

# Appendix

## List of all provenance trials planted in NZ 1954-1980

### Eastern USA

*Pinus banksiana* 1955/56 six seedlots, Kaingaroa, Naseby. 2 plots/site. 225 trees/plot (Kaingaroa), 360-400 (Naseby)

*Pinus resinosa* 1956 seven seedlots, Kaingaroa, Karioi, Berwick, Naseby 2-3 plots/provenance/site, no data on trees/plot

*P. elliotii* var. *elliottii* 1956 eight provenances, 17 OP seedlots, Waitangi, 1-3 plots/seedlot, 144 trees/plot

*P. taeda* 1955 18 seedlots (13 provenances and bulks), Waitangi, Rotoehu, 1-3 plots/seedlot/site, 196 trees/plot

*P. strobus* 1970 77 seedlots, Gwavas, Rotoehu, Golden Downs, 5 reps., 10-tree row plots, Sets in Reps. design with ca. 20 seedlots per set.

### Europe and Asia

*P. pinaster* 1955 47 seedlots, 9 sites, Woodhill, Waitangi (RCB), Rotoehu, Berwick, Puhipuhi, Berwick, Naseby. 2-3 plots/seedlot at Woodhill, Waitangi, rest 1 plot/seedlot, 196 trees per plot at RCB sites, others 100 trees/plot

*P. sylvestris* 1956 Five seedlots 3 sites, Kaingaroa, Berwick, Naseby, 1 plot/provenance/site, 100, 121, 190 trees per plot respectively

*Larix decidua* 1959 27 native, 10 exotic seedlots, Kaingaroa x 2.(1-2 plots/seedlot, 100 trees/plot), Patunamu, Gwavas, Golden Downs, Hanmer, Berwick, Rankleburn, Naseby, Whaka (1-3 plots/seedlot, 121-144 trees/plot)

*Larix leptolepis* 1957 20 provenances, Kaingaroa x 2, 1-3 plots/seedlot, Patunamu, Gwavas. 3 plots/seedlot, Golden Downs, Hanmer, Berwick, Naseby, Whaka 1-3 plots per seedlot, 100-196 trees/plot

*P. nigra* 1956-58 39 seedlots (native populations), 5 ex European plantations, 4 NZ at Whaka, Gwavas, Golden Downs, Karioi, all one plot/provenance. Karioi, Golden Downs, Ngaumu, 3 plots/provenance. 100 trees plot except 144 at Golden Downs and Karioi.

### Western North America

- P. attenuata*** 1961 49 seedlots, from southern Oregon to south California, including 2 hybrids with *radiata*. Designs: 3-4 reps RCB of 16 trees/plot/site, and 7x7 lattice with 2 rows of 6 or 8 trees/plot. Only 11 seedlots with 2-6 OP seedlots/provenance. Sites, Whaka, Kaingaroa, Karioi, Naseby
- P. muricata*** 1972 Rotoehu only (Bannister) 16 provenances, 15 OP families/provenance, 236 families, probably 20 trees per family max.
- P. muricata*** 1973 Trinidad, Mendocino, Sonoma, 2 NZ blue (Mendo.), Marin, NZ green (Marin). 10 sites, Kaingaroa (x2), Karioi, Kaweka, Golden Downs, Mahinapua, Naseby, Berwick, all 10-tree rows, RCB, 5-10 reps.
- P. contorta*** 1958-61 14 seedlots by Egon Larsen, 11 by USFS, 3 NZ. 7 coastal provenances, 13 murrayana, 5 latifolia, 2 intermediates. 15 sites, 3-4 plots/prov./site. No information on trees/plot but assume 100+. Esk and Kaingaroa 25 plots/provenance, 2 trees/plot.
- P. ponderosa*** 1954 Five seedlots all within 50 miles of lat. 38° 30'. 1 plot/seedlot/site at 9 sites, 169-324 trees/plot, 3 plots/seedlot at Gwavas, 2-4 Golden Downs, 2 Berwick. 170-324 trees/plot.
- P. ponderosa*** 1960-61 8 sites 1960, 8 in '61, 1 in '62. 64 seedlots. RCBs, 14 sites with 3 plots/seedlot/site, 13 sites with 4 plots, Esk 1 plot/rep, 32 trees/plot.
- Picea sitchensis*** 1972 RCB 5-10 reps/site, 10 tree row plots, 8 sites (4 per island), Hunua, Karioi, Slopedown, Whaka
- Picea sitchensis*** 1956 4 seedlots, Big Lagoon, Caspar (Cal.), Waldport, Ore., Vancouver Is., Naselle, Wa. 1-3 plots/site., 17 sites, 11 of 17 abandoned by age 24.
- Pseudotsuga menziesii*** 1957 mostly commercial lots, Darrington, north Wa. to Siskyou, south Ore. also Vancouver Is., No coastal provenances. 7 sites 100-196 trees/plot, Rotoehu (1/2 121), Kaingaroa (3 196), Kaingaroa (1 99), Patanamu (1 121), Golden Downs (3 ?), Hanmer (2/3 196), Berwick (3 144)
- Pseudotsuga menziesii*** 1959 20 sites, 121-144 trees/plot, 1-3 plots/seedlot/site, mostly 1 plot. Sites with 2 or 3 plots/provenance: Glenberrie, Rapanui (NZFP), Kaingaroa Cpt. 1149, Gwavas, Golden Downs, Hanmer, Rangleburn.

