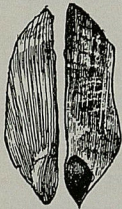
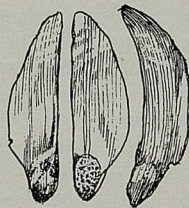


Selection of Conifer Seed for British Forestry

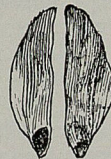
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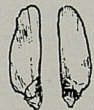
SCOTS PINE



CORSICAN
PINE



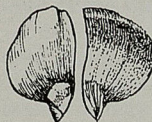
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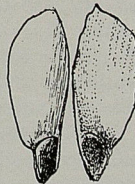
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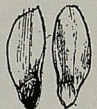
EUROPEAN
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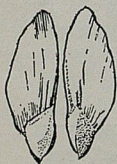
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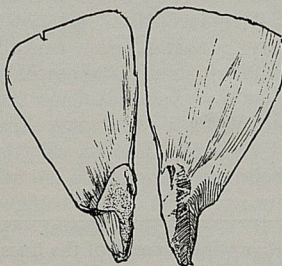
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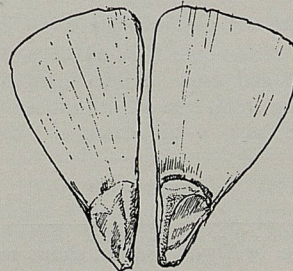
SITKA
SPRUCE



DOUGLAS
FIR



NOBLE
FIR



GRAND
FIR



WESTERN
RED CEDAR

The cover drawing, by David Walker, shows representative winged seeds of the trees discussed, from different aspects, at twice natural size.

SELECTION OF CONIFER SEED FOR BRITISH FORESTRY

By J. N. KENNEDY, B.Sc.

Forestry Commission

All the major conifer species grown for timber production in this country, except for Scots pine, are introductions from abroad. Most of these introduced species have a wide and often continuous natural range.

Trees raised from seed collected in different parts of the range of any one species exhibit variations which influence growth rate, stem form, and resistance to disease, exposure, frost and other adverse conditions. These variations are most striking in species having a wide natural distribution.

Over the past 40 years, comparisons have been made in "provenance" experiments of the performance in this country of trees raised from seed from various points within the natural range of the most important timber-producing species. The results of these experiments can be used in the recommendation of seed sources to be used in Great Britain. In some cases one or more sources may be suitable for use throughout the country, in others more detailed recommendations may be made to take account of site variations in soil and climate.

Recommendations on seed sources therefore relate to geographical areas of greater or lesser extent, and the seed sources are usually quoted in terms of "provenance" or "origin".

In directives of the European Economic Community (EEC) *provenance* is defined as *the place in which a stand of trees (whether native or not) is growing*, while *origin* is defined as *the place in which a native tree is growing* (in this case therefore the same as provenance) *or the place from which the seed from which a stand of non-native trees was raised was introduced*. In forestry in general, the use of the term *provenance* is commonly extended to mean *the geographical source of a given sample of seed and of the trees raised from it*. It is in this extended sense (which includes origin,

and accords with the definition of Ford-Robertson*) that the term is used in this leaflet.

A provenance may then be defined as the location (anything between a few hectares and hundreds of square kilometres) where seed with given characters has been or may be collected. Several or many provenances may occur within a recommended geographical region. If there are no meaningful differences in performance between the provenances of a species within a region, then for practical advisory purposes they may be grouped together. While a region may be extensive laterally, it may be bounded by elevational limits.

The following notes summarise the factors which make it essential to specify provenance especially when planting Sitka spruce, European larch and lodgepole pine, and make recommendations on sources of seed of these and other species suitable for use in this country. It must be emphasized, however, that the choice of the best provenance for different conditions is a complex issue and this leaflet provides only broad guidance in the simplest terms. If more guidance is required, the Forestry Commission's Research and Development Division at Alice Holt Lodge, Wrecclesham, Farnham, Surrey, should be consulted.

SCOTS PINE, *Pinus sylvestris* L.

This is the only pine native in Great Britain. A great deal of work has been done on the selection of the best Scots pine plus trees, and seed orchards have been established which

*Ford-Robertson, F. C. (1971). *Terminology of forest science, technology practice and products*. English language version. Society of American Foresters, Washington, D.C.

can now supply sufficient seed to meet all demands.

