WILDING CONTROL

Guidelines for the Control of Wilding Conifers

Dense wilding pines at Tarndale, Molesworth Station

After removal of wilding pines at Tarndale, Molesworth Station

SCION

N.J. (Nick) Ledgard

"SITS9" - A Stitch in Time Saves Nine

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This Guideline Manual on wilding control follows a first Manual produced in 1999 on Wilding Prevention available from SCION, P.O. Box 29237, Fendalton, Christchurch. Phone: 03 364 2949.

It is primarily aimed at farmers and land owners looking for a "first-step" advice relative to choosing the best technique for controlling wildings in their circumstances.

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Timely wilding tree control is important.

Many years elapse between the arrival of a wilding tree and when it produces its first seeds.

If not removed before seeding, control costs will increase significantly.

Therefore, those involved in wilding control should always remember:

SITS9 - ‘a stitch in time saves nine’

Wilding location

Take great care if wildings are growing:

- **On areas which are too dangerous to access (e.g. on bluffs), then professional input will be needed.**
- **In areas frequently used by people, then appropriate signage or access restrictions will be needed.**
- **Close to shore - no part of the tree should end up on the beach or in the water.**

The wilding control ‘toolbox’ - options for wilding trees

Site management:

Burning

Grazing

Fertiliser

Physical - by hand:

Hand-pulling

Hand tools

Ring-barking

Physical - power tools:

Chainsaw

Scrub-bar

Machine:

Mulcher

Digger/dozer

Chemical:

Foliar

Cut stump

Stem poisoning

Soil uptake

Bark application

Which control technique should I use?

There are many options in the wilding tree control ‘toolbox’.

The simplest way to determine the most appropriate tool is to look first at the:

- Size of wildings involved
- Density of trees present

Wilding size

	Diameter	Height
Small	<2 cm at base	Most less than 0.5 m tall
Medium	2-20 cm at 1.4 m	Most greater than 1 m
Large	20+ cm at 1.4 m	Often 10+ m tall

Density

Lone wildings or widely scattered individuals
Dense trees - often with touching crowns

	Isolated trees	Dense trees
Small		
Medium		
Large		

Small trees

Diameter: **< 2 cm at base**

Height: **Most less than 0.5 m tall**

	Site management			Physical			Power tools
Tree Density	Burning 	Grazing 	Fertilising 	Hand pulling 	Hand tools 	Ring barking 	Chainsaw 
Lone wildings or widely scattered individuals	C	C	C	Y	Y	N	N
Dense wildings - touching crowns	Y	C	C	C	Y	N	N
Page number	12	14	16	18	20	22	24

Y = **Y**es, recommended
C = see **C**omments
N = **N**ot recommended

This manual does not contain all details for all techniques. For extra details go to website:

www.wildingconifers.org.nz

Small trees

Diameter: **< 2 cm at base**

Height: **Most less than 0.5 m tall**

Power tools	Machine		Chemical				
Scrub-bar 	Mulching 	Digger/ dozer 	Foliar 	Cut stump 	Stem poison 	Bark application 	Soil uptake 
N	**C**	**N**	**Y**	**N**	**N**	**N**	**C**
Y	**Y**	**C**	**Y**	**N**	**N**	**N**	**C**
26	28	30	32	34	36	38	40

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Medium trees

Diameter: **2 -20 cm at 1.4 m**

Height: **Most greater than 1 m**

	Site management			Physical			Power tools
Tree Density	Burning 	Grazing 	Fertilising 	Hand pulling 	Hand tools 	Ring barking 	Chainsaw 
Lone wildings or widely scattered individuals	C	N	N	N	C	Y	Y
Dense wildings - touching crowns	C	N	N	N	C	N	Y
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Scrub-bar 	Mulching 	Digger/ dozer 	Foliar 	Cut stump 	Stem poison 	Bark application 	Soil uptake 
C	C	N	C	Y	Y	Y	Y
C	Y	C	C	Y	Y	C	C
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Large trees

Diameter: **20+ cm at 1.4 m**
Height: **Often 10+ m tall**

	Site management			Physical			Power tools
Tree Density	Burning 	Grazing 	Fertilising 	Hand pulling 	Hand tools 	Ring barking 	Chainsaw 
Lone wildings or widely scattered individuals	N	N	N	N	N	C	Y
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Large trees

