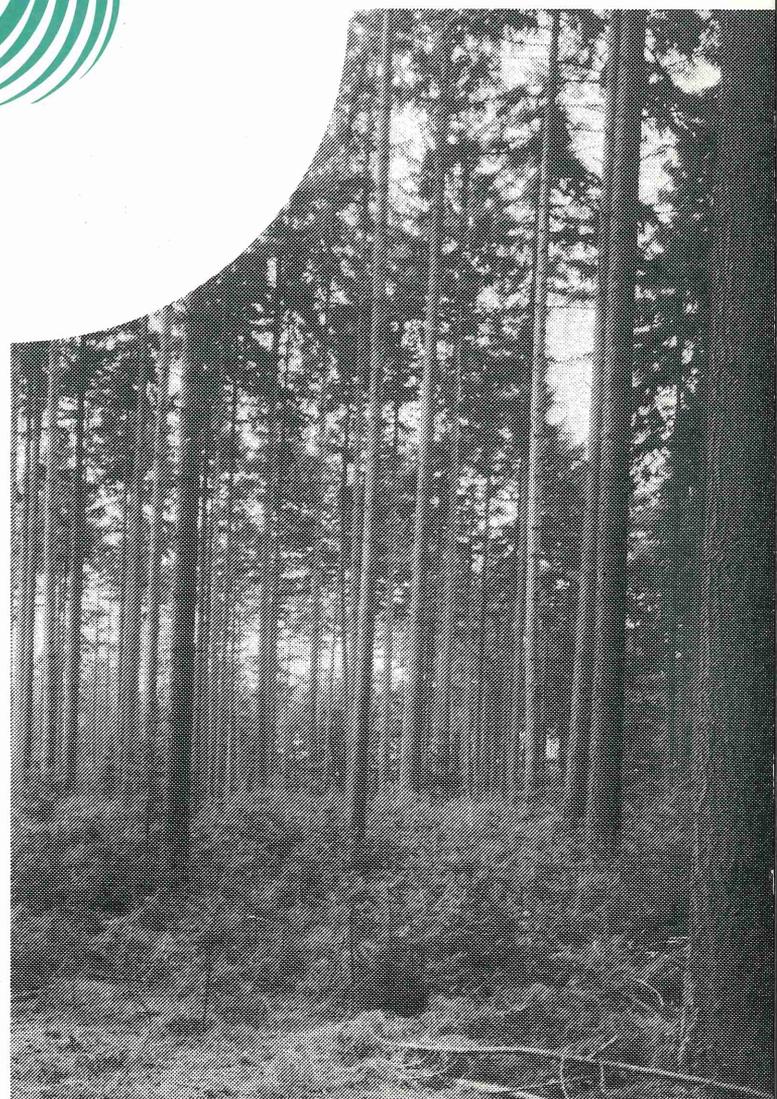


Douglas fir provenance research in The Netherlands; 1966/67 IUFRO series

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ibn-dlo



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1 SUMMARY

Results of height growth and survival in two provenance trials in the Netherlands with 52 IUFRO provenances of Douglas fir, *Pseudotsuga menziesii* (Mirb. Franco) of the 1966/'67 series are presented in this report. The first results of these experiments were published in 1974 and later in 1979 by Kriek.

Growth and survival of provenances from the three areas in Washington, USA which were selected in 1974 and 1979 for seed collection still proved to be the best.

Three areas in Washington with good provenances could be distinguished:

- A: The area east of Puget Sound with the good provenances Arlington, Darrington, Granite Falls and North Bend. This area covers parts of the seed zones 202, 403 and 412.
- B: The area west of Puget Sound around Mount Olympus with the good provenances Matlock, Humptulips, Hoh River, Forks, Louella Guard Station and Lake Crescent. This area covers parts of the seed zones 012, 030 and 221.
- C: The third area is found in the south along the Columbia River in seed zone 041 with the provenances Cathlamet, Naselle and Skamokawa.

These best performing provenances are listed in the Sixth list of approved clones and provenances of trees, 1995. (in press).

