Minor Conifers Research Project

by Scott McG Wilson

Background

This article reports the outcomes of an independent study by the author, funded by Woodland Heritage, examining the silvicultural and timber utilisation potential of the "minor conifer" species in Great Britain. This was based on the development of a set of some 30 illustrated case-studies, demonstrating successful experiences of growing, marketing, processing and utilising these timbers from throughout the country.

The species selected for inclusion in the project were Douglas Fir, Larch, Grand Fir, Noble Fir, European and Pacific Silver Firs, Western Hemlock, Western Red Cedar, Coastal Redwood, Japanese Cedar, Nootka Cypress, Lawson and Leyland Cypresses, Monterey Cypress and Monkeypuzzle. A conscious decision was taken to include Douglas Fir and Larch, as, although they have well developed markets, current establishment and restocking of these species is at a level well below that necessary to meet latent future demand.

Over recent years the British sawmilling industry has specialised in the processing of Sitka Spruce (and to a lesser extent Scots and Corsican Pines) using high-tech Scandinavian derived continuous-flow mill-lines. These are optimised for uniform material in the 30-60cm diameter class and address standardised markets such as timber-frame carcassing and treated fencework. There has been a growing perception of difficulty in marketing timbers of the major conifers in diameter classes above 60cm and of the minor conifers in any size classes, with the exception of very high-quality Douglas Fir stems. Some species, such as Frand Fir and Western Hemlock, have come to be regarded as virtually unsaleable.

However, against this background there is growing interest in the potential of the minor conifers for future silviculture and timber production within Britain. Some of the key factors serving to promote this interest are:

- *climate change* - predicted effects on Sitka Spruce in drier parts of the country – drought damage has already emerged in north-east Scotland after 2003.
- *pathogen outbreaks* – notably the incidence of red-band needle blight affecting Corsican and Lodgepole Pine plantations and threatening Scots Pine woods.
- *timber treatment* – changes in regulations affecting the use of CCA salts to treat Spruce and Pine for use in external applications, favouring durable timbers.
- *silvicultural transformation* – moves to wider adoption of continuous-cover selection systems which favour the use of species with shade-tolerant regeneration.

Britain has a substantial, if dispersed, resource of maturing plantations of a range of minor conifer species. These were mainly established between 1920 and 1960 by both private growers and the Forestry Commission, adopting experience acquired in forest gardens and arboreta since the mid-1800s. These successful plantations have well demonstrated the silvicultural potential of a range of these species, and are now supplying the growing small-scale, specialist wood-processing sector which is the focus of many of the case-studies developed within this project.

This work has revealed a higher than expected level of processing activity for many of these species, with considerable latent demand for some of them, especially those with a degree of natural timber durability. Increased adoption of these species offers potential solutions to some of the other challenges highlighted – for example alternatives to Sitka Spruce and Corsican Pine where required and suitable options for CCF selection forestry. *However a number of perceived obstacles remain to their wider adoption, including an inadequate research base on tree improvement and silviculture, a fragile in-service silvicultural knowledge-base and unsympathetic forest policy and grant regimes. The PAWS restoration agenda has emerged as one of the more acute challenges.* After discussing the potential of each species, this article will then conclude with some some suggested ways forward.

Douglas Fir

Douglas Fir might be considered an "honorary" minor species in that it is in substantial demand for construction timber across the country. However this latent demand is currently being met mainly from a finite resource of fine "capital" stands established

Douglas Fir beams at Somerscales sawmill.

during the 1920s and 1930s, many on Forestry Commission lands, as well as on some private estates and water-supply catchments. Particular concentrations of fine stands are to be found in Highland Scotland, the Borders, Lake District, Wales, the Marches and southwest England, with outliers in the New Forest and Thetford further east. Stands established since the war have generally been less successful, probably through a combination of provenance and early tending decisions.

