The management of introduced wilding conifers in New Zealand

Nick Ledgard,
Forests and Environment, Ensis, Christchurch, New Zealand

www.wildingconifers.org.nz
Wilding terminology

- Fringe spread
- Distant spread (outlier trees)
- Take-off sites

P. contorta spread, L. Ohau
### Major Spreading Conifer Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Age of Significant Coning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contorta pine (<em>Pinus contorta</em>)</td>
<td>8</td>
</tr>
<tr>
<td>Scots pine (<em>P. sylvestris</em>)</td>
<td>12</td>
</tr>
<tr>
<td>Dwarf mountain pine (<em>P. mugo</em>)</td>
<td>8</td>
</tr>
<tr>
<td>Douglas-fir (<em>Pseudotsuga menziesii</em>)</td>
<td>12</td>
</tr>
<tr>
<td>Corsican pine (<em>Pinus nigra</em>)</td>
<td>13</td>
</tr>
<tr>
<td>European larch (Larix decidua)</td>
<td>12</td>
</tr>
<tr>
<td>Radiata pine (<em>Pinus radiata</em>)</td>
<td>10</td>
</tr>
<tr>
<td>Maritime pine (<em>P. pinaster</em>)</td>
<td>10</td>
</tr>
<tr>
<td>Bishops pine (<em>P. muricata</em>)</td>
<td>10</td>
</tr>
<tr>
<td>Ponderosa pine (<em>P. ponderosa</em>)</td>
<td>13</td>
</tr>
</tbody>
</table>
Typical sequence of *P. contorta* pine spread in undeveloped grasslands

Sequence of wilding spread

Tree spread can be controlled by:

1. Pasture management and controlled grazing in fringe areas
2. Removal of trees on take-off sites upwind of undeveloped areas
3. Removal of outlier trees before they produce seed

Ledgard, 2001
Area affected by wildings

- This is difficult to estimate due to differing interpretations of the word ‘affected’
- In the North Island, an area of 150,000 ha has been suggested.
- In the S. Island, the area ‘affected’ by wildings’ is estimated at over 500,000 ha
- Much larger areas are susceptible to wilding invasion if a source of seed was planted nearby.
Major areas of coniferous spread (>100 trees/ha) in New Zealand

Ledgard, 2001
Sources of seed for wildings

In general, wildings have arisen from:

- Commercial plantations (now privately owned, but mostly planted by the State) – 33%
- Erosion-control plantings in mountainlands (mostly planted by the State) – 33%
- Private plantings (mostly woodlots and shelterbelts on farmland) – 33%
Wildings are seen to threaten:

- **Landscape values**
  - disrupt existing open and often treeless landscapes

- **Conservation values**
  - dominate/degrade native flora/fauna habitats

- **Existing pastoral uses**
  - shade out grazing species

- **Future land use options**
  - often made more expensive

- **Existing hydrology**
  - can significantly lower catchment water yield (but only if >20% of catchment affected)
Major factors influencing spread

- Species choice
- Siting (beware seed ‘take-off’ sites)
- Plantation design
- Surrounding land management (particularly grazing pressure) and vegetation cover
Species choice - Molesworth

Spread occurrence and rate varies with species and site (altitude, rainfall)

P. sylvestris is spreading

P. nigra not coning at this altitude (900m), but is 200m lower
Be wary of planting spread-prone conifers on exposed sites – especially adjacent to lightly vegetated or lightly grazed rangeland.

Seed blown from these ‘take-off’ sites has given rise to wildings at least 9 km downwind.
Most wildings come from seed produced by edge trees.

Shown here is a marginal row of less spread-prone radiata pine around more spread-prone Douglas-fir.
Surrounding land management

Improved pasture = no spread risk

Unimproved pasture = high spread risk

The foreground stands are well located on a sheltered site, surrounded by improved pasture with good grazing.

Corsican pine

Douglas-fir

wind
Grazing, even at very low levels, will significantly reduce wilding survival.

Benecke, 1967
Even a very light grazing level (<0.5 sheep/ha) has been sufficient to significantly lower wilding establishment below the fence line (seed source 4 km away). BUT, once the wildings above the fence started coning, the seed rain became too heavy for a few sheep to control wilding emergence.
Existing vegetation vigour

Fertiliser application will increase competition from existing vegetation, which will depress wilding establishment.

Ledgard, 2006: NZ Jl For 51(3): 29-34
NZ case study - Queenstown

Douglas-fir
\((Pseudotsuga\ menziesii)\)
invasion behind
Queenstown

1985

2004
NZ case study – Mt Dewar, Q’town

From 1992 on, sheep numbers significantly reduced, plus no pasture fertilising
NZ case study - Craigieburn

Pinus contorta, P. mugo, P. sylvestris, Pseudotsuga menzesii, Larix decidua

2001

Steady rain of seed since 1970s. Wildings appeared after change of farm ownership and lowering of sheep numbers in 2002.