Diameter: **20+ cm at 1.4 m**
Height: **Often 10+ m tall**

Power tools	Machine			Chemical			
Scrub-bar 	Mulching 	Digger/ dozer 	Foliar 	Cut stump 	Stem poison 	Bark application 	Soil uptake 
N	**N**	**C**	**C**	**C**	**Y**	**N**	**N**
N	**N**	**Y**	**C**	**N**	**Y**	**N**	**N**
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Burning

Safety
Conducting a safe burn is a major operation, requiring an experienced and qualified team

Audit
Assess percentage of dead trees not sooner than one month after the burn

Tools
All appropriate equipment and labour to contain fire to target area

Cost - see pages at end of manual

Comments:

- Can be cheap for small wildings and possibly dense stands of medium/large trees.
- A ‘grassland’ fire may not kill scattered wildings more than 3-4 m tall
- Often destroys non-target plants, and creates a seedbed for weed reinvasion
- Usually requires official consent - can be costly and time consuming

Recommendations:

- Not recommended for amateurs
- Only undertake with experienced and qualified teams

Grazing

Safety
No significant safety issues

Audit
Regular check for effectiveness, plus removal of larger seedlings

Tools
Mob stocking of sheep in restricted areas.
Cattle not effective

Cost - see pages at end of manual

Comments:

- Mainly prevention - the major control means in NZ, and often inadvertent
- Only effective on very young seedlings (1-2 years old). Older trees only checked.
- Annual mob-stocking with sheep needed for long term control

Recommendations:

- Use if possible - the simplest means of reducing wilding establishment in pasture/grasslands
- Best when combined with pasture improvement - use of fertilisers

Fertilising

Safety
No significant safety issues - except for normal application considerations

Audit
Regular check for effectiveness, plus removal of larger seedlings

Tools
Normal NPK pasture fertilisers and rates

Cost - see pages at end of manual

Comments:

- Mainly prevention - effective by increasing competition of existing vegetation (especially grasses)
- May reduce resident native plant numbers
- Long-term maintenance needs are unknown

Recommendations:

- A simple and effective option for professional farmers
- Best in pasture/grasslands, especially when combined with grazing

Hand Pulling

Safety
No significant safety issues - other than proper physical technique (use of back and legs). Injuries usually occur if attempts made on too large seedlings

Audit
Check for missed seedlings by independent person for 20% of operational time, particularly at start. Agree on a rework if >1% have been missed

Tools
Gloves for those who need them. Secateurs or a small jacksaw a useful standby for larger seedlings

Cost - see pages at end of manual

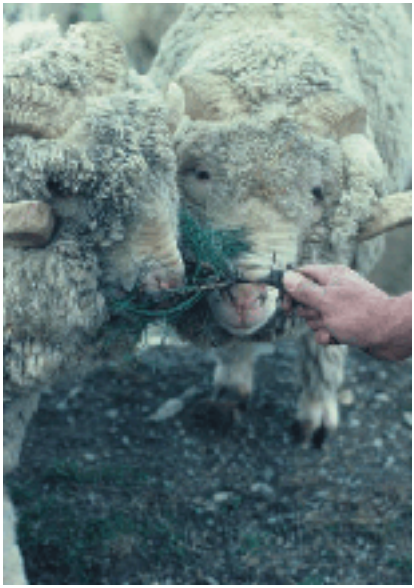
Comments:

- Only suitable for scattered small seedlings, those over 30 cm tall can be difficult
- Simple - can be undertaken by most fit people
- Remove all green foliage. If any green needles remain intact, then the seedling will not die

Recommendations:

- Ideal for unskilled volunteers, if combined with good initial supervision
- Often best in conjunction with hand tools
- Contractors - agree on audit standards at outset

Burning



Grazing

Fertilising

Hand Pulling

Hand Tools

Safety
No major issues - other than this technique involves use of sharp tools

Audit
Check for trees with remaining green foliage by independent person for 20% of operational time (40% at start). Agree on a rework if >1% still present, or with live foliage attached to stump

Tools
Loppers (often lightweight), secateurs, hand saws (jack-knife and fixed blade), axes, slashers, grubbers

Cost - see pages at end of manual

Comments:

- Simple - can be undertaken by most fit people
- MUST remove all green foliage
- Medium sized trees can be hard work

Recommendations:

- Most useful for use by unskilled volunteers on small trees (<2m tall), although -
  - Experience needed for safe, effective use of axes and slashers
  - Ensure good instruction at outset and supervision throughout - especially to ensure removal of all green needles
  - Contractors - agree on audit standards at outset

Ring-barking

Safety
No major issues - other than this technique involves use of sharp tools and/or chainsaws