Several case-studies were developed around the use of long, large-section Douglas Fir beams for load-bearing applications in building construction and marine work. The C24 stress-grading appellation is often sought. ***There are a number of specialist mills sawing these beams, including Somerscales and JB Timber on Humberside, Gilmour & Aitken on Clydeside and East Brothers near Salisbury.***

There is strong competition for large, pole-length Douglas Fir stems in the 70 to 90cm class, which justify transportation from all parts of Britain. Log prices can exceed £100/m³ at times of exceptional demand. There has been an increasing tendency for large Douglas Fir beams to be specified for premium architectural projects such as shopping malls, heritage visitor centres, sporting arenas etc in place of steel or GLULAM beams. Smaller Douglas Fir beams are used in individual house construction projects and the timber is also sought for carcassing, decking, fencing and other sawn markets.

While some fine stands of Douglas Fir are being managed on CCF systems, regeneration can prove problematic. A number of stands have been felled and restocked with Sitka Spruce (on grounds of more reliable establishment) or with native hardwoods (on PAWS restoration sites). ***New planting with Douglas Fir, especially in Scotland, is at a much reduced level. These trends, taken together, are limiting the supply of premium material for the future and encouraging processors to source French, German and second-growth North American log supplies.*** There is potential to address this by use of suitable provenances of Douglas Fir to restock drought and pathogen stressed stands of Sitka Spruce/Corsican Pine in eastern Britain.

Larch

Larch has been grown in Britain for over 200 years, especially in parts of central and eastern Scotland. It was traditionally used as a construction and boatbuilding timber in place of Oak, and for the latter purpose retained its position even after the introduction of Douglas Fir and Sitka Spruce. For these demanding applications, European Larch of 150 to 200 years was originally preferred, but 70 to 90 year slower-grown material of both European and

Larch cladding in Highland Scotland.

Hybrid (Dunkeld) Larches is now in demand. Japanese Larch is less sought-after and tends to find mainly poorer markets. ***The case-studies developed within the current project for Larch centred on the three main markets (a) boat-building, (b) cladding and (c) smaller-dimension structural timbers.***

While traditional Larch-skinned fishing boats are now an occasional trade, there remains a considerable demand for smaller Larch-hulled pleasure boats and for repair of larger vessels. In northern Scotland, Wales and Cornwall, there is also an increasing interest in heritage boat building such as the recreation of Viking longboats and Gaelic birlinns. Traditional boatskin suppliers such as JB Timber on Humberside and Gilmour & Aitken on Clydeside are still involved, alongside a range of smaller artisan sawmillers. Larch cladding is in growing demand, with home-grown material now increasingly accepted as an alternative, and equivalent, product to the more traditional Siberian Larch. Especially in Scotland, Larch cladding was long seen as a vernacular building method in rural districts, and many architects are specifying Larch cladding for new builds, including office buildings, schools, community centres, individual houses and rural social housing projects.

The *Scotlarch* brand promoted by Russwood of Newtonmore is an example of the increasing scope of this sector, and considerable performance and durability research has been pursued at the Centre for Timber Engineering, Edinburgh. ***Larch does not attract the same premium as Douglas Fir for very large-dimension structural members, but there is interest in systems using smaller Larch beams and battens such as the gridshell roof of the Savill Building, Windsor.***

There seems little question that the standing resource of high-quality Larch stems is gradually being consumed, but there is good potential for future management of fine Larch in well-thinned stands, mixtures with Pine and Spruce and indeed as

a minor component of broadleaved woodland, where it has lesser effects on desirable PAWS attributes.

Western Red Cedar

Western Red Cedar has been planted in Britain since the late 1800s, with some of the finest stands in existence dating from early Forestry Commission plantings in the 1920s – for example at Gwydyr and Forest of Dean. ***A number of private estates throughout the country have a notable record with the species, including Novar (Easter Ross), Darnaway (Moray), Kyloe (Northumberland), Longleat and Stourhead (Wiltshire), Dunster (Somerset) and Weasenham (Norfolk).***

Western Red Cedar appears to grow very well throughout Britain on many site types, including wet upland sites in Wales and Scotland and dry lowland sites in southeastern England and East Anglia. It also regenerates well in CCF selection woodlands etc. Although few new plantations have been created since the early 1960s, there is clearly good potential for the future.

