

DSS 1. CALCULATING WILDING SPREAD RISK FROM NEW PLANTINGS^{a,b}

(Select score applicable for each of the five categories)

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1. SPECIES – GROWTH (score for one species only)

Spreading vigour varies with species

- Redwoods, Leyland cypresses, cedars and spruces (very low risk – no need to proceed further) 0
- Radiata (*P. radiata*) and ponderosa (*P. ponderosa*) pine, Lawsons cypress (*C. lawsoniana*) 1
- Muricata (*P. muricata*) and maritime (*P. pinaster*) pine and larches (*Larix* spp) 2
- Corsican (*P. nigra*) and mountain/dwarf mountain (*P. uncinata/mugo*) pine 3
- Douglas-fir^g (*Ps. menziesii*), Scots pine (*P. sylvestris*) 4^g
- Lodgepole/contorta pine (*P. contorta*) 5

Enter score (0, 1, 2, 3, 4 or 5) here

2. SPECIES – PALATABILITY

Palatability varies with species

- Radiata, maritime and ponderosa pine 1
- Lodgepole and muricata pine and European larch 2
- Scots and mountain/dwarf mountain pine and Douglas-fir 3
- Corsican pine 4

Enter score (0, 1, 2, 3 or 4) here

3. SITING OF NEW PLANTING^{c,d}

Trees are located on

- Sites well sheltered from prevalent and strong winds 0
- Flat sites (<10°), partially exposed to strong/prevalent winds 1
- Lea slopes where strong eddy gusts are likely 2
- Flat sites (<10°), fully exposed to strong/prevalent winds 3
- Either elevated 'take-off' sites, (ridge-tops, or base of exposed slopes >10°) 4
- or sloping land, fully exposed to strong/prevalent winds

Enter score (0, 1, 2, 3 or 4) here

4. DOWNWIND LANDUSE – GRAZING

Wilding establishment influenced by grazing (particularly with sheep)

- Intensive grazing on developed pasture 0^d
- Regular mob stocking with sheep^e 1^d
- Semi-improved grazing (sheep/cattle)/ occasional mob stocking with sheep 2^d
- Extensive grazing only^e 3^d
- No grazing 4^d

Enter score (0, 1, 2, 3 or 4) here

5. DOWNWIND VEGETATION COVER (if Douglas-fir involved see^g in Notes)

Wilding establishment influenced by competition from existing vegetation

- Plantation forest, developed pasture (intensive grazing) 0^d
- Native forest^h, shrubland/tussock/grassland with a continuous and dense vegetation cover 1^d
- Forest/shrubland/tussock/grassland with few gaps 2^d
- Open forest and/or scattered patches of dense shrubland/tussock/grassland with many gaps 3^d
- Open slips/rockland and/or light, low-stature shrubland/tussock/grassland 4^d

Enter score (0, 1, 2, 3 or 4) here

TOTAL SCORE

(See Assessment below for interpretation)

ASSESSMENT

- A score of **12** or more indicates a high risk of spread from the planted site.
- BUT, if a score of '0' is obtained in 1. SPECIES – GROWTH, or 4. DOWNWIND LANDUSE – GRAZING, or 5. DOWNWIND VEGETATION COVER, the total score automatically becomes '0' (ie., there is no risk of wilding spread). Although, note the need to test long distance spread risk from exposed sites (scoring 3 or 4 in 3 - Siting)

A high risk does not necessarily mean that trees should not be planted. A change of species, or siting, or downwind land management can significantly lower spread risk. Conversely, a change of species when replanting after harvesting might increase spread risk. If there is a risk of wilding spread, then a commitment to wilding removal should be made - this may not be onerous, particularly for scattered trees (often outliers from distant spread).

NOTES:

