Book review

Choice of Sitka spruce seed origins for use in British forests. C.J.A. Samuel, A.M. Fletcher and R. Lines (2007). Forestry Commission Bulletin 127. ISBN 978-0-85538-727-3.

This Bulletin is highly specialised in that its subject is confined to one species – Sitka spruce, nevertheless a most important species for forestry in Britain. The publication is an exhaustive study of the performance of the species in Britain over the period from its introduction in 1831 to the present day.

The authors have spent most of their working lives studying the early growth and performance of Sitka spruce throughout Great Britain, in its natural range in Canada and the US, as well as in other parts of Europe. Between them they bring together this unrivalled knowledge, complemented by results from scientific field trials undertaken in Britain. Overall, the study is one of the most comprehensive undertaken.

Taking as their starting point the year of introduction, 1831, the authors highlight the fact that since it was introduced by David Douglas, Sitka spruce has become the most important commercial timber producer in upland forestry in Great Britain, while accounting for 36% of the total forest area in 2004.

The natural range of the species is the greatest of the world's spruces, some 3,000 km, occurring along a narrow coastal belt from Kodiak Island in Alaska to northern California, and covers significant variation in climatic conditions. Provenance variation has evolved, and the authors highlight the need to determine by means of comprehensive provenance experiments the most suitable seed origins for use in Great Britain. Also highlighted is a comparison between the British climate and that of north-western America, with a clear focus on the many similarities, especially the fact that the general climate throughout the range of the species is predominantly maritime, strongly influenced by the prevailing westerly winds from the Pacific Ocean.

The publication addresses the evaluation of Sitka spruce seed sources, through the process of obtaining and testing various seed lots during the early phases of seed origin research, which eventually leads on to the development of the IUFRO (International Union of Forest Research Organisations) source authenticated seed collections throughout the species natural range. This culminated in the establishment of two main series of experiments, one in 1960/61 and the other in 1974/75. The authors suggest that the latter was the most comprehensive as it was based on the IUFRO 1968/70 collections and had 62 seed origins represented. Results from these experiments, both from the nursery and field stages, have shown the adaptability of several of the seed origins for a range of site types. Variation in date of flushing between origins is small and therefore cannot be used as a defining factor in selecting seed sources which might be used to avoid spring frost damage. However, date of growth cessation and therefore susceptibility to damage by unseasonal autumn frosts is much greater and has to be considered during the nursery and early forest stage. The authors highlight the fact that the more southerly origins in which growth cessation is late in the year, are very susceptible to autumn frosts and also produce the greatest numbers of lammas shoots.

In Britain there is a general cline in increasing vigour with decreasing latitude, with origins from northern Oregon proving to be the most vigorous, especially on southern sites. Poorer growth is found in origins from the Skeena River, mainland and lower coastal British Columbia and the Puget Sound area in Washington. In contrast, seed origins from the Queen Charlotte Islands of British Columbia produce better than expected growth, although there is some variation within the Queen Charlotte Islands origins, with the low elevation seed sources from the northern and eastern parts of Graham Island having higher than average production. These origins proved to be well adapted and productive over a wide range of sites in Britain.

The Bulletin points out that Sitka spruce is also an important species in Ireland, in both Northern Ireland and the Republic of Ireland, and points out that because plantations of the commonly used Queen Charlotte Islands origins grew well in the early days, investigations in Ireland of the more southerly origins did not commence until 1960, when ten origins – the same as in the British 1960/61 series – were planted at Killarney. Here the results showed the clear superiority of the Washington provenances. In 1972 a meeting of the IUFRO Working Party on Sitka spruce met in Ireland; thirteen countries agreed to establish an international provenance experiment in Sitka spruce. The experiments, called the IUFRO Sitka Spruce International Ten Provenance Experiments were established to last for a maximum of ten years after planting, and were designed to provide data on variation in the species during the nursery and field establishment phase. This series acted as a complement to the main IUFRO series of experiments established with a much larger but not common selection of seed sources and with larger plots to allow growth measurements to be made for up to half the rotation length.

In an Irish context the Bulletin presents the International Ten Provenance Experiment as described by the late John O'Driscoll, with results at the nursery stage in 1976 and again with further results presented after three growing seasons in the forest covering three different sites. The pattern of height growth was similar at all sites with the tallest seed lot from Necanicum (Oregon). There were also significant differences in flushing, growth cessation and frost damage. The overall pattern of flushing on all the field sites was similar to that in the nursery, with the southern provenances first to flush but with only a maximum of seven days difference between the provenances. The pattern of growth cessation was also similar to that in the nursery but the range was far larger, with a maximum of 64 days recorded between sources at the Kenmare (Co Kerry) site. There was also a strong clinal pattern in growth cessation, with the most southerly provenances the last to cease growth.

In addition to these experiments, the authors report that the main IUFRO collection of 67 provenances was planted in Ireland across nine sites covering a wide range of site conditions. As with the International Ten Provenance Experiments, results from these also showed that the pattern for height growth after nine years was similar to that at the end of the nursery stage. Height at both ages was closely

correlated with latitude of seed origin. Southern Oregon and northern Californian provenances were the fastest growing, decreasing progressively to Alaska, except for the Nass and Skeena Rivers (British Columbia) provenances, whose height was lower than expected for that latitude. Provenances from mid-Oregon southwards all had autumn frost damage in the nursery but all were hardy in the field, once past the tender seedling stage. Damage due to late spring frost was experienced at one field site but there were no differences in its effect on the different provenances due to the small range in flushing date.

The Bulletin also reports results for wood density and branching characteristics for Ireland, measured in six selected provenances at four of the most contrasting sites, when the material was 12 years old. The results showed that wood density is negatively correlated with growth rate but positively correlated with latitude of seed origin. However, site type had a greater influence on wood density than seed origin, but seed origin had a greater influence on branch size and number than site type, with the slow-growing origins from Alaska and British Columbia having larger sized branches in relation to stem diameter than those from Washington and Oregon.

Six of the Irish sites were re-measured after 19 growing seasons for top height. The results continued to show that height growth increased from north (Queen Charlotte Island provenances) to south (Washington and Oregon provenances) until it began to decrease in the Northern Californian provenances. An increase of two or even three yield classes could be achieved by planting southern Washington provenances (yield class 24) and Oregon (yield class 26) provenances rather than Queen Charlotte Island provenances (yield class 18). Earlier growth studies also demonstrated that the southern provenances produced fewer and smaller branches, thus adding to the advantage these provenances have, especially when planted in sheltered sites. On colder, more exposed sites the northerly provenances of Queen Charlotte Island and Vancouver Island performed better.

Sitka spruce is and continues to be the most important species in Irish forestry with the recent National Forest Inventory showing that it presently represents 56% of the forest estate.

While this Bulletin provides results of the performance of an extensive range of seed source studies of Sitka spruce in Britain, it also compiles results on provenance studies in Sitka spruce from many other European countries, especially Ireland. For anyone involved in the establishment and management of Sitka spruce as a forest crop this publication is both timely and relevant and it is recommend as necessary reading for all those who have an interest in Sitka spruce and its role in Irish forestry. For forest owners and managers, as well as forestry students it is very useful reading, especially for those who wish to extend their knowledge of the potential and performance of the species, based on results from field experiments carried out over a prolonged period.

John Fennessy

(John Fennessy is Research Programme Manager, Tree Improvement in COFORD.)