Audit
Check for appropriate practise by independent person during operation. Agree on a rework if >5% still alive after one year

Tools
Slashers, axes, bark peelers, chainsaws

Cost - see pages at end of manual

Comments:

- Has been successful on trees too large to readily fell, BUT
- Can be difficult to sever all cambium layer
- Results often variable, with trees remaining alive or dying very slowly
- Bark peelers can be quick/effective on medium sized trees with smooth bark

Recommendations:

- Usually used on medium / large isolated trees, BUT
- Not recommended as a reliable tree killing technique
- More successful using hand bark peeler on smooth-barked trees

Power tools - Chainsaw

Safety
The most dangerous publicly available tool! All appropriate safety gear essential. Training recommended and required for trees >20cm diameter.

Audit
Check for trees with green foliage remaining below cut stump by independent person for 20% of time (40% at start). Agree on a rework if >1% still present or with live foliage still attached to stump

Tools
Chainsaws, plus associated safety and felling equipment. Tomahawk, jacksaw

Cost - see pages at end of manual

Comments:

- Certainly the most common means for removing medium/large trees, BUT
- Should not be undertaken without appropriate training
- Can involve carrying considerable weight (chainsaw, safety gear, fuel etc.)
- Not favoured where large trees surrounded by shrubland, as light-wells created and new wilding establishment encouraged. In such situations, stem poisoning favoured

Recommendations:

- Best for medium/large trees, BUT
- Not recommended for inexperienced amateurs (training needed)
- Small axe / tomahawk useful for removing green foliage close to ground
- Contractors - agree on audit standards at outset

Power tools - Scrub-bar

Safety
Another potentially dangerous tool! Training and experience required for safe and proper use

Audit
Check for green foliage remaining below cut stump (unless spraying) by independent person for 20% of time (40% at start). Agree on a rework if >1% of cut stumps still retain live foliage (unless spraying)

Tools
Scrub-bar, tungsten-tipped blades, special sharpening gear plus associated safety equipment. New development is spraying attachment for applying chemical to stumps as cut (see insert below)

Cost - see pages at end of manual

Comments:

- Suitable for a wide range of wilding sizes, from small seedlings to saplings
- Less physically demanding (no bending) and often cheaper than chainsaws, BUT
- Operators need to be skilled for cost effective use

Recommendations:

- Most effective on areas of denser trees up to 15 cm in diameter at base, BUT
- Not recommended for amateurs (training needed)
- Use in conjunction with chainsaws for larger trees
- Contractors - agree on audit standards at outset

Hand tools

Ringbarking

Chainsaw

Scrub-bars

Machines - Mulching

Safety
For use by skilled professional operators only

Audit
Check for missed trees by independent person 10% of the time (especially initially). Agree on a rework if >1% still alive, or on post-operational follow-up to remove very small seedlings.

Tools
A range of mulchers now available - from 200hp tractor-driven drum mulchers to 700hp specialist machines

Cost - see pages at end of manual

Comments:

- Depending on machine size, can tackle trees from seedlings to trees 20+ cm diameter
- Very cost-effective tool for dense wilding stands on the right sites (smooth ground surface, not too steep)
- Tractor mulchers (power take-off driven) may fail to remove low green foliage, especially on uneven sites
- Major impact on non-target species (often natives)
- Creates ideal soil surface for new seedling invasion

Recommendations:

- Most effective on dense areas of small/medium wildings, BUT
- Choice of machine size important, and for use by skilled operators
- Important to prepare for post-removal vegetation successions (sow desired seed, or risk new weeds)
- Contractors - agree on audit standards on outset

Machines - Digger/dozer

Safety
For use by skilled professional operators only

Audit
Check for missed trees by independent person 10% of the time (especially initially). Agree on a rework if >1% still alive, or on post-operational follow-up to remove very small seedlings.

Tools
Diggers of around 20 t; bulldozers of D6 and above

Cost - see pages at end of manual

Comments:

- 'Traditional' clearance of medium/large trees into windrows 20-30 m apart
- Windrow removal can present problems - costly to carry away, difficult to burn
- Major impact on non-target species (often natives)
- Creates ideal soil surface for new seedling invasion

Recommendations:

- Most effective on dense areas of medium/large wildings, BUT
- Only for use by skilled operators
- Important to prepare for post-removal vegetation successions (sow desired seed - or risk new crop of weeds)
- Contractors - agree on audit standards at outset

Mulcher

Digger

Chemicals - foliar application

Chemicals - cut stump application

Chemicals
Foliar application (ground and aerial)

Safety
For use by skilled professional operators only. Requires usual precautions relative to clothing, and sites where chemicals mixed and equipment cleaned. Many chemicals need certified applicators.

