CFP Internship Blog- Eve Anthoney

I applied to the CFP internship because it provided an incredible opportunity to learn more about biology and forestry while applying the maths and statistics skills I had gained at university. I hoped the internship would be the first step in a career in which I could use mathematical modelling and statistics to solve problems in biology and ecology. The chance to do fieldwork and gain practical skills also really appealed to me as I had never had the opportunity to do that kind of research before.

I began my CFP internship in October 2023, and on my very first day I went on a field trip to Yair to see a Scots pine experiment. I spent the first few weeks reading papers on provenance trials, wood density, and silver birch trees, and familiarising myself with the R Shiny app developed by the previous intern which I would use later in my internship to analyse the resistance data collected on field trips. I also got to learn how DNA is extracted from plant material in the lab and visited the clonal archives at Glencorse. Then, after learning how to use the IML RESI PD Microdrill to measure resistance and completing a first aid course, I was ready to do fieldwork!

The focus of my internship was collecting and analysing phenotype data from silver birch provenance trials. In 2003, silver birch trees from 29 provenances across Britain were planted at three sites – Drummond Hill (Scotland), Thetford (England) and Llandovery (Wales). During my internship I visited all three sites…

Drummond Hill (Scotland)

In the last week of October, I went on a field trip to collect data on the wood density of silver birch trees from provenance trials at Drummond Hill. This was done by measuring resistance of trees as the microdrill goes through them, as resistance has been found to be significantly correlated with wood density.

Measuring resistance of silver birch trees at Drummond Hill

The area where the trees were planted was slightly off the track, with a few hurdles in the way which I navigated successfully, though unfortunately not gracefully. I started off using the microdrill to measure the resistance of trees, and my supervisor Domen checked to make sure the drill had gone through correctly etc. Then we switched tasks, and I took a turn of taking notes and navigating the plots.

It was interesting to see the differences between some of the provenances- for example, in some of the plots all the trees were tall, straight, and had a relatively high diameter, while in other plots the trees were all really thin, or crooked and falling over.

On the third (and final) day we started early and got through all the measurements before midday, taking twice as many for the last two plots to see if it makes a difference measuring the wood density from the North (uphill) rather than the East (which is where we had been taking the measurements to avoid going through tension wood as much as possible). Immediately after we finished the rain started!

Thetford (England)

I visited the Thetford site in December. It was a much easier site to navigate than Drummond as the trees were much more uniform and the ground was flat (although there were some brambles which were very determined to grab onto my jacket).

Measuring resistance of the final tree at Thetford.

The trees at Thetford were much thinner (and taller) than those at Drummond Hill, which is what I expected from analysing the diameter data, but it was interesting seeing the difference visually.

Having successfully collected all the resistance data we needed from Thetford, we stopped at Cambridge to have a meeting with Mike Charters from Kew about the silver birch project before travelling back to Edinburgh.

Llandovery (Wales)

Two neighbouring plots from different provenances - there is a clear difference in diameter between the plots.

In January I visited the final site, Llandovery, to collect the resistance data. I had never been to Wales before, so I was excited to have the opportunity to visit, and I enjoyed the scenery on the journey. This site looked very different again from the other sites, with very distinct differences between provenances in diameter and form. The weather was clear most of the time we were there, and there were a few robins which followed us around as we worked our way through the trees. Navigating the plots was slightly more difficult here because there were quite a lot of missing trees, but thankfully we had the map to help. It felt like quite a momentous occasion when we had finished measuring the resistance of the final tree out of over 2000 trees across all three sites.

Data Analysis

I really enjoyed having the opportunity to collect data myself on field trips and I think this gave me a better perspective on the data- I could see the differences (in diameter particularly) between provenances in the experiments and then saw this reflected in the data analysis.

After visiting each site, I downloaded the resistance data and extracted mean resistance values (excluding bark), and bark thickness data for each tree using the R Shiny App. I had also been given diameter data on all the trees at each site. I did exploratory analysis of this data and investigated whether there were significant differences in traits such as diameter and resistance (a proxy for wood density) between provenances and between sites. I created a coordinate map of the trees for

each site and developed an algorithm in R-studio to count the number of neighbouring trees of each tree and identify which trees were edge trees. I found that the number of neighbouring trees had an impact on the diameter, and that edge trees had significantly higher diameter on average.

I also obtained climate data (such as precipitation and temperature data) on each of the provenances and sites as well as SPEI drought index data which I extracted from raster files. I enjoyed figuring out how to work with the raster data as I had never done that before. I then explored the relationship between these climate variables and traits such as diameter and wood density. I have most recently been learning how to use ASReml to build linear mixed models for the silver birch provenance trials and model spatial effects at the sites.

CFP Conference and visit to Kew and Alice Holt

At the end of February, I went to the CFP Conference at Kew Gardens. I did a short presentation about the research I have been doing during my internship, which I was slightly nervous about at first, but it was a great opportunity to present at a conference and a positive experience overall. I enjoyed hearing about all the other CFP projects and talking to other researchers from Forest Research and Kew Gardens about their projects. I also met the other interns, Phoebe and Sian, and it was great to hear more about how their internships were going.

The Orchid Festival at Kew Gardens

The day after the conference Phoebe, Sian and I went on a tour of Kew Gardens. It was incredible to see the archives recording plants sampled many years ago, and we visited the Orchid Festival and saw the world's oldest potted plant!

The next day we visited Alice Holt and were given a tour of the labs- including the mobile lab where they can do DNA extraction in the van. We learned about how researchers are protecting trees from pests and diseases and monitoring and preparing for potential threats. Then we visited the Alice Holt research forest- it was fascinating to learn about how they are monitoring the flux of carbon in and out of the forest, and to see all the scientific equipment monitoring the trees as well as environmental variables of the forest.

Overall internship experience and next steps

I have really enjoyed my CFP internship at Forest Research, it has been such an interesting and varied experience- I have had the opportunity to visit different experiments across Britain, learn fieldwork techniques, attend conferences on tree health and forest protection, and even graft a tree. The internship has been a great experience of what it is like to work in research, which is what I would like to do in my career. I am starting a PhD later this year- the project involves assessing and explaining plant invasion distribution across French Polynesian islands- and the skills and knowledge I have gained during my internship will be invaluable.

One of the best things about my internship at Forest Research has been the people I have worked with. Everyone I have met at Forest Research and through the CFP has been so supportive, and I have learned a lot from them, which has made it such a positive experience.