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Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI






Trees for the farm

A decision support tool for farmers

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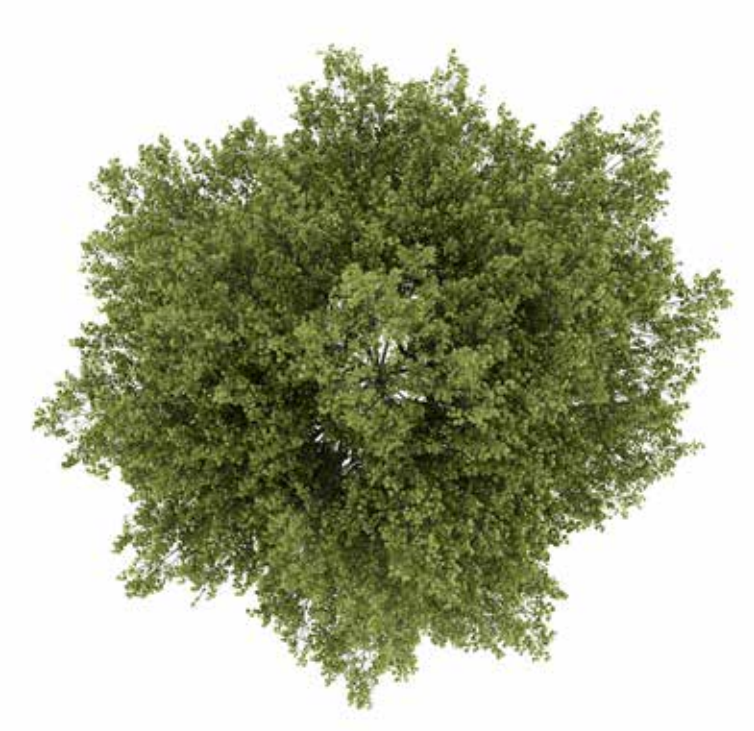


Section A

ON-FARM ESTABLISHMENT OF POPLAR AND WILLOW TREES

Introduction

This booklet provides information to farmers who are planting poplar and willow trees on their farms, to assist you in gaining the most benefit for your effort.

In the first section advice is provided on choosing the most suitable variety, where to plant, how far apart to plant and what useful things can be done to manage the trees to best advantage. The second section provides some sound economic and environmental reasons why trees on farms add value. These reasons are often revealed when serious rainstorms hit a region.

An ancient Chinese proverb (they are always ancient) says 'The best time to plant a tree was 20 years ago. The second best time to plant is now'.

MPI Sustainable Farming Fund contributed to this publication.

WHAT TREE DO I PLANT?	
To protect	
SLOPES	Plant 'Moutere' and 'Tangoio' willow in the gullies, seek Regional Council advice on choice of poplar and where up the slope to plant it.
TRACKS	Plant narrow form poplar, e.g. 'Veronese', 'Geyles', 'Kawa', 'Crowsnest'.
WATERWAYS	Plant a range of species: *Pittosporum spp*. and other natives, osier willow and tree willows if bank stability is needed. Osier willows are favoured because they are small and compact and require less management.
YARDS	If planting for summer shade, choose a deciduous tree with spreading branches and leaves that are safe to eat, e.g poplar, elm, willow.

Spaced pole planting on a slope.

Poplar trees blocking a slip from covering an access track.

WHERE DO I PLANT?

SLOPES	Plant poles across the slope at spacing of 12–15 m apart with the next row 12–15 m above and staggered.
TRACKS	Plant two rows of poplar poles 5–10 m above the track and 8–10 m between poles. Stagger the second row of poles so they provide a maximum barrier to any slip tail from above.
WATERWAYS	Plant waterways where there are issues with bank stability or gully erosion. Plant tree willows at 10 m spacing with osier willows between. Plant between 1 and 2 m from the water course. Native species can replace osier willows or allow the willows to act as a nurse crop for the natural establishment of natives by birds.
YARDS	Plant close to a holding yard (1 m) where shade is needed, and protect the tree from stock damage. Plant to allow trunk growth, i.e. at least 50 cm from the yard rail. Choose a tree with widespread branches, e.g. Chinese poplar, Golden elm, weeping willow.
SHELTERBELT	Plant narrow form poplars 4 m apart with either osier willows or another species as a second row on the windward side.