2 INTRODUCTION

Douglas fir was first introduced in the Netherlands around the year 1860. This first introduction was quite successful. Later imports were used in plantations with varying success. It was later recognized that the source of the seed had much to do with the results in the plantations, but the provenance of the first introduction and of subsequent imports of seed are unknown. In 1923 a first provenance study was initiated. In a period of 14 years about 35 provenances of known origin in British Columbia, Canada and Washington and Oregon, USA were imported and 27 experiments containing 1 to 8 provenances each were established. The results of this research were published by Veen in 1951 and de Vries in 1962. Some of the provenances grew very well and proved to be well suited to the Netherlands. However by the time this conclusion was reached it was impossible to obtain more seed from these sources as the original stands had disappeared. The sampling of the natural range had not been extensive enough to provide a sound basis for delineation of the most promising seed collection areas for the Netherlands. The climatological data of the natural range had to serve as criterion for decisions about whether provenances were suitable. In 1950 a zone around the Puget Sound in Washington and a zone in the north-west of Oregon around Vernonia and Jewell were designated for seed collection. The altitude in these zones varied from 20 to 40 m in the north to 225 m in the south. These zones were chosen on the assumption that provenances from relatively dry zones would be most suited to the Netherlands. It was realized that some provenances from moister areas were performing well, but some doubts existed about their winter hardiness (Studiegroep Bosbouw 1950). When more experience was gained it became evident that provenances from moister zones in the coastal area and at somewhat higher altitudes in Washington and on Vancouver Island, were to be preferred. However it was unsatisfactory that the choice of provenances for import was based on climatological data without sufficient support from results obtained in provenance research. Therefore the need was felt for more extensive provenance research.

When, under the auspices of the IUFRO (International Union of Forest Research Organisations) plans were made for seed collection of a great number of provenances throughout the natural range for provenance research and gene conservation, the former Forest Research Station 'De Dorschkamp' decided to start a new series of provenance tests. Seed of 104 provenances was collected in 1966 and 1967 in British Columbia, Washington and Oregon. Of this first series 57 provenances have been included in our research programme. Early results with these provenances in the nursery and in one trial were reported in 1974 (Kriek 1974). Later results of 52 of the 57 provenances in two experiments were reported in 1979 (Kriek 1979).

The present report deals with further results in the two provenance trials Sleenerzand and Sprielderbos.

3 MATERIAL

The geographic locations of the provenances in the Dutch trials are shown in Figure 1 and Table 1.

Seed was sown in three replicates in December 1967 in the nursery from "De Dorschkamp". The seedlings were transplanted in the spring of 1969 in the same nursery maintaining the same three replicates. In April 1971 an experiment was established with part of the three-year-old material (1+2) in the forest range Sleenerzand in the northeastern part of the Netherlands. The remaining planting stock was transferred to nurseries in the Sprielderbos forest range in the centre of the country. This material was used for establishing a trial in Sprielderbos in spring 1973. At that time the plants were five years old (1+2+2).

4 TRIAL DATA

SLEENERZAND:

Establishment: April 1971.
Previous crop: Japanese larch of 1939.
Site preparation: Every other row of the larch was felled leaving 5 m between the remaining rows, which were oriented east-west.
Soil: 'Haarpodzol'.
Spacing: In the cleared strips 2 x 2 m.
Plant material: 3 years old (1+2).
Layout: 50 provenances in 6 blocks.
Plot size: 4 rows of 5 plants; 10 x 10 m.
Remarks: The remaining Japanese larch trees were felled in 1974 and 1975.

SPRIELDERBOS:

Establishment: March 1973.
Previous crop: Scots pine of 1920.
Site preparation: Some of the Scots pine was felled in 1972 leaving strips of the old stand oriented east-west. These remnants of the old stand were thrown by storms in 1972 and 1973, before and just after planting. Sods 50 x 50 cm were cut before the planting holes were dug.
Soil: 'Holtpodzol'.
Spacing: 2 x 2.5 m.
Plant material: 5 years old (1+2+2).
Layout: 40 provenances in 8 blocks.
Plot size: 4 x 4 plants; 8 x 10 m.

5 ASSESSMENTS AND THINNINGS

Results of the performance of the provenances until 1977 were reported by Kriek (1974 and 1979). After 1977 new assessments of height, diameter and survival were recorded. Also a first thinning was carried out in both trials. At the end of 1980 at the age of 13 years from seed in both trials height and for the first time also the diameter was measured from all trees.

The trial in Sleenerzand was thinned in December 1980. This was a selective thinning by which the poor and badly shaped trees were removed as much as possible. Next to that some competitive trees were also removed. Including losses a total of 40 % of the trees was removed. This thinning was recorded as well as survival before thinning. The trial in Sleenerzand was measured again at the end of 1983 and 1987 at the age of 16 and 20 years from seed. The trial in Sprielderbos was measured again at the end of 1984 and 1987 at the age of 17 and 20 years from seed. In this trial a selective thinning was carried out during the winter of 1984/'85. This thinning was carried out later than in the Sleenerzand trial because of poorer growth. In the Sprielderbos trial also 40 % of the trees including the losses was removed with this first thinning.

6 RESULTS

6.1 growth

Tables 2 and 3 show results of height and diameter growth in both trials in 1980, 1983, 1984 and 1987.

The provenances were arranged in five groups and ranking within these groups was based on the height in 1987.