Audit
Assess if agreed coverage attained immediately after operation (use of dyes). Agree on full payment only if acceptable % of trees totally killed.

Cost - see pages at end of manual

Comments:

- Main determinant of success is degree of foliar coverage achieved
- Full coverage is difficult on trees >2 m tall - currently almost impossible with aerial booms
- Most effective when applied during periods of active growth (spring and summer)
- Major impact on non-target plants (often natives), depending on chemical and species
- Special consideration needed around waterways (resource consents?)

Recommendations:

- Ground use - most successful on scattered and dense stockings of small wildings with reasonable access, achieving total foliar coverage with appropriate chemical plus penetrant
- Aerial use - reliable, one-hit, target-specific boom-spray methods have yet to be proven.
- Currently, metsulphuron/glyphosphate mixes give best results, but non-target species very susceptible
- Diquat (Reglone) almost as good and more target specific, but repeat sprays required
- Contractors - agree on audit standards at outset

Tools

Ground use: high pressure vehicle mounted gun sprayers (knapsacks often not suitable). Aerial use: usually booms from fixed wing aircraft or helicopters (sometimes spot sprayers). Chemicals and rates - vary according to species.
See website: **www.wildingconifers.org.nz**

Chemicals - Cut stump application

Safety

Other than accidental spillage (use water-tight containers for liquids), no major safety issues. Requires usual protection (appropriate clothing, gloves) and site precautions relative to mixing chemicals and cleaning equipment. Certification needed for use of some chemicals.

Audit

Agree on acceptable % of totally killed trees. Full payment only if met - after post-operation inspection.

Cost - see pages at end of manual

Comments:

- Double-handling (cut stem and apply) makes for labour intensive work
- Need for chemical application immediately after stem cutting
- Winter application can give poor results
- Results can be variable

Recommendations:

- Most useful on scattered medium sized trees on stony ground (risk of chainsaw damage), especially with multi-stemmed trees
- Try not to have more than one green whorl below cut stump
- Vigilant and home-made gels can be used but metsulfuron at 20g/litre more cost-effective
- Apply chemical immediately after cutting - and to outer zone of stump
- Contractors - agree on audit standards at outset

Tools

Handsaw or chainsaw to cut stem. On cut stump Vigilant Gel is proven and safe (but expensive. Metsulfuron at 20g/litre effective and cheaper)

Chemicals - Stem poisoning

Safety

Other than accidental spillage (use water-tight containers for liquids), no major safety issues. Requires usual protection (appropriate clothing, rubber gloves, ear-muffs, safety glasses) and site precautions relative to mixing chemicals and cleaning equipment. Beware of creating decaying trees in areas of human habitation and use.

Audit

Agree on acceptable % of totally killed trees. Full payment only if met - after post-operation inspection.

Cost - see pages at end of manual

Comments:

- Most useful for large trees in difficult access/rocky terrain, and in bush/shrublands where felling can create light-wells and promote new wilding establishment
- Proven ‘bore and fill’ method is simple and can give impressively quick results (more reliable than ring-barking)
- Proven chemicals available for use without training
- Spring/summer application best
- Chemical rates for non-radiata species not properly tested (likely to need higher concentrations)

Recommendations:

- Most useful and successful with medium/large trees
- Use ‘bore and fill’ technique with appropriate chemicals - usually glyphosphate or metsulfuron, plus mixtures (see website for details)
- Caution - dead-decaying trees can be hazardous near areas of human use - plus visually obtrusive
- Contractors - agree on audit standards at outset

Tools

Motorised drill and 20 mm bit (or hand drill only for small tree numbers). Chemical in spill-proof drench back-pack (with calibrated gun), or pump pot, squeeze container

Chemicals - Bark application

Safety
Other than accidental spillage (use water-tight containers for liquids), no major safety issues. Requires usual protection (appropriate clothing, rubber gloves, ear-muffs, safety glasses) and site precautions relative to mixing chemicals and cleaning equipment. Be particularly aware of possible splash-back from stem.

Audit
Agree on acceptable % of totally killed trees. Full payment only if met - after post-operation inspection.