A highly erodible slope planted with poplars.

Poplars planted to stabilise a gully.

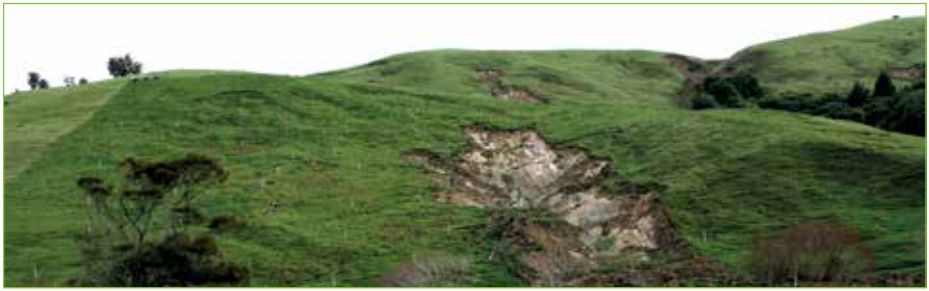
PLANTING POLES ON HILLS

Location – identify the unstable parts of the slope (tension cracks running through pasture, grassed-over slip scars, grassed mounds and hollows, tunnel gullies, watercourses)

SLOPES	Plant poles 12–15 m apart with closer spacing where the slope is particularly unstable.
GULLY	Pair plant poles up active gullies with each tree opposite its pair at spacings of between 5–6 m down to 2–3 m depending on extent of instability.

Tree placement

Look for the places on unstable ground where soil is sufficiently deep and moist for a pole to establish, and where runoff water will flow towards the pole.



Poplar clonal mixes add feed options and interest to the landscape.

Tree management

POPLARS are naturally leader dominant and are best grown as a single leader. They should be managed by form pruning to protect soil, increase light to pasture and for wood. They can be pollarded but do not yield as much edible fodder as willows.

YEAR	POPLAR MANAGEMENT PLAN
0	Plant pole, re-ram in early summer
3	Reduce to a single leader
5	Prune branches to 4 m height using a pole saw
9	Prune branches to 6 m height using a pole saw
20+	Progressively harvest and replant another pole nearby

WILLOWS are naturally multi-stemmed and hard to manage as a single leader. They are best managed by pollarding to protect soil, increase light to pasture and provide supplementary fodder.

YEAR	WILLOW MANAGEMENT PLAN
0	Plant pole, re-ram in early summer.
8	Pollard at trunk diameter of 28–30 cm by cutting all branches back to a short stump at 2 m above the ground, i.e. above cattle grazing height.
11-12	Repeat the pollarding cycle every 3–4 years. Do not pollard all willows on a slope in the same year.

Further information | Ask your Regional Council about pole planting contractors.

Brochures on Poplars and Willows for farms are available on the New Zealand Poplar & Willow Research Trust website: ***www.poplarandwillow.org.nz***

Section B

WHY PLANT TREES ON FARMS? A COST-BENEFIT EVALUATION

COSTS OF EROSION

On-farm costs of erosion

- → Repair of infrastructure (tracks, drains, streams, dams, fences, yards and buildings)
- → Reduced nutrient and water storage
- → Reduced pasture production
- → Reduced income from soil productivity loss
- → Increased application of fertilisers to maintain production
- → Reduced property values.

For example, direct damage cost $231K on average per farm from the April 2011 storm in Hawke's Bay (43% loss of production, 57% damage to infrastructure).

Off-farm costs of erosion

- → Damage to transportation and utility networks
- → Increased sedimentation, reduced water quality, disruption to waterways
- → May be higher than on-farm costs.