Both height and diameter growth in the Sleenerzand trial was better than in the Sprielderbos trial. Mean height in Sleenerzand was in 1980, 1983 and 1987 at the age of 13, 16 and 20 years from seed 5.5, 7.9 and 11.1 m. respectively. This means an annual increment of 0.80 m. during the period of 1980 until 1983 as well as during the period of 1983 until 1987.

The best performing provenances are from the distinguished areas for seed collection in Washington as were recognized in 1974 and 1979. (Kriek 1974 and 1979). These provenances showed in 1987 a height from 11.1 to 12.4 m. Also diameter growth of these provenances turned out better than from provenances outside these areas.

Mean height in the Sprielderbos trial in 1980, 1984 and 1987 at the age of 13, 17 and 20 years from seed was 4.4, 8.0 and 10.4 m. respectively. Annual increment in the period of 1980 until 1984 was 0.90 m and from 1984 until 1987 this was 0.80 m. Just as in the Sleenerzand trial the best performing provenances in the Sprielderbos trial originate from the three distinguished areas. These provenances showed in 1987 a height that varied from 10.3 to 11.4 m. In both trials provenances from the main land of British Columbia showed poorest growth.

6.2 Survival

Tables 2 and 3 show survival in both trials before thinning the Sleenerzand trial in 1980 and the Sprielderbos trial in 1984. Since the last survival recording in 1977 (Kriek 1979) losses did not increase. Survival in the Sleenerzand trial was higher than in the Sprielderbos trial.

Mean survival in the Sleenerzand trial at the age of 13 years from seed was 79 %, varying per provenance from 43 - 99 %.

Survival was very high until 1974 three years after establishment. Threequarters of the provenances at that time showed losses of only 0 - 3.5 %. Drought in 1975 and 1976 and repeated damage by late frosts in spring caused bigger losses.

Survival of the provenances from the distinguished areas with losses from 1 - 17 % may be considered as high except the provenance Skamokawa which showed a loss of 27 %. Provenances outside these areas showed a lower survival except the provenances Chilliwack, Sooke, Lake Crescent and Hebo.

Provenances from the mainland of British Columbia showed the lowest survival.

Mean survival in the Sprielderbos trial in 1984 at the age of 17 years from seed

was 72 %, varying per provenance from 41 - 89 %. Until 1975 survival was moderate to high. Threequarters of the provenances showed losses from 2 - 10 %. The remaining provenances showed losses of 12 - 27 %. After 1975 drought and late frosts in spring increased losses. Serious late frosts killed most of the trees in 21 adjoining plots in blocks 1 and 3. These plots had to be abandoned. In 1984 about two-third of the provenances showed losses from 13 - 30 % and one-third showed losses from 31 - 59 %. The provenance Humptulips with a loss of 11 % showed the highest survival. In both trials the provenances from the mainland of British Columbia showed poorest growth and lowest survival. On the basis of these results of growth and survival at the age of 20 years from seed recommendations can be given for the choice of provenances for use in the Netherlands. The provenances from the three distinguished areas in 1974 and 1979 still proved to be the best. Figure 2 shows these areas in Washington and they can be defined as:

A: The area east of Puget Sound with the good provenances Arlington, Darrington, Granite Falls and North Bent. This area covers parts of the seed zones 202, 403 and 412.

B: The area west of Puget Sound round Mount Olympus with the good provenances Matlock, Humptulips, Hoh River, Forks, Louella Guard Station and Lake Crescent. This area covers parts of the seed zones 012, 030 and 221.

C: The third area is found in the south along the Columbia River in seed zone 041 with the provenances Cathlamet, Naselle and Skamokawa.

These best performing provenances are listed in the Sixth list of approved clones and provenances of trees, 1995. (in press).

7 CONCLUSIONS

Results of growth and survival of the 57 tested IUFRO provenances at the age of 20 years from seed in the provenance trials Sleenerzand and Sprielderbos lead to the following conclusions:

Former distinguishing of three areas in Washington, USA for seed collection for use in the Netherlands (Kriek, 1974 and 1979) can be maintained. These areas with good performing provenances are:

A: The area east of Puget Sound with the good provenances Arlington, Darrington, Granite Falls and North Bend.

This area covers parts of the seed zones 202, 403 and 412.

B: The area west of Puget Sound around Mount Olympus with the good provenances Matlock, Humptulips, Hoh River, Forks, Louella Guard Station and Lake Crescent. This area covers parts of the seed zones 012, 030 and 221.

C: The third area is found in the south along the Columbia River in seed zone 041 with the good provenances Cathlamet, Naselle and Skamokawa.

These best performing provenances are listed in the Sixth list of approved clones and provenances of trees, 1995. (in press).

