used to provide plant material for stock to eat.

Kīrearea
Pests

Willow sawfly

Willow sawfly is related to the common wasp. Its caterpillar feeds exclusively on willow and was discovered in Auckland in February 1997.

It has since spread to other parts of the country and large numbers of caterpillars were found to be damaging and defoliating several different willow types. In some cases, willow trees have been killed by the fly. Although the effects from sawfly in the Waikato region have been low since the initial infestation in the late 1990s, there is still potential for further outbreaks.

Lab trials indicate that tree willow is susceptible to damage whereas shrub willow is generally not selected by the sawfly. To reduce the risk of damage from a sawfly outbreak it is recommended to plant a mix of poplar and willow species and different willow varieties. Some sawfly resistant varieties of willow are now being developed and are available from some nurseries.

Sawfly larvae climing up a fence post after being blown off willow trees by heavy wind.

Sawfly larvae.

Keep up pest control

Try to control possums and goats. Both these animals find some poplar and willow very palatable. Possums also cause damage by climbing trees and breaking branches, leading to poor tree form.

Early signs of possum damage include:

- broken branches and/or leaves stripped off
- bark being stripped, scratch marks on sleeves, possum droppings around the base of the pole, and possum runs along the ground.

To help reduce possum damage you can:

- carry out possum control prior to planting
- survey the wider area for likely possum habitat, including bush gorges and plantations
- use Dynex sleeves on all 2.5 and 3 m poles
- fit a possum plate around the top of the protective sleeve (like those on power poles)
- avoid planting next to banks, fence posts and other places where possums can jump from
- plant varieties that are unpalatable to possums.

Possums damage trees.

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