While Western Red Cedar was originally seen as a semi-commercial estate mill timber, it is now finding stronger markets for external carpentry and joinery work, on the strength of its natural durability. While this may not quite reach the levels of Canadian old-growth heartwood, it far exceeds that of home-grown Pine and Spruce timbers. ***A number of case-studies were developed for Western Red Cedar, dealing with emerging markets for cladding, garden construction, glass-house framing and beehive making.*** These have in common their requirement for consistent supplies of well-grown Red Cedar in the 30-50cm class, preferably with a predominance of heartwood, and without the need for excessive transportation. Activity is centred mainly in England and Wales, with concentrations of processing in the Marches, southwest England, the south coast and East Anglia/ Lincolnshire. However interest in Scotland is currently increasing, drawing upon a more dispersed Cedar resource across the Scottish Highlands.

With demand for Western Red Cedar likely to continue to increase, there is a need to establish new well-tended plantations of this species on suitable sites, and to avoid losses of existing stands by clear-felling. The latter is often happening within the context of PAWS restoration. Anecdotally, current demand for nursery planting stock is at a very low level and most restocking is by natural regeneration. ***It was notable, in the case of Western Red Cedar, that it was possible to find growers lacking a market and processors lacking timber supplies within a single region – this could be addressed by better communication.***

Western Red Cedar.

Western Hemlock and Silver Firs

This group of species, marketed as "Hem-Fir", in North America, includes Western Hemlock, Grand Fir, Noble Fir and the European and Pacific Silver Firs. These species have been grown productively in Britain since the late 1800s (European Silver Fir since the 1600s). However, although their timbers have been accepted for construction and joinery use in North America (and Continental Europe for the European Silver Fir), they have traditionally been viewed with scepticism by the British sawmilling sector. ***This is unfortunate given their ecological suitability, silvicultural productivity and regeneration capacity within CCF selection forestry.*** In part, the difference in views of these species stems from the fact that their timber may develop differently under natural growth conditions as opposed to the even-aged plantations found in Britain.

A number of case studies were developed reporting the growing and marketing of these species for "run-of-the-mill" applications, including treated fencing, dunnage, pallet and potato box manufacture. These provide reliable local markets for growers, while not particularly lucrative. Enterprising small-scale sawmillers are willing to take these timbers at prevailing market prices and process them for lightly-specified carpentry uses, with or without treatment.

These include shed construction, ship-lap cladding and mountain-bike "Northshore" boardwalks. Hemlock has a reputation among more knowledgeable sawmillers as being easy to work and accepting planing and nailing well, compared, for example, with Spruce. Some development work has been undertaken on the potential of Noble Fir for untreated cladding applications, using a combination of drip-shedding chamfer-edging and careful technical barrier detailing. ***Heat-treated Noble Fir has been demonstrated by Coed Cymru for internal joinery work.*** A small number of sawmillers will now accept Hemlock and Grand Fir for short-run rustic beamwork in barn restoration and agricultural building projects.

Due to the ecological and silvicultural potential of these species, further research is now merited on the potential to select against degrades such as fluting and included bark in Hemlock and drought crack in Grand and Noble Firs. The European and Pacific Silver Firs may have a potential role for future use in selection forestry situations on site types intermediate between the bottom-land site preference of grand fir and the montane site preference of Noble Fir.

Redwood

Coastal Redwood ***(Sequoia sempervirens)*** is productive in Britain and has demonstrated its potential in a small number of famous stands such as the Charles Ackers Grove at Leighton (Powys), Longleat (Wiltshire), Dartington Hall (Devon), Kyloe (Northumberland) and Benmore (Argyll). ***Aruyn Morgan's recent articles (see Woodland Heritage 2009) have set out in detail the silvicultural and wood processing characteristics of this species in Britain.*** Two case-studies were developed for the present project, one dealing with use of Redwood for chalet construction and the other as an attractive outdoor decorative timber for garden landscape design. There is clearly further potential for silviculture and utilisation of the Coastal Redwood within Britain.

Cypresses

The main Cypress species grown in Britain have been the Lawson Cypress and the Leyland Cypress (itself a hybrid of the Monterery Cypress and the Nootka Cypress). As well as their role as hedging plants and game cover, Lawson and Leyland Cypresses have been grown as plantation forestry species by the Forestry Commission in a number of locations, and by some private estates, notably Longleat.