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ANNEXES: tables, figures

Table 1. Location and number of trees from which seed was collected

sel.no. IUFRO	sel.no. IBN	Provenance	Lat. N.	Long. W.	Altitude m.	No.of trees
CANADA: BRITISH COLUMBIA						
1002	1653	Dean	50 48'	126 57'	20	15
1004	1654	Stuie	52 22'	126 00'	230	16
1012	1656	KLina Klini	51 07'	125 35'	5	15
1021	1657	D'Arcy	50 33'	122 30'	270	15
1023	1658	Jeune Landing	50 27'	127 27'	170	15
1024	1659	Owl Creek	50 20'	122 43'	210	15
1025	1660	Nimpkish	50 19'	126 53'	90	15
1026	1661	Stella Lake	50 17'	125 28'	150	15
1029	1662	Thasis	49 47'	126 38'	15	11
1030	1663	Squamish	49 46'	123 09'	15	15
1031	1664	Gold River	49 45'	126 04'	90	15
1032	1665	Courtenay	49 41'	125 03'	70	15
1033	1666	Forbidden Pl.	49 39'	125 09'	610	15
1034	1667	Sechelt	49 30'	123 52'	180	15
1036	1668	Alberni	49 19'	124 51'	140	15
1037	1669	Franklin R.	49 06'	124 46'	150	15
1038	1670	Chilliwack	49 06'	121 42'	910	15
1039	1671	Chilliwack	49 04'	121 48'	170	15
1040	1672	Cassidy	49 03'	123 57'	200	15
1041	1673	Caycuse	48 55'	124 26'	210	15
1042	1674	Duncan	48 45'	123 45'	60	15
1043	1675	San Juan	48 34'	124 04'	210	15
1045	1677	Sooke	48 24'	123 44'	45	15
USA: WASHINGTON.						
1050	1678	Marble Mnt.	48 35'	121 24'	120	15
1051	1679	Sedro Woolley	48 32'	122 19'	60	16
1053	1680	Darrington	48 16'	121 38'	150	15
1054	1681	Arlington	48 13'	122 04'	90	15
1057	1682	Granite Falls	48 05'	122 02'	90	19
1058	1683	Lake Crescent	48 04'	124 00'	300	15
1060	1684	Sequim	48 02'	123 02'	30-90	16
1061	1685	Louella Gua.St.	48 00'	123 05'	460	15
1062	1686	Forks	47 59'	124 24'	90	15
1063	1687	Gold Bar	47 51'	121 39'	120	15
1064	1688	Hoh River	47 48'	123 58'	240	15
1069	1689	North Bend	47 28'	121 45'	150	16
1073	1690	Humtulpis	47 19'	123 54'	140	17
1075	1691	Enumclaw	47 16'	121 56'	240	15
1076	1692	Matlock	47 15'	123 25'	120	16
1077	1693	Shelton	47 15'	123 12'	90	15

Continuation of table 1.

1080	1694	Yelm	47 01'	122 44'	60 15		
1085	1696	Randle	46 33'	122 03'		336	16
1086	1697	Naselle	46 22'	123 44'		30-60	15
1087	1698	Skamokawa	46 21'	123 30'		180-240	16
1088	1699	Castle Rock	46 19'	122 52'		150	15
1089	1700	Cathlamet	46 18'	123 16'		150-240	15
1091	1701	Yale	46 00'	122 22'		120	16

USA: OREGON.

1094	1702	Vernonia	45 46'	123 13'		210	15
1096	1703	Sandy	45 23'	122 18'		270	15
1098	1704	Tillamook	45 13'	123 51'		120-180	15
1100	1705	Grande Ronde A.	45 06'	123 36'		150-210	15
1101	1706	Waldport	44 24'	123 52'		30-90	15
1102	1707	Upper Soda	44 23'	122 12'		915-1070	15

Table 2. *Sleenerzand height and diameter in 1980, 1983 and 1987 at the age of 13, 16 and 20 years from seed.*

Survival in % in 1980 before thinning.

