



CONIFER BREEDING
CO-OPERATIVE

Newsletter

July 2024

We are excited to provide our friends and supporters with a 2024 progress update. As regular readers will know the Conifer Breeding Co-op exists to take forward the improvement of key commercial conifer species. Our breeding goals are both conventional (improving performance traits for growth & quality) and to address more recent concerns around pest and disease resistance and future proofing against climate change. The need to provide viable alternatives to Sitka spruce to allow diversification of commercial forests in particular has added renewed impetus to our work.

We are delighted to report that all of our species programmes (NS, DF, SP, SS) have made significant progress over the last 12 months. The Alternative Conifers Plus Tree project is now sprinting towards the finishing line, and a large-scale field trial to test resilience in Sitka spruce is due to be planted out this autumn. Both of these projects are funded by the Tree Production Innovation Fund (TPIF) which aims to build capacity of plant and seed supply and improve the quality of planting stock available to the forestry sector. More details on these two projects is provided below. We have a third project running, to improve resilience in national Scots pine Seed Orchards. We will report on this in a later edition of the newsletter.

Alternative Conifers Project

The Co-op has committed to an ambitious target of assembling full breeding populations of Norway spruce and Douglas fir by the end of the TPIF funding period in March 2025. This is being achieved by the selection and grafting of Plus Trees from all regions of the UK. After growing on for a couple of years, grafted trees will be planted out into new seed orchards hosted by our members. Four new Douglas fir and three new Norway spruce orchards are planned.

The nature of grafted stock, which retains the biological age of the donor tree, means that orchard trees will move into their reproductive phase within 4 or 5 years after planting and will quickly start to produce commercial quantities of quality seed. The orchards will also act a resource for a breeding programme. In the medium term, we will test the seed in trials to identify the best parents within the population and move our orchards to 'tested' status. We are pleased to report that, as we enter the final year of the TPIF programme,

we have located and grafted 77% of the Norway spruce Plus Trees we require and 91% of the Douglas fir which means we are on track to achieve our base population target by the end of March 2025.

The many storms which have battered the country over the 12 months have made the Norway spruce programme in particular very timely as it is unlikely that a viable NS Plus Tree programme could have been put together in two- or three-years' time due to rapid degradation of a nationally overmature growing stock. On a more positive note, the project has allowed us to safeguard the genetics of some very fine trees. An example is the mature seed stand at Cairn Edward Hill, near Loch Ken in Galloway. See fig. 1. (overleaf). The Co-op wishes to thank FLS for allowing us access to this material. **In this final phase of work we would appeal to all landowners and managers to contact us if you have high quality Norway spruce stands that could be included in the breeding population.**



Alternative Conifers Project

DNA fingerprinting of Plus Trees

Over the past 18 months, Oxford University, who are partnering with us on the TPIF Alternative Conifers project, have developed a new assay (lab test) to allow DNA fingerprinting in Norway spruce. Oxford are creating DNA records for all of our Plus Trees (NS, DF, & SP). The unique “fingerprints” will aid the tracking of individuals through the grafting and orchard creation process and allow the parentage of seed produced in open pollinated orchards to be verified. Given the multiplicity of potential practical applications, fingerprinting is expected to become an important tool in tree breeding in the decades ahead. In the final year of the project the Oxford team, led by Professor John Mackay, will be focussing on refining the technique to make the tool as accessible and user-friendly as possible.

Data collection from Douglas fir field trials

Also funded through the TPIF Alternative Conifers project, Forest Research have been busy collecting a huge dataset from two types of Douglas Fir experiments in the Welsh Marches. These were set up in the 1990's and form part of a European network of experiments to evaluate the performance of certain DF families from Washington and Oregon (known as progeny testing). Data have been collected from progeny tests for growth, tree form, wood stiffness and wood density measured as drilling resistance using the IML-RESI powerdrill (Figure 2).



Fig 1. A fine stand of NS near Loch Ken, Dumfries and Galloway. Scion collection courtesy of Forestry and Land Scotland. For scale – note arborist on orange banded tree.