- ^a **Multiple calculations.** As the above score sheet indicates, there are a range of factors influencing the risk of spread. The impact of these will vary from site to site, both within a single forest and on the surrounding land. Therefore, spread risk will need to be calculated not just once, but a number of times in order to accommodate the range of sites represented within and outside the forest.
- ^b **Risk assessment location.** This DSS was compiled primarily for use in the drier hill and high country areas of the eastern South Island, where low-stature grasslands (and to a lesser extent, shrublands) often dominate, and where opportunities for wilding establishment are greatest. Wilding spread risk is considerably less in the warmer, wetter parts of New Zealand (mostly present in the North Island), due to higher-stature vegetation covers being more vigorous and complete, and to poorer seed production in some species (such as Douglas-fir).
- ^c **Altitude.** The coning ability of some species drops off quickly with increasing altitude. Contorta and mountain pine will readily establish and cone above native treeline. Scots pine and Douglas-fir will establish at tree line. Corsican pine and Douglas-fir coning drops off quickly above 800 and 1100 m respectively – the limit for Scots pine coning is unknown. Radiata pine is a reluctant spreader above 6-700 m, except on the warmer sites. The altitudinal establishment and coning limits for muricata pine and larch are unknown.
- ^d **Long distance spread.** This is quite possible if a score of 3 or 4 is scored in 'Siting' (in 3) especially if Douglas-fir, larch or Corsican, contorta, mountain or Scots pines are involved (all have light seed which is readily dispersed greater distances by wind). In these circumstances, the risk of spread relative to grazing (4) and vegetation cover (5) needs to be scored out to beyond the 'fringe' area, to a distance of 2 km. ('Fringe' infers a distance from seed source of 1 – 200m)
- ^e **Regular mob stocking.** If the pasture is only semi-improved and the seed rain is heavy, such as alongside mature conifers (particularly Corsican pine – the least palatable conifer), regular mob stocking may not prevent wilding establishment over the long term.
- ^f **Light grazing.** This will reduce wilding establishment, but given enough time, some wildings will eventually grow to above browse height. Palatability of introduced conifers is (in decreasing order): radiata > ponderosa > contorta > larch > Scots pine > Douglas fir > Corsican pine.
- ^g **Douglas-fir.** i) This species is more shade tolerant than the other common conifers. Therefore, it is more likely to invade under forest canopy gaps and within low-stature (<2m tall) shrublands.
ii) Douglas-fir requires some drought stress during bud formation in late summer to ensure cone buds are formed in the following season; otherwise they become vegetative buds. Hence, coning is significantly less in moister (and often warmer) parts of NZ (eg., much of N. Island, west coast of S. Island). *Therefore, in these areas, Douglas-fir should be given a score of '1' (not '4') in 'SPECIES – GROWTH'.*
- ^h **Native forests .v. plantations of introduced trees.** Man-made plantations are much more likely to have a continuous canopy cover, than are existing native forests, where disturbance and canopy gaps are a normal part of the natural succession cycle.

DSS 2. CALCULATING RISK OF WILDING TREE SPREAD INTO/WITHIN NEW SITES ^{1,7}

(Select score applicable for each of the six categories)

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1). SPECIES PROVIDING SEED SOURCE (score for one species only)

Spreading vigour varies with species

- Redwoods, Leyland cypresses, cedars and spruces 0
- Radiata (*P. radiata*) and ponderosa (*P. ponderosa*) pine, Lawsons cypress (*C. lawsoniana*) 1
- Muricata (*P. muricata*) and maritime (*P. pinaster*) pine and larches (*Larix* spp) 2
- Corsican (*P. nigra*) and mountain/dwarf mountain (*P. uncinata/mugo*) pine 3
- Douglas-fir ⁶ (*Ps. menziesii*), Scots (*P. sylvestris*) pine 4 ⁶
- Lodgepole/contorta (*P. contorta*) pine 5

Enter score (0, 1, 2, 3 or 4) here

2). SITING OF SOURCE TREES ^{2,3}

Source trees are on....

- Sites well sheltered from prevalent and strong winds 0
- Flat sites (<10⁰), partially exposed to strong/prevalent winds 1
- Lea slopes where strong eddy gusts are likely 2
- Flat sites (<10⁰), fully exposed to strong/prevalent winds 3
- Either elevated 'take-off' sites, (ridge-tops, or base of exposed slopes >10⁰) or sloping land, fully exposed to strong/prevalent winds 4

Enter score (0, 1, 2, 3 or 4) here

3). SITING OF SAMPLE SITE RELATIVE TO SOURCE TREES

Location relative to seed-dispersing winds

- Up-wind relative to prevalent or strong winds (If upwind and >1km distant - score 0) 1 (0)
- Subject to cross-winds and/or wind-eddies relative to prevalent or strong winds 2
- Down-wind relative to prevalent and strong winds (often from N and W) 3

Enter score (0/1, 2 or 3) here

4). DISTANCE OF SAMPLE SITE FROM SOURCE TREES ³

Spread risk decreases with distance from seed source

- Greater than 5km 0 ³
- 1-5km 1
- 200m – 1km 3
- 0-200m 4

Enter score (0, 1, 3 or 4) here

5). GRAZING WITHIN SAMPLE AREA

Wilding establishment influenced by grazing (particularly with sheep)