Seln. IUFRO	Seln. IBN	Provenance	H and D after thinning						Survival 1980 %	
			H'80 m.	D'80 cm.	H'83 m.	D'83 cm.	H'87 m.	D'87 cm.		
1 Area east of Puget Sound and adjacent area:										
1054	1681	Arlington	6.6	8.6	9.1	13.6	12.2	17.3	92	*
1053	1680	Darrington	6.4	8.7	9.0	13.8	12.0	17.7	94	*
1057	1682	Granite F.	6.2	8.3	8.7	13.0	11.8	17.0	93	*
1069	1689	North Bend	6.2	8.0	8.7	12.9	11.7	16.1	84	*
1075	1691	Enumclaw	5.7	7.2	8.5	13.0	11.6	16.8	65	o
1063	1687	Gold Bar	6.0	7.7	8.3	12.8	11.4	15.9	92	*
1050	1678	Marble Mt.	5.5	7.3	7.9	12.5	11.3	16.0	83	o
1039	1671	Chilliwack	5.7	8.0	7.9	12.7	11.2	16.2	95	o
1051	1679	Sedro W.	5.5	7.4	8.0	11.8	11.2	16.3	77	o
1038	1670	Chilliwack	5.6	7.0	8.0	11.8	11.0	15.1	87	o
Mean:			5.9	7.8	8.4	12.8	11.5	16.4	86	
2 Area west of Puget Sound and adjacent area:										
1076	1692	Matlock	6.5	8.2	9.1	13.2	12.4	17.0	93	*
1062	1686	Forks	6.4	8.2	9.1	12.7	12.3	16.7	99	*
1064	1688	Hoh River	6.1	7.7	8.9	13.5	12.0	16.4	83	*
1073	1690	Humtulpis	6.1	8.4	8.7	13.5	11.9	17.1	91	*
1061	1685	Louella GS.	6.1	8.2	8.5	13.1	11.6	16.4	98	*
1077	1693	Shelton	5.6	7.9	8.2	12.7	11.5	17.0	68	o
1080	1694	Yelm	5.7	8.0	8.1	13.7	11.2	17.3	82	o
1058	1683	Lake Cresc.	5.7	7.3	8.2	12.1	11.1	15.5	91	*
1060	1684	Sequim	4.6	6.6	6.9	10.5	9.9	14.0	65	o
Mean:			5.9	7.8	8.4	12.8	11.5	16.4	86	
3 South Washington and north Oregon:										
1086	1697	Naselle	5.8	7.3	8.3	12.4	11.7	16.1	93	*
1087	1698	Skamokawa	5.7	7.3	8.2	13.1	11.5	17.1	73	*
1089	1700	Cathlamet	5.8	7.8	8.3	12.4	11.5	16.4	86	*
1094	1702	Vernonia	5.5	7.8	8.1	13.0	11.5	16.8	67	o
1085	1696	Randle	5.7	8.0	8.1	12.6	11.4	16.5	78	o
1098	1704	Hebo	5.8	7.2	8.1	12.7	11.3	15.8	87	o
1096	1703	Sandy	5.5	7.6	7.9	12.3	11.2	17.2	84	o
1088	1699	Castle Rock	5.4	7.3	7.8	12.5	11.2	16.2	64	o
1091	1701	Yale	5.3	7.1	7.8	12.0	11.1	15.6	73	o
1100	1705	Grande R.A.	5.2	7.6	7.7	12.5	10.9	16.1	76	o
Mean:			5.6	7.5	8.0	12.6	11.3	16.4	78	

Continuation of table 2.

4 South Vancouver Island and the adjacent main land of British Columbia:

1037	1669	Franklin R.	5.5	7.0	7.9	11.8	11.4	15.8	83	o
1033	1666	Forbidden P.	5.4	7.6	7.7	12.7	11.1	15.6	71	o
1034	1667	Sechelt	5.5	7.4	7.9	11.9	11.1	15.8	78	o
1042	1674	Duncan	5.5	7.2	7.9	12.3	11.0	15.9	79	o
1045	1677	Sooke	5.7	7.6	8.0	12.2	11.0	15.2	88	o
1030	1663	Squamish	5.4	7.2	7.8	11.9	10.9	15.4	71	o
1032	1665	Courtenay	5.4	7.5	7.7	12.1	10.7	15.5	83	o
1041	1673	Caycuse	5.2	6.7	7.5	11.1	10.7	14.6	69	o
1043	1675	San Juan	5.1	6.3	7.4	11.0	10.5	14.2	79	o
1036	1668	Alberni	5.1	7.4	7.4	11.6	10.3	15.7	77	o
1040	1672	Cassidy	4.6	6.3	6.8	10.8	9.9	14.5	43	o
Mean:			5.3	7.1	7.6	11.8	10.8	15.3	75	

5 North Vancouver Island and the adjacent main land of British Columbia:

1026	1661	Stella Lake	5.6	7.3	7.8	11.8	11.2	15.2	84	o
1002	1653	Dean	5.4	7.2	7.8	12.0	11.0	15.2	79	o
1023	1658	Jeune Land.	5.1	6.8	7.6	11.4	10.9	15.2	59	o
1025	1660	Nimpkish	5.3	6.7	7.7	11.3	10.8	14.3	79	o
1012	1656	Klina Klini	4.8	6.0	7.1	10.7	10.4	14.0	63	o
1029	1662	Thasis	5.2	6.8	7.6	10.9	10.4	14.0	82	o
1031	1664	Gold River	4.9	6.3	7.4	10.0	10.3	13.2	68	o
1004	1654	Stuie	4.7	6.1	7.0	10.4	10.2	13.3	67	o
1021	1657	D'Arcy	4.5	6.0	6.8	10.0	9.9	14.0	64	o
1024	1659	Owl Creek	4.8	6.2	6.8	10.5	9.9	14.4	63	o
Mean:			5.0	6.5	7.4	10.9	10.5	14.3	71	

Mean all provenances: 5.5 7.3 7.9 12.1 11.1 15.7 79

* = provenance in for seed collection distinguished areas.
o = provenance outside these areas.