Cost - see pages at end of manual

Comments:

- A new control technique currently being tried for medium-sized trees still in the 'soft-bark' phase of growth
- Chemical absorbed through bark into stem
- Could be useful for scattered trees where complete coverage of foliage is difficult from the ground

Recommendations:

- Yet to be proven - so await current trial results before using (see website)
- Probably most useful for medium-sized (1-5 m tall), 'soft-bark' trees, where stem can be accessed readily
- Apply in spring/summer at waist-stem height in 10-20 cm band all around stem
- Caution - standing dead trees can be visually obvious for some years
- Contractors - agree on audit standards at outset

Tools
Knapsack sprayer or pump pot, preferably set at low pressure to avoid splash-back

Chemicals
Soil uptake (Formula

Safety
Other than accidental spillage (use spill-proof containers), no major safety issues. Requires usual protection (appropriate clothing, rubber gloves) and site precautions relative to mixing chemicals and cleaning equipment. Beware of creating decaying trees in areas of human habitation and use

Audit
Agree on acceptable % of totally killed trees. Full payment only if met - after post-operation inspection.

Cost - see pages at end of manual

Comments:

- Most useful for outlier medium sized wildings in difficult to access areas
- Formula 4 works via the roots, and may take up to three months to see effects
- Do not apply direct to foliage or the soil - or during rain or to trees in swampy areas
- Do not apply >12 kg (120 litres of Formula 4 per hectare) at any one time
- Suitable for all wilding pine species

Recommendations:

- Use on outlier trees not larger than 10 cm in diameter at 1.4 m
- Apply Formula 4 to base of main trunk or stump
- For chemical mixing and rates refer to Formula 4 website
- Apply between months of October - February
- Caution - dead/decaying trees can be a hazard near areas of human use, plus visually obtrusive
- Contractors - agree on audit standards at outset

Tools

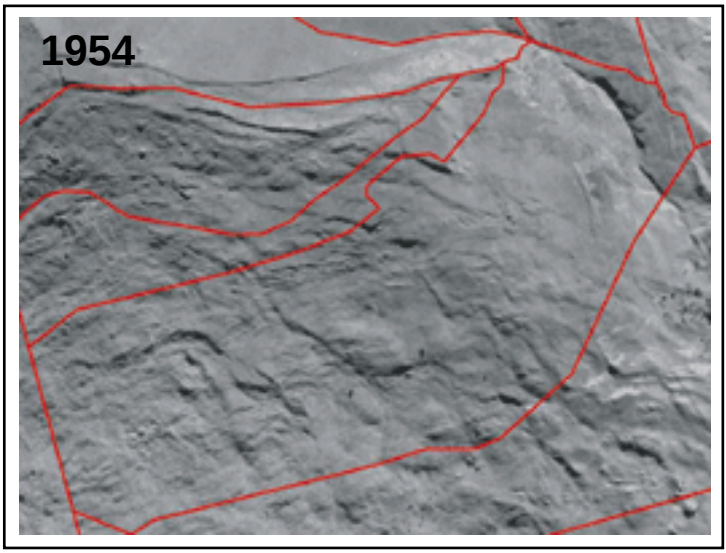
Chemical in spill-proof drench-pack (with calibrated gun), or pump-pot, squeeze container. For chemical (see Formula 4 website)