- Intensive grazing on developed pasture 0
- Regular mob stocking with sheep ⁴ 1 ⁴
- Semi-improved grazing (sheep/cattle)/ occasional mob stocking with sheep 2
- Extensive grazing only ⁵ 3
- No grazing 4

Enter score (0, 1, 2, 3 or 4) here

6). VEGETATION OF SAMPLE SITE (if Douglas-fir involved see ⁶ below)

Wilding establishment influenced by competition from existing vegetation

- Developed pasture, rank grass, plantation forest (no gaps) ⁸ 0
- Native forest ⁸, shrubland/tussock/grassland with a continuous and heavy vegetation cover 1
- Forest/shrubland/tussock/grassland with few gaps 2
- Open forest and/or scattered patches of dense shrubland/tussock/grassland with many gaps 3
- Open slips/rockland and/or light, low-stature shrubland/tussock/grassland 4

Enter score (0, 1, 2, 3 or 4) here

TOTAL SCORE:

(See Assessment below for interpretation)

ASSESSMENT

- A score of **14** or more indicates a high risk of invasion by the assessed species onto the sample area.
- BUT, if a score of '0' is obtained in any one category, the total score automatically becomes '0' (ie., there is no risk of wilding spread). Although, note the need to test long distance spread risk from exposed sites (scoring 2 or 3 in 3 - Siting)

A high risk does not necessarily mean that the area will inevitably succumb to wilding trees. A commitment to wilding removal can be made, possibly involving the owner of the source trees. Providing it is timely (before wildings cone and produce seed), this commitment need not necessarily be onerous, particularly for scattered trees (often outliers from distant spread).

NOTES:

- Multiple calculations.** As the above score sheet indicates, there are a range of factors influencing the risk of spread. The impact of these will vary from site to site, both relative to the seed source and to the land being sampled. Therefore, spread risk will need to be calculated not just once, but a number of times in order to accommodate the range of sites represented at the seed source and at the site being sampled.
- Altitude.** The coning ability of some species drops off quickly with increasing altitude. Contorta and mountain pine will readily establish and cone above native treeline. Scots pine and Douglas-fir will establish at tree line. Corsican pine and Douglas-fir coning drops off quickly above 800 and 1100 m respectively – the limit for Scots pine coning is unknown. Radiata pine is a reluctant spreader above 6-700 m, except on the warmer sites. The altitudinal establishment and coning limits for muricata pine and larch are unknown.
- Long distance spread.** This is likely if a score of 3 or 4 in 'Siting' (in 3) is followed by a 2 or greater in 'Vegetation' and 'Grazing' (in 5 & 6), especially if Douglas-fir, larch or Corsican, contorta, mountain or Scots pines are involved (all have light seed which is readily dispersed greater distances by wind). In these circumstances, the risk of spread may need to be considered out beyond 5 km.
- Regular mob stocking.** If the pasture is only semi-improved and the seed rain is heavy, such as alongside mature conifers (particularly Corsican pine – the least palatable conifer), regular mob stocking may not prevent wilding establishment over the long term.
- Light grazing.** This will reduce wilding establishment, but given enough time, some wildings will eventually grow to above browse height. Palatability of introduced conifers is (in decreasing order): radiata > ponderosa > contorta > larch > Scots pine > Douglas fir > Corsican pine.
- Douglas-fir.** i) This species is more shade tolerant than the other common conifers. Therefore, it is more likely to invade under forest canopy gaps and within low-stature (<2m tall) shrublands.
ii) Douglas-fir requires some drought stress during bud formation in late summer to ensure cone buds are formed in the following season; otherwise they become vegetative buds. Hence, coning is significantly less in moister (and often warmer) parts of NZ (eg., much of N. Island, west coast of S. Island). *Therefore, in these areas, Douglas-fir should be given a score of '1' (not '4') in 'SPECIES – GROWTH'.*
- Risk assessment location.** This DSS was compiled primarily for use in the drier hill and high country areas of the eastern South Island, where low-stature grasslands (and to a lesser extent, shrublands) often dominate, and where opportunities for wilding establishment are greatest. Wilding spread risk is considerably less in the warmer, wetter parts of New Zealand (mostly present in the North Island), due to higher-stature vegetation covers being more vigorous and complete, and to poorer seed production in some species (such as Douglas-fir).
- Native forests .v. plantations of introduced trees.** Man-made plantations are much more likely to have a continuous canopy cover, than are existing native forests, where disturbance and canopy gaps are a normal part of the natural succession cycle.