Table 3. *Spiroderbos* height and diameter in 1980, 1984 and 1987 at the age of 13, 17 and 20 years from seed.

Survival in % in 1980 before thinning.

Seln. IUFRO	Seln. IBN	Provenance	Height and Diameter Before and after thinning						Survival 1984 %
			H'80 m.	D'80 cm.	H'84 m.	D'84 cm.	H'87 m.	D'87 cm.	
1 Area east of Puget Sound and adjacent area:									
1057	1682	Granite F.	5.4	7.1	9.1	11.6	11.4	14.7	76 *
1053	1680	Darrington	4.8	6.3	8.6	11.6	11.1	14.7	76 *
1039	1671	Chilliwack	5.2	7.1	8.7	11.8	11.0	14.8	77 o
1051	1679	Sedro W.	5.1	6.8	8.6	11.6	11.0	14.7	77 o
1054	1681	Arlington	5.0	6.6	8.5	11.8	10.7	15.1	70 *
1038	1670	Chilliwack	4.9	6.4	8.3	11.1	10.5	14.2	83 o
1063	1687	Gold Bar	4.4	5.9	8.0	11.5	10.5	14.9	73 *
1069	1689	North Bend	4.7	6.3	8.2	11.2	10.5	14.5	61 *
Mean:			4.9	6.6	8.5	11.5	10.8	14.7	74
2 Area west of Puget Sound and adjacent area:									
1073	1690	Humtulpis	5.5	6.9	9.3	11.9	11.8	14.7	89 *
1076	1692	Matlock	4.6	5.8	8.5	11.2	11.2	14.0	69 *
1064	1688	Hoh River	4.6	5.9	8.2	11.4	10.9	14.8	59 *
1061	1685	Louella GS.	4.5	5.8	7.8	10.7	10.4	14.3	51 *
1062	1686	Forks	4.2	6.6	8.0	10.2	10.4	13.3	66 *
1058	1683	Lake Cresc.	4.5	6.1	8.1	10.9	10.3	13.8	69 *
1077	1693	Shelton	4.2	5.4	8.0	10.8	10.3	14.2	72 o
1060	1684	Sequim	4.0	5.6	7.8	10.6	10.0	13.2	79 o
Mean:			4.5	6.0	8.2	11.0	10.7	14.0	69
3 South Washington and north Oregon:									
1090	1701	Yale	5.0	6.6	8.8	11.9	11.3	15.0	77 o
1089	1700	Cathlamet	4.6	5.9	8.6	12.2	11.2	15.2	78 *
1096	1703	Sandy	4.6	6.4	8.4	12.0	10.9	15.6	75 o
1101	1706	Waldport	4.1	5.2	8.3	12.4	10.9	15.4	83 o
1085	1696	Randle	4.8	6.6	8.3	11.8	10.9	15.3	65 o
1088	1699	Castle Rock	4.3	5.8	8.5	11.8	10.8	16.5	64 o
1087	1698	Skamokawa	4.2	5.4	8.3	11.4	10.6	14.1	76 *
1100	1705	Grande R.A.	4.8	6.8	8.1	11.7	10.6	15.0	78 o
1102	1707	Upper Soda	3.7	4.5	6.8	9.0	9.3	12.6	41 o
Mean:			4.5	5.9	8.2	11.6	10.7	15.0	71

Continuation of table 3.

4 South Vancouver Island and the adjacent main land of British Columbia:

1030	1663	Squamish	4.9	6.2	8.7	11.2	11.0	14.2	79	o
1034	1667	Sechelt	4.5	5.8	8.2	10.8	10.6	13.7	71	o
1032	1665	Courtenay	4.5	5.9	8.3	10.8	10.4	13.8	75	o
1042	1674	Duncan	4.6	6.1	8.0	10.8	10.4	13.4	78	o
1045	1677	Sooke	4.5	5.8	8.0	10.6	10.4	13.9	77	o
1037	1669	Franklin R.	4.5	5.8	8.0	10.5	10.3	13.3	78	o
1041	1673	Caycuse	4.2	5.4	8.1	10.4	10.2	12.5	82	o
1043	1675	San Juan	4.2	5.4	7.7	10.0	10.1	13.0	70	o
1036	1668	Alberni	4.6	6.1	7.8	10.8	10.1	13.7	87	o
1040	1672	Cassidy	3.9	5.2	7.4	10.2	9.7	13.1	79	o
1033	1666	Forbidden P.	3.6	4.6	7.2	10.0	9.3	12.5	82	o
Mean:			4.4	5.7	7.9	10.6	10.2	13.4	78	