2007
NZ case study – Marlborough Sounds

Reversion to woody species after farm abandonment (1970) (pine is *P. radiata*)

1970

By 1990s, invasion opportunities for pines closed by invasive scrub cover (native)

2006
Sounds – typical wilding cover today

Vigorous native shrub cover means little chance for new conifer invasion

Open foreshore strip most susceptible to on-going wilding invasion
Modelling wilding spread

# Ecological process model — Buckley *et al.*, 2005, *Jl Apl Ecol*

# Ben Tal/Laing control simulation model
North and Ledgard, 2005 (unpubl)
Wilding control options (a)

- **Burning**
  - Consent difficulties
  - Difficult to kill large trees, unless stocking dense

- **Browsing / grazing**
  - For seedlings < 2 years old
  - Most common control agent (often unintentional)

- **Competition from existing vegetation**
  - Fertilisers to increase competition and lower wilding emergence
  - Often used in conjunction with grazing
Wilding control options (b)

- **Physical**
  - Pulling of small seedlings (<50cm tall)
  - Hand tools – saws, loppers, axes, slashers (trees < 2m tall)
  - Ring-barking – post peeling knife, axe, slasher (‘soft’ bark stage)

- **Mechanical**
  - Hand - chainsaw, scrub bar
  - Machine - tractor-driven mowers / mulchers (trees to 3-4 m tall)
  - Machine - bulldozers and diggers (trees > 3-4 m)

- **Chemical**
  - Foliar application. OK for small trees from ground. Problems with canopy penetration of large trees, particularly from the air.
  - Cut stump. Useful if all green foliage cannot be removed from stump
  - Stem poison. Used when felling not desirable
Volunteer wilding removal days for the public. Most trees are small (<0.5 m tall) and will be pulled out by hand.
Wilding control – physical (b)

Broken River – upper Waimakariri

Chainsaw – most common
Wilding control - green foliage removal

All green foliage *must* be removed below stump height

*Otherwise, after a few years, this will lead to this …*
Wilding control - machines

Wilding removal on Molesworth station

Bulldozer and digger removing mature trees

Mulching young wildings
Wilding control – chemical spraying of foliage

Mid Dome – partially successful aerial spraying with reglone

OK with gun spraying from ground

Still to be perfected from air

Molesworth – killing of non-target native species

Tarndale – aerial spraying of small wildings with reglone. Larger trees still alive at base.
Wilding control – stem poisoning

Large trees poisoned, as felling creates light wells in scrub, in which new conifers can establish

Poisoning more cost-effective than ring-barking
Wilding regulations

- In New Zealand, the Resource Management Act (RMA - 1991) and the Biosecurity Act (BA - 1993) deal with weed and pest issues.
- These Acts are administered by locally elected governments – known as Regional and District Councils.
Wilding regulations - RMA

- The RMA gives Councils the power to regulate land use activities, according to any potential adverse effects.
- If adverse effects may result from a land use, then a Resource Consent is required.
- In the drier parts of NZ, the planting of new forests usually requires a Resource Consent.
- Often, the major Resource Consent condition, is associated with wilding spread risk.
- Councils will only approve a Resource Consent application, if the applicant satisfies them that any risk of wilding spread will be avoided, remedied or mitigated.
Wilding regulations - BA

- Under the Biosecurity Act, Councils can define a plant as a weed that needs control.
- The majority of Councils in the drier parts of NZ require the issue of wildings to be addressed in their Regional Pest Management Strategies.
- Most strategies list *Pinus contorta* as a ‘total control weed’. Wildings of other conifers can be listed as ‘weeds to be controlled in designated areas’.
- As the BA works on a ‘beneficiary/exacerbator’ principle, it is argued that control costs should be paid by those who benefit from weed control or those who contribute to the weed’s existence.
Summary - mitigating measures

- Future plantations
  - Prevention - assess spread risk (use of assessment form)
    - Siting – beware of seed take-off sites
    - Design – use of marginal planting
    - Surrounding land use – use of grazing / fertilisers

- Existing plantations
  - Removal of spread before coning – particularly outliers
  - Plan for most cost-effective use of resources
  - Use of grazing and fertilisers
Conclusions

- The risk of wilding spread from conifer plantations has to be taken into consideration.
- On many dry eastern sites a spread risk is likely.
- Good knowledge and planning will lead to wilding spread mitigation becoming the ‘norm’.

To use a pastoral analogy – it should be as normal as a farmer’s awareness of the need to:

- have barriers (normally fences) to mitigate the risk of spread by domestic animals
- remove animals which have spread beyond the managed boundary

www.wildingconifers.org.nz
The power of mycorrhizae

Not mycorrhizal

Plus mycorrhiza

Both seedlings 3 years old - sown on same day
Reversion to native shrubs after farming/disturbance
Erosion control. Seeded lines of *P. contorta*, plus infilling by wildings. *Pseudotsuga menziesii* also prominent.