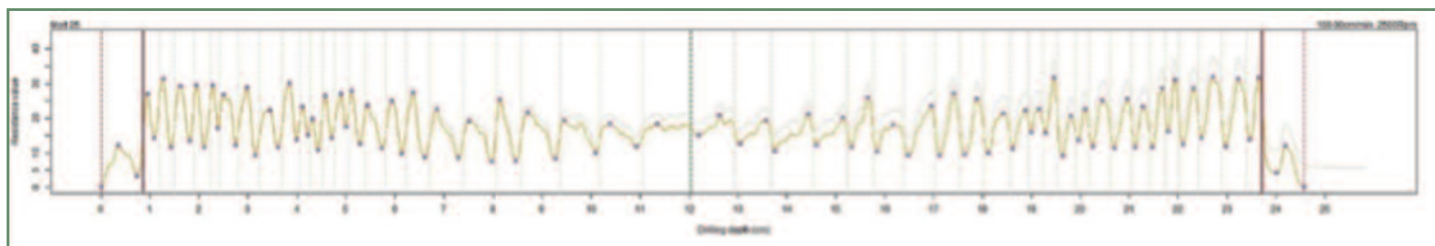


Fig 2. Example of the profile of drilling resistance through a Douglas fir stem growing in a progeny trial in Mortimer forest.

Two trials were set up to compare performance of commercially available seed from European sources and have been scanned using handheld terrestrial LIDAR devices (Figure 3). In the last year of the project the FR team, led by Dr Richard Whittet, will analyse the data which will feed into the Co-ops Douglas Fir breeding strategy, and the best trees from progeny trials will be selected and added to the base population through grafting. Data from the seed source comparison trials will allow FR to publish updated recommendations to the industry on the choice of most suitable planting stock, until our new seed orchards become productive.

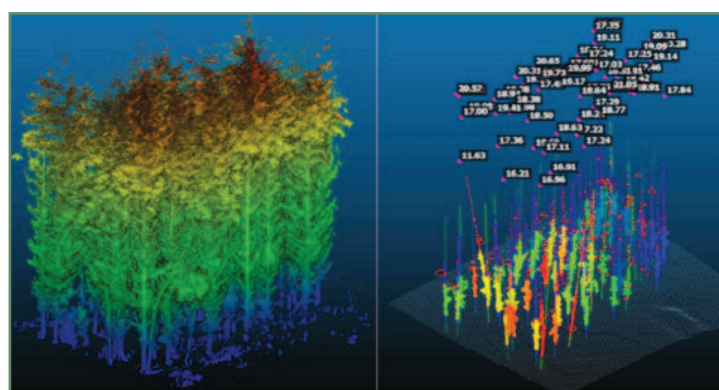


Fig 3. Terrestrial LIDAR scans (TLS) of one Douglas fir plot in an experiment in Gwent.

2024 Resilience Trial in Sitka Spruce

With the support of further TPIF funds secured in our 2023 bid we are now able to take forward a multi-site trial of full-sibling Sitka spruce families. We will be testing 100 full-sibling families (which means the seed produced by a controlled cross between two tested, superior parents) on 6 sites across the UK. The trial will be designed to gather information on conventional traits (growth rate, form, wood properties) but, more unusually, will be configured to allow testing for resilience to drought and pests and diseases. The material in the trial is the product of a focussed breeding programme by Forest Research over many decades, so is extremely well documented. One experiment site is planned for the East Midlands, which would normally

be considered too dry for Sitka spruce. By placing full-sibling material in this testing environment we hope to be able to identify families with drought-tolerant genetics.

In the fullness of time the CBC will consider developing separate breeding groups matched to particular growing conditions and UK regions if tests show this to be necessary. The trial requires careful management of around 3000 separate plant identities and many thanks go to the team at Maelor who have successfully collected, rooted and transplanted large numbers of plants whilst maintaining the integrity of the stock ID's. See image below.



Full-sibling Sitka spruce plants being grown on at Maelor Forest Nurseries for CBC Resilience Trial.

In conclusion

Work at the Conifer Breeding Co-op continues apace to address some of the most pressing issues facing forestry owners today: how to maintain the flow of benefits from productive woodland whilst safeguarding forest diversity and resilience. Through TPIF funded projects we are laying the foundations for full breeding programmes in four of our most important conifer species (NS, DF, SP & SS) by:

- Identifying the best trees growing in the forest and replicating them through grafting.
- Securing the genetics by planting grafts in seed orchards and clone banks.

- Collecting and analysing new data from existing field trials.
- Setting up new field trials to verify predicted gains, test for resilience, and test seed lots from other international programmes under UK conditions.
- Developing DNA techniques such as fingerprinting & genomic analysis.

Post TPIF (March 2025 onwards) the Co-op intends to develop full breeding plans for each of its four principal species and will then be in search of sponsors to help take the programmes forward.