These seed sources are particularly recommended for use in Scotland and north east England. In eastern and southern England, locally collected seed provides an alternative as good as, and sometimes better, than the seed orchard material, which is based mainly on selections made in Scotland. Thus when planting in East Anglia it is preferable to use seed collected from registered stands in East Anglian plantations if it is available.

CORSICAN PINE, *Pinus nigra* var. *maritima* (Aiton) Melville

Good stem form and fine, light branching are characteristics which make provenances from Corsica most desirable for use in this country. The stands in Corsica are generally uniform, and no particular area can be recommended as the best seed source.

The best stands of Corsican pine in Britain have been grown from seed imported from CORSICA. Good seed can be collected from these plantations, particularly in East Anglia.

LOGGEPOLE PINE, *Pinus contorta* Douglas ex Loudon

The provenance variations within this species are particularly important and can lead to enormous differences in growth and yields of timber. Six provenance groups are recognised from the west coast and inland areas of North America, but procurement of seed is difficult from the sparsely populated northern regions.

1. Alaska

Trees from this provenance group are slow-growing with a bushy habit but a straight stem, and are not liable to basal bowing. They withstand exposure and are wind firm. Use is likely to be confined to northern Scotland. Desirable provenances include HOLLIS, ANNETTE ISLAND, KETCHIKAN and PETERSBURG. The Hollis seed must be obtained from home sources, as the original source in Alaska has been felled.

2. North Coastal (Canada)

Slow-growing trees with dense crowns. Useful for heather suppression on northern sites. Seed is very difficult to procure and many of the various provenances are therefore mainly of academic interest. They include QUEEN CHARLOTTE ISLANDS, and the north, north west and west coasts of VANCOUVER ISLAND. Seed from Lower Fraser River, Lulu Island and south and east Vancouver Island should *not* be used.

3. South Coastal (Washington and Oregon, USA)

Trees grow rapidly but exhibit poor stem form. Basal bowing is common. General health and resistance to exposure are good. Trees from south coastal provenances are remarkably adaptable and grow well on deep acid peats, or dry sandy soils in low or high rainfall areas. Particular well-tested provenances include LONG BEACH and SHELTON. Trees from the central coastal regions of OREGON have slightly poorer stem form and coarser branches.

If basal bowing can be prevented (and there are indications that the use of tubed seedlings might overcome this defect), these provenance groups will assume major importance.

4. Skeena River Area

Trees show moderate vigour, and good health, stem form and needle retention. Habit is intermediate between coastal and interior provenances. These provenances have not been tested on very exposed sites. Desirable seed sources include TERRACE, HAZELTON and KISPIOX and these can be used on a wide range of sites particularly those which are marginal for Scots pine.

5. Central Interior

Trees are relatively slow-growing, with light foliage and poor needle retention, but with no tendency to basal bowing. They are suitable for use on east coast sites in low rainfall areas or on high elevation sites where snow damage is a problem. Pro-

venances include PRINCE GEORGE and QUESNEL.

6. Southern Interior

Trees are moderately fast-growing with fair stem form. Their use should be confined to eastern heaths on sites where roots can reach mineral soil. Plantations raised from seed from these sources are not very resistant to exposure. Because climate (rainfall) and elevation are so varied in the Southern Interior region it is important to use provenances from the interior wet belt. These include MOUNT IDA, FALKLAND and CLEARWATER. Seed sources in *low rainfall* areas on the valley floor of the Thompson River should be avoided.

SITKA SPRUCE, *Picea sitchensis* (Bongard) Carriere

Two regions on the west coast of North America provide the bulk of our imports, and little improvement on present use is thought possible.

1. Queen Charlotte Islands (QCI)

Seed from stands in the north and east of these islands has been widely used in this country during the past 50 years, and these sources can be regarded as suitable for general use in this country. Trees raised from such seed exhibit good stem form and health, are resistant to exposure, and are not susceptible to damage by autumn frosts.

2. Washington

Growth rates of trees raised from seed from coastal Washington, eg Hoquiam, are generally better than those raised from the Queen Charlotte Islands. The trees are however more susceptible to autumn frosts, particularly in the nursery stage, and to winter cold. Stem and crown form is normally superior to that of trees from the Queen Charlotte Islands. Planting should be confined to southern Britain, lowland Wales and less exposed sites in south and west Scotland. Seed should be sown in relatively frost-free nurseries and the seed-

lings should be covered at the end of the first year.