Their timber is semi-durable, some argue comparable with that of home-grown Western Red Cedar, although of a paler colour. Many plantations have been badly underthinned, resulting in a dense growth of thin, multi-stemmed trees. ***However, where better tended, as at Longleat, the species can perform well on a wide range of site types, producing timber suitable for fencing material and cabin building.***

Monterey Cypress.

A single national case-study was developed for these two species, highlighting these applications, including the construction of a log cabin of Leyland Cypress for the Forestry Commission visitor centre at Grizedale, Lakes. Some sawmillers are looking at the potential of these species as a substitute for Western Red Cedar for cladding and beehive manufacture applications, given the potential future shortage of mature Western Red Cedar plantations.

The Isle of Wight has notable plantations of Lawson and Leyland Cypresses, but in addition the Monterey Cypress ***(Cupressus macrocarpa)*** has been planted at a number of locations on the island. This species, although often of rather poor stem form, produces a highly durable and attractive timber that is suitable for furniture-making and outdoor applications such as board-walks and beach stairs – the subject of a local case-study on this unusual species. ***Given their timber properties there seems a good case for a modest expansion of Cypress planting in Britain, so long as it is accompanied by consistent selective thinnings.***

The Nootka Cypress ***(Chamaecyparis nootkatensis)***, also known as the Yellow or Alaska Cedar, produces a highly valued and durable timber

which is in demand around the northern Pacific rim. The species has been trialled in forest gardens within Britain, but is known to suffer from rather slow initial growth. Further research would be required before it could be recommended for wider planting within Britain, but it should not be discounted.

Cedars

There has been a tradition of growing specimens of the true Cedars *(Cedrus spp)* in Britain – Deodar and the Lebanon and Atlantic Cedars. Their timber is in high demand for "hardwood equivalent" furniture markets when available, but the volumes harvested are small.

The Japanese Cedar *(Cryptomeria japonica)* has been planted out on quite a number of estates and Forestry Commission land-holdings throughout Britain – especially in western coastal areas of Cornwall, Wales and Argyll. It grows well, and, especially if appropriately thinned, produces valuable, semi-durable timber. Although there is limited experience of processing this species in Britain it appears to be comparable with Western Red Cedar, although of a paler colour and would be likely to serve similar markets such as cladding, shed-building and beehives.

The timber is highly sought-after for construction in its native Japan, although conservation restrictions have led to its widespread substitution by Yellow and Western Red Cedar imports from the Pacific Northwest. Further research is now required to evaluate its potential further in Britain and to define those site types where it might be preferred to Western Red Cedar, when selecting semi-durable species.

Monkeypuzzle

In addition to individual specimen trees, there are small plantations of this species on Longleat and Kyloe estates. A national case-study was developed, centring on use of their timber for decorative turnery and craft furniture, making a feature of the unusual whorl knot patterning.

Stand of Monkeypuzzle on the Longleat Estate.

Ways forward for the minor conifers

While the main objective of this work was to highlight the potential of the minor conifer species, it inevitably also highlighted a number of areas where action is needed to unlock that potential for the future. Key strands were:

Research

It was quite evident that the forestry research effort needs to be partially redirected from a current focus on Sitka Spruce and the native tree species (including Scots Pine) to address a wider range of productive forestry species. In particular investigations along the following lines were now required to address the "minor conifer subsector":

- Provenance studies and tree breeding work needs to take in a range of the minor conifer species, through the field selection of plus trees from the home-grown resource, establishment of improved seed orchards and selection against undesirable traits such as fluting in Western Hemlock and crack in Grand and Noble Firs.
- Silvicultural research should re-focus from a current emphasis on clear-fell/replant and shelterwood systems towards selection systems for the future management of mixed-species woodlands with a significant component of shade-tolerant species. Yield modelling and thinning prescriptions for species such as Douglas Fir, Larch and Western Red Cedar would also merit improvement for regular and irregular stands.
- Technical development work should address some of the key active constraints to effective management of selection forestry, especially on steeper ground in areas where public recreation remains a key priority. Development of cable-crane, log-chute, helicopter and horse/quad-bike logging methods would be of benefit.
- Wood technology research should move on from its successful focus on Douglas Fir structural timber and Larch cladding to a greater emphasis on the massive timber construction and timber engineering methods capable of absorbing larger volumes of the weaker species such as Western Hemlock and the *Abies* Firs by jointing of small batten material into larger elements.