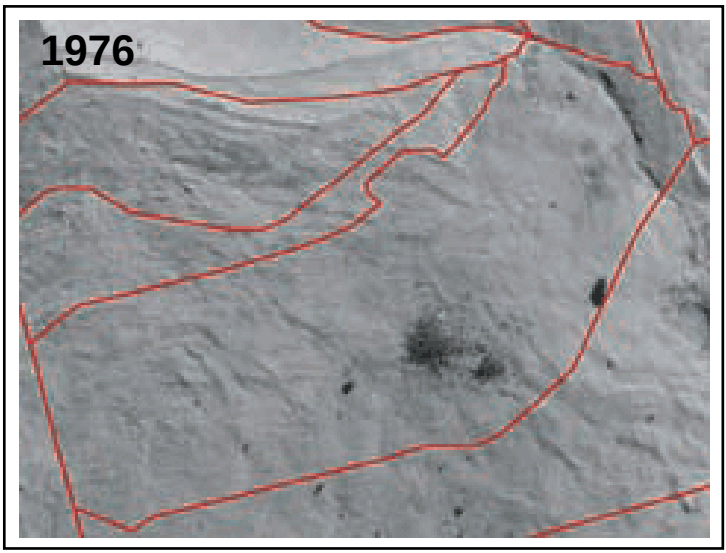
Stem poisoning

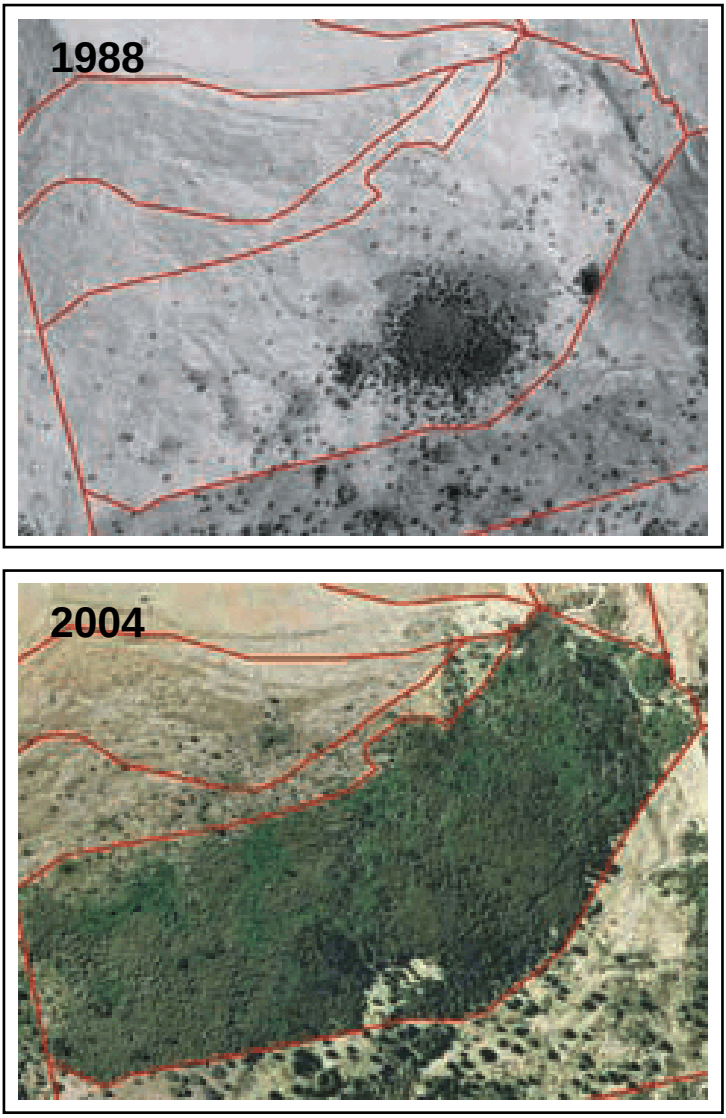
Bark application

Soil injection

Wilding spread on Mt Dewar Station, near Queenstown







The large increase in wildings between 1988 and 2004 was encouraged by a reduction in sheep grazing intensity.

Use of helicopters

Helicopters allow access to wildings which would be difficult/ impossible to reach otherwise. They can be used for aerial spraying, or for carrying people with removal equipment (usually chainsaws) to drop-off areas (this is called skid hopping) or directly to wilding trees on the end of long strops (human sling). The skid hopping and human sling methods of control can only be carried out by highly skilled and trained operators.

Operation effectiveness:

Pre-work briefing and quality control

Pre operation briefing of all workers is important.

The briefing should:

- Clearly demonstrate appropriate safety practices and removal techniques
- Set acceptability standards to ensure that work quality is maintained
- State desired outcome of control eg., restoration of native vegetation, or create new pasture.

Quality control *(auditing)* is needed, particularly at the start of operation, to ensure:

- Safety standards are being met
- Avoidance of faults, such as trees missed, stems not completely severed, green foliage still on cut stumps, trees not killed by chemicals

Quality control can be backed up by:

- A system involving demerit points, or
- Deferred payment until audit standards met