Nationwide costs of soil erosion

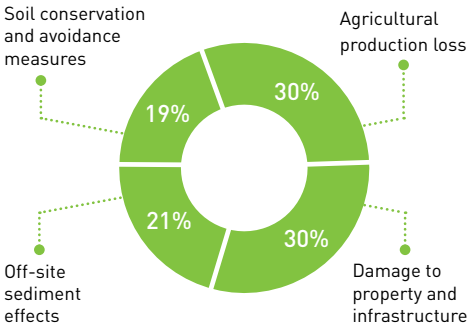


Figure 1. Nationwide costs of soil erosion in New Zealand ($126.7M in 1998, $159.1M in 2008) (after Jones et al. 2008, p.36).

Soil conservation and avoidance measures are effective in reducing agricultural production losses and infrastructure damage.

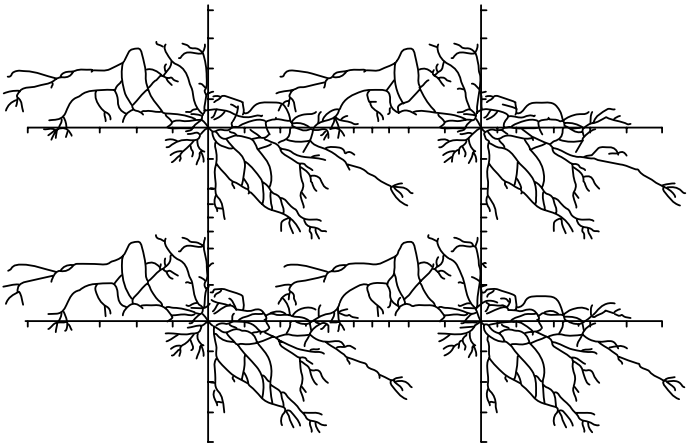


Figure 2. Root systems of adjacent trees add reinforcement strength as they mesh together.

BENEFITS OF SOIL CONSERVATION TREES

Trees have a deeper, stronger, more extensive root system than pasture plants which helps to reduce mass movement erosion.

Every mature poplar or willow tree (15+ years) protects an area of approximately 300 m^2. Trees in a spaced planting are more effective than isolated trees because of the interconnected root systems (see Figure 2), analogous to steel reinforcing mesh.

A density of 30–50 mature trees/ha (18–14 m apart) is required for water management, topsoil retention and slope protection over erosion-prone land, while enabling good pasture production.

Annual pasture production/ha in areas with this density of wide-spaced unmanaged trees is reduced by 8–13% compared with areas with open pasture provided there is no further erosion.

Pasture production on eroded slopes, immediate to long term, is reduced by 20–80% compared with production on un-eroded slopes.

Willows stabilising and drying out a slumped site.

COSTS OF HAVING WIDE-SPACED TREES

Installation costs:

Planting cost/ha of planting poplars or willows to a high density, and thinning with time	
60 poles @ $23 per pole (pole, sleeve, planting)	= $1380 per hectare
Pair plant poles up active gullies with each tree opposite its pair at spacings of between 5–6 m down to 2–3 m depending on extent of instability	
30 poles @ $23 per pole + 10%	= $759 per hectare
Re-ramming loose poles (2 hrs @ $50/hr)	= $100

Maintenance costs per hectare (based on 60 poles/ha):

Reducing to a single leader (varies with the clone) by age 3 years (3 hrs @ $50/hr)	= $150
Pruning 60 trees up to 6m in two lifts by age 9 years (30 hrs @ $50/hr)	= $1500
OR	
Pollarding 60 trees for fodder at age 9 years (30 hrs @ $50/hr)	= $1500
Harvesting for fodder every 3 years	= $0 (time = fodder value)

Harvesting costs:

After 20 years; for pruned trees = $3000; for pollarded trees = $0

Total costs:

Planting cost/ha of planting poplars or willows to a high density and thinning with time.	
Per hectare over 20 years	= $1480 + $1500 + $3000/$0
Any income from sale of wood reduces per hectare per year cost accordingly. Pruning tasks are small and can be done as add-ons to other farm work.	

Figures are based on 2015 values without subsidies.