5 North Vancouver Island and the adjacent main land of British Columbia:

1031	1664	Gold River	4.2	5.0	7.9	9.9	10.2	12.5	74	o
1026	1661	Stella Lake	4.3	5.6	7.7	10.3	10.0	13.3	75	o
1002	1653	Dean	4.3	5.4	7.6	9.9	9.9	12.9	77	o
1012	1656	Klina Klini	3.5	4.2	6.9	9.1	9.7	12.4	67	o
1024	1659	Owl Creek	3.7	4.6	7.0	9.6	9.1	12.3	70	o
1021	1657	D'Arcy	3.7	4.5	6.9	9.3	9.0	11.8	59	o
1023	1658	Jeune Land.	3.6	4.2	6.9	8.2	8.9	10.3	46	o
1004	1654	Stuie	3.5	4.0	6.2	8.7	8.8	11.8	60	o
Mean:			3.9	4.7	7.1	9.4	9.5	12.2	66	

Mean all provenances: 4.4 5.8 8.0 10.8 10.4 13.8 72

* = Provenance in for seed collection distinguished areas.

o = Provenance outside these areas.

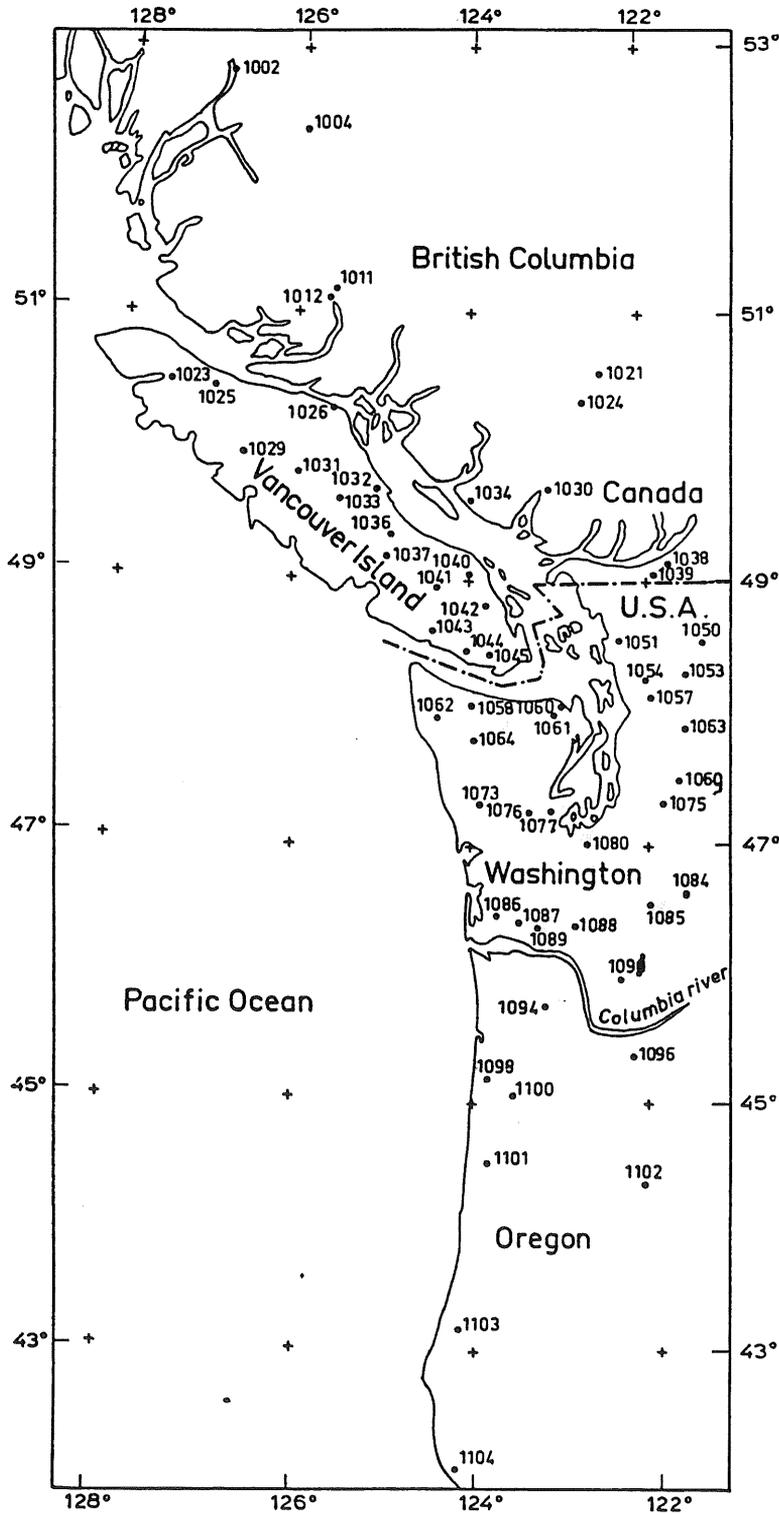


Figure 1. Douglas fir IUFRO provenances 1966/67 series

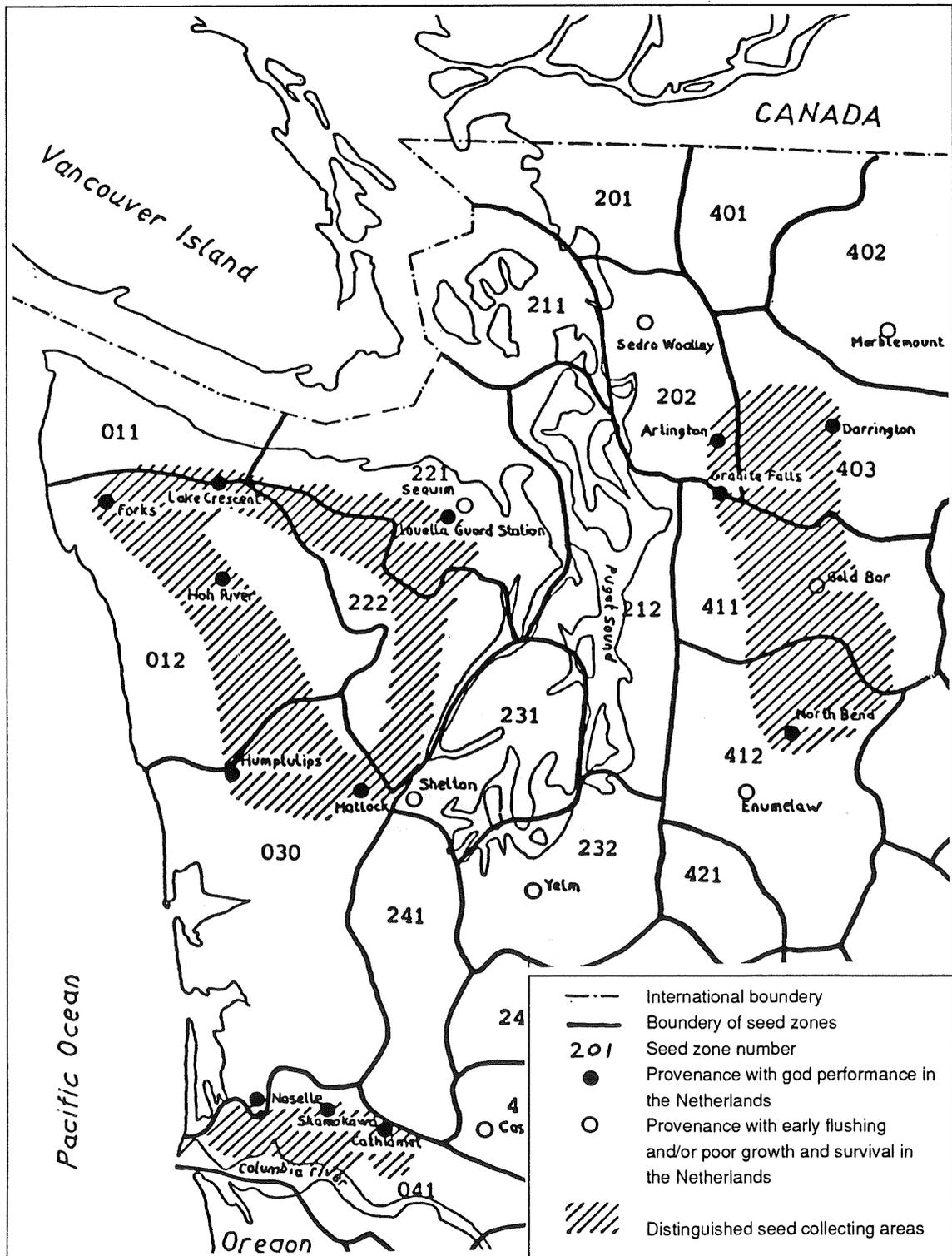


Figure 2. Douglas fir IUFRO provenances in Washington State (USA)



*Good growth and high survival. Provenance North Bend from Washington, USA.
Seven years after establishment the Sleenerzand trial.*



Poor growth and low survival. Provenance D'Arcy from British Columbia, Canada. Seven years after establishment the Sleenerzand trial.

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