Monitoring

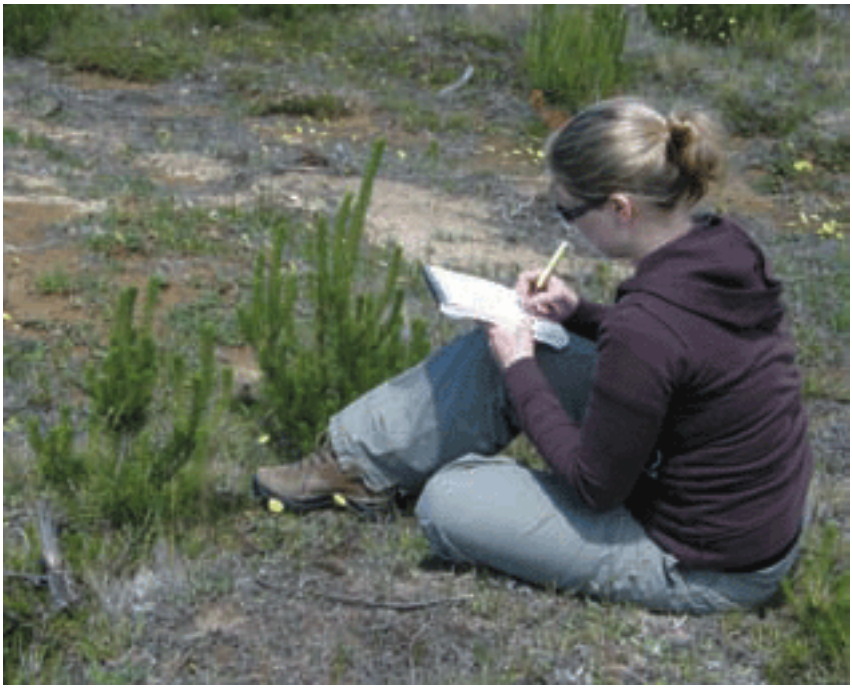
Monitoring involves determining:

- Changes in wilding abundance over time
- Whether desired vegetation successions are occurring

Techniques may involve:

- Aerial surveillance. Small wildings can be difficult to see from the air, but very accurate locations can be recorded using modern GPS mapping techniques
- Ground sampling. Line transects / plots for denser stockings, or GPS locating on maps for more widely scattered trees and lone outliers
- Photo points. Useful for awareness / education. Will determine gross changes over time, but can be difficult to quantify.

Maintaining control



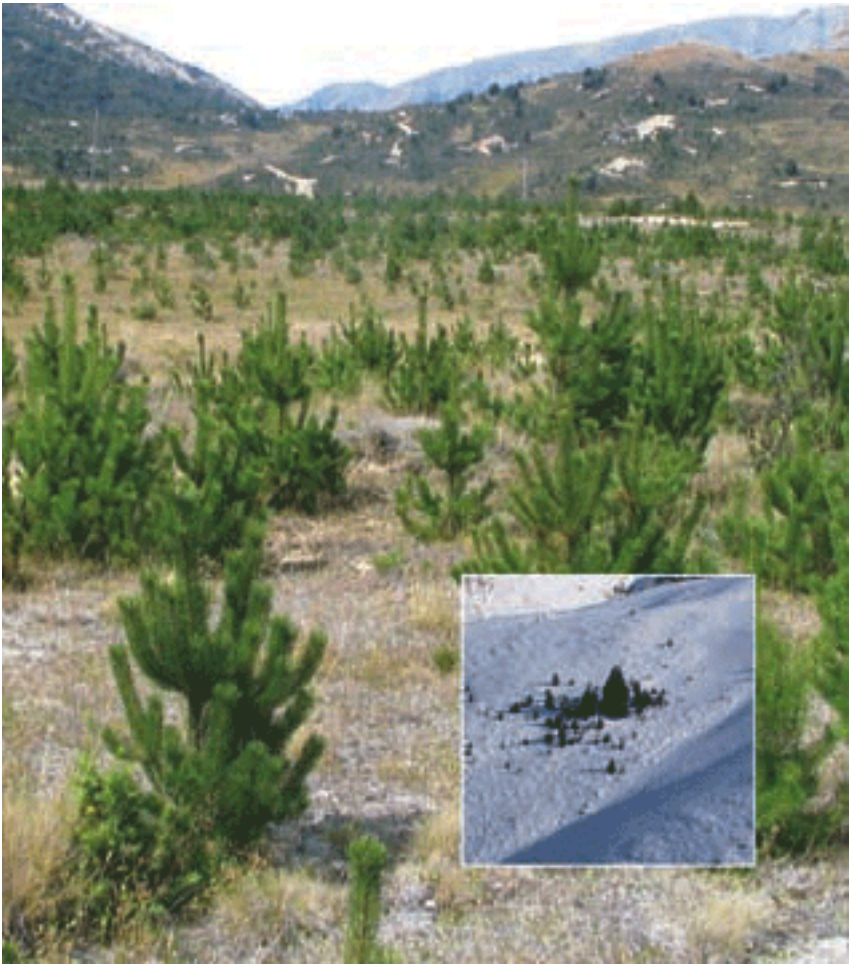
Long-term wilding control requires return visits after initial wilding removal, to remove delayed germinants or small seedlings missed in the last sweep.