BENEFITS OF SERVICES FROM WIDE-SPACED TREES

Provisioning services

- → Feed (pasture quantity, quality; tree foliage)
- → Wood
- → Shade and shelter to animals.

Regulating services

- → Filtering of nutrients and contaminants
- → Flood mitigation
- → Recycling of wastes and detoxification
- → Carbon storage in soil and trees
- → Regulation of N_2O and CH_4 emissions
- → Biological control of pests and diseases.

Provisioning and regulating services (or benefits) have an economic value. Overall, erosion decreases these values, whereas soil conservation increases them (Figures 3 & 4 on the next page).

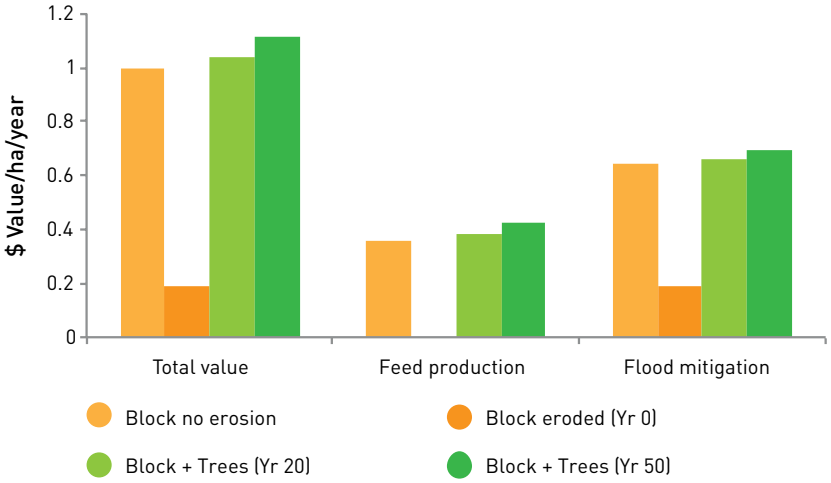


Figure 3. Relative $ value of feed production and flood mitigation (as examples of ecosystem services) on a representative hill country block in Southern Hawke's Bay before and after erosion event – **with** wide spaced trees *(Dominati and Mackay 2010)*.

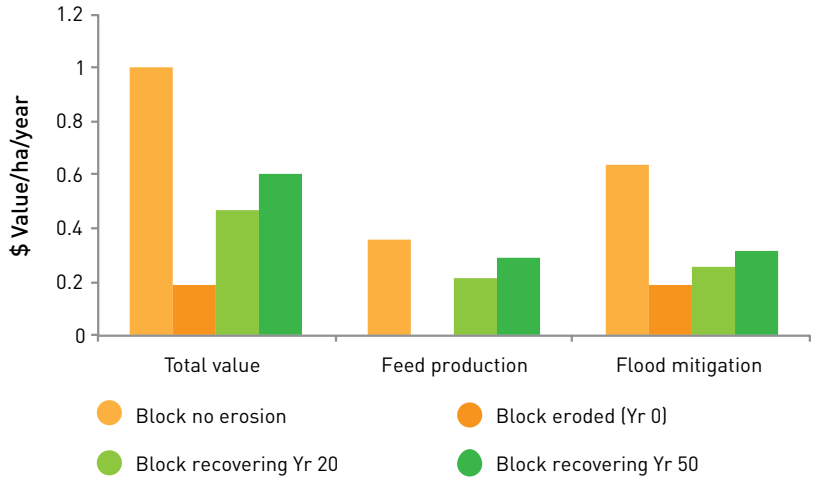


Figure 4. Relative $ value of feed production and flood mitigation (as examples of ecosystem services) on a representative hill country block in Southern Hawke's Bay before and after erosion event – **without** trees *(Dominati and Mackay 2010)*.

Further information

Review of knowledge on erosion processes (Jones et al. 2008).
bit.ly/pwrt1

An ecosystem services approach to the evaluation of soil conservation policy in New Zealand hill country.
bit.ly/pwrt2

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Further information can be found on the New Zealand Poplar & Willow Research Trust website
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