Such work could now be addressed by alternative research providers including universities, consultants and NGOs such as the Northmoor Trust and *Woodland Heritage*, complementing the valuable work of Forest Research.

Training

Very many of the Forestry Commission woodlands and private estates visited in connection with this project were under expert and committed management. However there was a perception that the scope of silvicultural training being delivered in

the university and in-service sectors had recently tended to neglect what might be called "classical silviculture", particularly as applied to selection forests of the shade-tolerant minor conifers. This has led, in some cases, to a lack of confidence in mid-career forestry staff, especially as regards selective thinning of stands and marketing of resulting produce. There is also a tendency to favour computer-aided "management by prescription" which sometimes excludes choices of minor conifers for stand establishment, leading to "forest simplification". ***Reinvigorated silvicultural training at all levels, coupled with restored "beat forester autonomy" would be likely to foster a much more favourable environment for more experimental adoption of minor conifer species options.***

Marketing

Most foresters develop a good understanding of the local markets for the principal species which they grow. Some private estates such as Longleat, Stourhead and Kyloe, which have a long heritage of growing a wide range of minor conifer species, have developed the "off-the-shelf supermarket" style of marketing, felling on demand. However other managers may regard minor conifers as a marketing problem, seeking to release them into the same markets as their major crops, often for a reduced price. In most cases species-specific marketing (as exemplified by the FC Scotland niche marketing initiative in Argyll and Lochaber) results in recovery of greater value for the grower and additional rural development advantages. A supporting mechanism would be some kind of national or regional "bulletin board" (distinct from electronic auction) which would match up supply and demand for minor conifer timbers, allowing the smaller growers to find commercial outlets without excessive time commitment.

Forestry policy and grant regimes

A high proportion of the most productive stands of minor conifers are to be found on sites which were replanted from native woodland between 1920 and 1970. These are concentrated on the lower slopes in sheltered valleys in areas such as Wales, the Marches and southwest England, and enjoy low windthrow risk and fertile brown-earth soil. Such sites are now termed ***"Plantations on Ancient Woodland Sites"*** or PAWS, and both policy and grant mechanisms favour their restoration to native species composition over time. Growers seeking to restock these sites with non-native species are generally not eligible for the full-rate (or in some cases any) forestry grant support, certainly for replanting. Methods of "PAWS restoration" have moved on from the early "clear-fell and naturally regenerate" option towards adoption of more gradual silvicultural transformation by means of CCF approaches, allowing the owner to recover

Leyland Cypress log cabin at Grizedale in the Lake District. (Photo: Mick Read).

standing value. However the longer-term objective remains centred on removal of the non-native species. While this may well be the correct approach in some cases, there is a feeling of a "blanket policy prescription" which does not take full account of the various values inherent in the forests created since the 1920s. There is certainly an attrition of the available ground for productive Douglas Fir, Western Red Cedar etc, which limits the potential for future timber production. ***To date, only a very small minority of the native hardwood stands created under PAWS restoration schemes have received early tending consistent with quality hardwood timber production in the future, though that may change.***

The forestry grant regime more widely, especially in England, currently places over-riding emphasis on what would formerly have been regarded as secondary forest benefits such as biodiversity and public recreation. While those are important, a restoration of the emphasis on production of quality timber (and creation of a national strategic reserve of same) would create a more favourable environment for the establishment and competent tending of productive stands of minor conifers. The case-studies developed for the current project, are, in large measure, reports of how an existing "national strategic reserve" of timber, established between 1920 and 1960 is now being utilised. Policy and grant drivers should encourage the silvicultural excellence necessary to ensure that this resource now continues to be developed for the future.

Scott McG Wilson

Dr Scott McG Wilson is a forestry consultant based in Aberdeen, who pursues science-based research and development work in support of the productive and sustainable management of forests across Britain. Scott is active in several forestry organisations, including the Royal Scottish Forestry Society, Royal Forestry Society, ICF, CCFG and the Silver Birch group of the British and Irish Hardwood Improvement Group (BIHIP).