I haven't been able to access any information on *Tsuga heterophylla* and *Thuja plicata*. *Tsuga* definitely planted at Hanmer. Both important species in Western forests. *Populus trichocarpa* and *Alnus rubra* are also both important.

### Australia

- Eucalyptus regnans*** 1977 two sites, Wiltsdown (Tokoroa) and Kaingaroa. 144 OP families in 36 provenances 36 reps, 'sets in reps' design (sort of!) Sets A, B, C, D at Wiltsdown Set D at Kaingaroa Set A Tasmania, Set B Victoria, Set C NZ, Set D mixed.
- E. fastigata*** 1979 Kinleith, Kaingaroa 126 seedlots total. 115 OP families 11 composites, from NSW and Victoria, 1 South Africa, 15 NZ stands, 51 NZ OP seedlots. Field trials 3 sets of 42 seedlots 36 reps STPs at Kinleith, 42 reps STPs at Kaingaroa.

- E. saligna* 1976 43 native OP families (as 18 provenances), 55 NZ families, 4 sites, STPs, ?? no. of sets. Includes *E. botryoides* (1), *E. grandis* (3), *E. deanei* (2), *E. dunnii* (1)
- E. delegatensis* 1977 38 native OP families, 52 NZ, RCB, 27 reps of STPs/site, 2 sites
- Eucalyptus species trial*** Longwoods, 1977 RCB 3 reps of Main plots (of species), 15, 30 or 45 trees. Provenances were STPs within Main species plots. Average 9 trees/prov., 5 provs./species.
- E. nitens* 1979 80 OP Victorian families plus a few NSW families. No data. ca. 4 sites inc. Longwoods, Tongariro, Kaingaroa, STPs, sets in reps
- E. nitens* 1990 Second gen. selections. 300 OP families, two sites STPs and 1 site forwards selection row plots

*Pinus radiata*

- Pinus radiata*** 1955 29 OP families 3 reps of 20 tree row plots (some select OPs as in 850 55) 20-tree-row plots, 3 sites, Gwavas, Golden Downs, Berwick, assessed 1967 age12. First estimates of genetic parameters from OP progenies, range of narrow sense  $h^2$ . Gave confidence for use of OP in '268' programme, starting in 1968/9.
- P. radiata* 1955 Two provenances of radiata, Monterey, Ano Nuevo. 2 sites, Golden Downs, Gwavas. Big plots 100-200 trees/plot 2 or 3 plots/prov/site.
- P. radiata* 1957 Assorted CP crosses including many with '850'-19, '850'-55 (and '850'-20) as 'testers', plus a Kaingaroa bulk unselected lot. These provided the first estimates of genetic gains from radiata in NZ. 20 tree-row-plots, 3 reps in RCB. Total number of crosses (not including fastigiate clone 20) about 20.
- P. radiata* 1964-66 Genetic survey of *P. radiata* ca. 350 OP families (5 native and 2 NZ populations with 50 OPs each. STPs with interlocking block design to facilitate thinning (Libby and Cockerham).
- P. radiata* 1968 '266' clonal tests, 216 clones selected in 1964 in 5- and 6-year-old stands (6 & 7 years from seed). Two sites, Cpt. 1350 Kaingaroa and Whaka forest. First STP design, 3 reps/site 3-6 ramets of each clone/rep. Laid out as Lattice.
- P. radiata* 1968 progeny test of 14 OP families ex seed orchard and CP families of most of these forming factorial of 8 '850' series clones from first orchard. 1 site. STPs 3-5 seedlings/family/rep. About 10 reps. 4 x 4 factorial results published by Wilcox, Shelbourne and Firth.
- P. radiata* 1969 progeny test of 588 OP families of '268' series. 3 sites, Kaingaroa Cpt. 1350, Waimihia, Gwavas. Sets in reps. 16 sets of 38 families, '850' orchard lot, bulk unselected lot, 10-tree row-plots (Set 16 is a half-set).
- P. strobus* 1970 77 mainly provenance seedlots, Gwavas, Rotoehu, Golden Downs, sets in reps, 20 seedlots/set, 5 reps, 10-tree plots.
- P. muricata* 1972 (Bannister) RCB 15 fams/provenance, 236 OP families, ca. 18 provenances. including NZ blue and green (Mendocino and Marin). 1 site Rotoehu, Trinidad, Mendocino, Sonoma, Marin, Monterey, San Luis Obispo, Santa Rosa, Santa Barbara 16 provenances plus Cedros radiata, small row plots RCB.