- Must be carried out before coning age - often every 3-4 years, but can be extended to 5 years for later maturing species
- Continue until clear that new wilding establishment is unlikely
- This may take 2-4 return visits

“SITS9” - stitch in time saves nine

Use must be made of the fact that young wildings become visible some years before they produce cones and seed.

Unless all these 3-5 year-old immature wildings are removed **now** - before they cone - a new concentration of wildings will appear (fringe spread - see inset), and the cost of removal increases significantly.



Remove all green needles

All foliage must be removed from cut stumps. If green branches and/or needles are left on the stump the tree will **not** die. With time, the remaining branches will 're-erect' themselves, and subsequent removal is made much harder.

Costs

1. This table of costs relates to circumstances existing in 2008
   Unless stated otherwise, accommodation and access costs not included

Pg	OPERATION	Characteristics	Average cost per hectare	Comments
12	**Burning**	Best on trees >2 m, or dense stockings		Requires professional organisation / timing
14	**Animal grazing**	Seedlings >2 cm tall hard to graze out	Variable	Best accompanied by fencing and fertilisers
16	**Fertilisers** - to increase competition	Prevention - will decrease wilding numbers c. 50%	c. $100	Effective, but best accompanied by grazing
18	**Hand tools** / **hand pulling** - volunteers with some chainsaw support	Typically scattered small/medium trees at low - moderate densities. Hand pulling of trees <0.5 m tall	$2	Covers cost of transport, coordination and supervision
20	**Hand tools** - contractors	Small trees at high to extreme density	$2000-3500	Likely cost of maintenance operations
		Moderate to high density	$250-750	
		Low densities	$10-100	
22	**Ring-barking**	Medium-size, round trees (no fluting) in 'soft bark' stage	<$1/tree	Volunteers with post peeling 'spoke-shaves'
24	**Chainsaws** - contractors	Dense mature stands	$5000-10,000+	Depends on species and access
		Dense medium sized trees	$1000-2000	Often fringe spread
		Frequent outliers of moderate to high density	$150-300	Associated costs likely to be higher if operations require helicopter ferry to access work site
		Occasional low to moderate density outliers	$15-30	

2. Gives average 2008 costs associated for wilding tree control, based on recent operations in the South Island high country

Pg	OPERATION	Characteristics	Average cost per hectare	Comments
26	**Scrub-bars** Contractors with some chainsaws for larger trees	Small trees at high to extreme densities	$500-1600	Scrub-bars can have spray attachments
		Mixed-age sparse density trees	$100	
28/ 30	**Machinery** (heavy). For controlling dense stands of small to medium trees	Mulcher using two sweeps	$300-500	Have associated transport costs Based on Molesworth costs
		Digger and bulldozer	$500+	
32	**Chemical** Ground spraying - foliar	Vehicle mounted hose gun for trees <2 m tall	<$1/tree	Normal woody weed procedure. Requires total foliar coverage
32	**Chemical** Aerial spraying - foliar	Helicopter boom application	$500-1000	Based on application rate of $250/ha + chemical
		Spot application	<$500	Depends on density
34	**Chemical** -Cut stump application	Can only be used in support of felling operations	$100-200	Costs per hectare are additional to felling
36	**Chemical** Stem poisoning	Usually large isolated trees	$3-5/tree	All-up cost - chemicals, tools, labour
38	**Chemical** Bark application	New technique with potential for 'soft-bark' medium-sized trees	Unknown	Yet to be proven
40	**Chemical** Soil uptake	Outlier trees of medium size in difficult to access areas	$1.10 - $1.80 per tree	Chemical cost only
44	**Helicopter** Skid hopping operation	For very low to moderate density trees only	$2-30	Based on use of a Hughes 500. Professionals only
44	**Helicopter** Human sling operations	Low density in difficult terrain	$10	Operation involving specialist contractors and a Hughes 500D. Professionals only

Removal: Tools of Trade

A useful belt for those encountering wildings in the field.

The tools are (left to right):

- Hand axe
- Small loppers
- First-aid kit
- Pouch containing
  - Secateurs
  - Vigilant gel (for cut stump application)
  - Jack-knife saw (Silky model)

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For an electronic version of this manual and additional details on wilding control go to:

www.wildingconifers.org.nz

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Before and after removal of scattered outlier wildings on the Hanmer ridge, Canterbury

MAF Sustainable Farming Fund