In provenance trials, plants raised from seed from OREGON provenances have so far done well on more favoured sites. Form and growth rates are similar to trees from Washington provenances and the same recommendations on nursery treatment and use apply.

For planting on very exposed or elevated sites Sitka spruce from ALASKAN sources should be used.

All seed provenances south of latitude 42°N are considered unsuitable for British conditions.

NORWAY SPRUCE, *Picea abies* (L.) Karsten

Information on the performance of European provenances of Norway spruce is limited, but those from south-east Europe grow more vigorously than others. The best provenances for use in Britain are thought to be SOUTH POLAND, then ROMANIA, CZECHOSLOVAKIA and BULGARIA, in that order. Seed from stands already established in Britain is generally unsatisfactory, and should not be collected unless supported by a specific recommendation from the Forestry Commission Geneticist.

EUROPEAN LARCH, *Larix decidua* Miller

The earliest larches introduced into Britain were of Alpine provenance. While on good sites they have grown well, with only a moderate tendency to suffer from dieback and canker, on poorer sites growth has not been good, and severe attacks of dieback and canker have been common. Seed from high elevations in Alpine regions must therefore be avoided, only that from elevations of 1300 metres or below is suitable for British conditions.

Prior to the war of 1939-45 a great deal of seed was collected from plantations in Scotland, much of which was almost certainly of Alpine origin. As a result, plantations in this country are heterogeneous, and seed collected from them gives variable results. Seed from some of the best of the older Scottish stands may produce vigorous trees

which are fairly resistant to dieback and canker, but this cannot be relied upon.

Genuine SUDETEN provenances are the most vigorous and the most resistant to dieback and canker. CZECHOSLOVAKIAN sources are to be preferred, with POLAND as a second choice. Unfortunately seed of Sudeten provenances is at present very difficult to obtain.

JAPANESE LARCH, *Larix kaempferi* (Lambert) Carriere

The natural range of Japanese larch is confined to a small region centred in Nagano Prefecture on the island of Honshu, and most of our seed imports have been from the slopes of MOUNT YATSUGADAKE near the town of Suwa. If seed cannot be collected from good stands in Great Britain, it should be obtained from this area, from the surrounding parts of NAGANO and neighbouring provinces, or from the island of HOKKAIDO. All origins must be below elevations of 2000 metres.

DOUGLAS FIR, *Pseudotsuga menziesii* (Mirbel) Franco

Most plantations in Britain have been raised from seed from the lowland area between the Cascade Mountains and the Coastal Range, on the Washington/Oregon border and the coastal areas of southern British Columbia. However the best source of seed is now considered to be from low elevations with high rainfall in the State of WASHINGTON, either from the coastal area or the northern foothills of the Cascade Mountains. Seed collected in Britain tends to be smaller than that collected in North America, and infestation by the seed wasp *Megastigmus* can seriously reduce the number of sound seed.

WESTERN RED CEDAR, *Thuja plicata* D. Don

Trees in this country produce good supplies of seed at regular intervals. Maximum seed

production occurs when the trees are between 40 and 60 years old.

Recommended sources from abroad are QUEEN CHARLOTTE ISLANDS and VANCOUVER ISLAND, both in British Columbia.

WESTERN HEMLOCK, *Tsuga heterophylla* (Rafinesque) Sargent

Early results from provenance trials indicate that there is less contrast in rates of growth of provenances from the range of Western hemlock than for Sitka spruce or Lodgepole pine. Good growth has been obtained with provenances from WASHINGTON. Provenances from the dry region of the PUGET SOUND have done well on dry sites in this country. Seed from VANCOUVER ISLAND and the QUEEN CHARLOTTE ISLANDS should also be suitable for most planting sites in Britain.

GRAND FIR, *Abies grandis* Lindley

Only limited work has been done on provenances of grand fir. Most imports of seed have been from VANCOUVER ISLAND and WASHINGTON and no change is recommended. Preferred sources in Washington are from the coastal range or the western slopes of the Cascade Mountains at elevations below 500 metres. Seed from high elevations should be used.

Seed produced in Britain is poor, with a high proportion of empty seed due to lack of pollination.

NOBLE FIR, *Abies procera* Rehder

In this country noble fir produces abundant seed but the quality of home-collected seed has on average been poorer than that of imported seed. Little is known of different provenances, but any source of seed from stands lying to the west of the CASCADE MOUNTAINS, below 600 metres, is likely to be satisfactory.

Acknowledgment

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