- P. muricata*** (Shelbourne) 1973 2 sites, Cpt. 1038 and 885 Kaingaroa, assorted Sonoma plus others. 10 site countrywide trials with Trinidad, Mendocino, Sonoma, Marin, 2 x NZ blue and 1 x NZ green (Marin) all RCB 10-tree row plots 5-10 reps.
- P. radiata*** 1972 '268' OP tests Golden Downs, Woodhill, Otago Coast, (Ashley failed), 220 of 588 '268' OP families plus 80 SI OP families, sets in reps, 30 families/set, 10-tree row plots.
- P. radiata*** 1975 Polycross 6 sites Kaingaroa (Western boundary Cpt. 327), Berwick, Golden Downs, 4 sets in reps, STPs but multiple trees (2-5) per rep., 100 families 25-30 per set
- P. radiata*** 1975 Disconnected Diallel '850' GE study, 11 sites, 25 parents, 5 half diallels, one 5x5 full diallel, sets in reps, diallels coincident with sets, 2-5 seedlings per cross per rep, 6 reps. Sites from Woodhill south to Berwick.
- P. radiata*** 1978 Genetic Gain trials. Type A Row plot of ca. 10 entries, RCB 8-10-tree row plots, ca. 10 sites.

Genetic Gain Type B large plot trials B1 sawlog regime, pruning and thinning to ca. 300 s/ha C. B2 pulpwood regime, no thinning, no pruning. Different initial spacing. RCBs, number of reps 6 Kaingaroa, Mohaka, Woodhill, Golden Downs, Rangleburn

- P. radiata*** 1980 '875' Disconnected Diallel second generation test STPs ca. 20 5 x 5 disc. half diallels, ca. 100 '875' parents, 2 or 3 sites, Kaingaroa Cpt. 327 and Tasman seed orchard, Kawerau
- P. radiata*** 1980 Full-sib selection blocks '268', 1 or 2 49 tree blocks for within-family selection from high GCA crosses among '268's. On Rotorua-Whakatane hwy. Plus 2 sites with STP trials
- P. radiata*** '880' second generation OP families 1982 4 sites, Moerewa, Rotoehu, ?? STPs sets in reps
- P. radiata*** '885' and '887's Additional BP, first gen., STPs, sets in reps design, OP tests (as at Kaingaroa Cpt. 327 but where else?)
- P. radiata*** Native populations collected by Firth and Eldridge in 1978. OP progenies bulked to make single sub-population lots, sub-populations bulked for field gene resources. Plot size ? ca. 49 planted throughout NZ.

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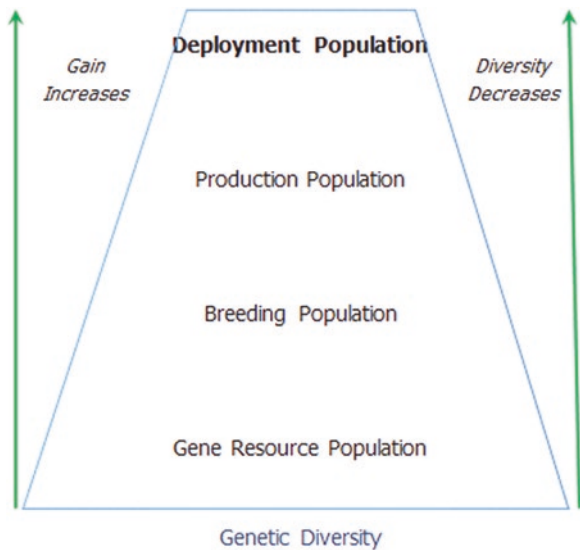


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**Table 1** Areas from National Forest Survey of pure and mixed combined exotics (acres)

<i>Species. Pseudotsuga menziesii</i>	Area	Percentage
<i>P. ponderosa</i>	86,179	39.9
<i>P. nigra</i>	67,805	31.4
<i>P. contorta</i>	26,401	12.2
<i>P. pinaster</i>	11,452	5.3
<i>P. muricata</i>	6,670	3.1
<i>P. elliotii</i>	4,350	2.0
<i>P. strobus</i>	3,232	1.5
<i>P. taeda</i>	3,105	1.5
<i>P. patula</i>	2,963	1.4
<i>P. palustris</i>	2,462	1.1
<i>P. sylvestris</i>	360	0.2
<i>P. echinata</i>	358	0.2
<i>P. lambertiana</i>	167	0.1
<i>P. banksiana</i>	132	0.1
<i>P. canariensis</i>	57	
<i>P. monticola</i>	49	
<i>P. attenuata</i>	12	
<i>P. pseudostrobus</i>	10	
<i>P. tenuifolia</i>	6	
<i>P. durangensis</i>	1	
<i>P. montezumae</i>	1	
<b>Totals</b>	<b>215,772</b>	

**Fig. 1** The Tree Improvement Triangle (refer Chap. 16)



# References

**Note: the first number in each entry indicates the Production Forestry Division (Branch) report number**

## Species and Provenance Testing

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