

Investigating Scots pine resilience

Intern diary

October 2025–March 2026

Finlay Bowler

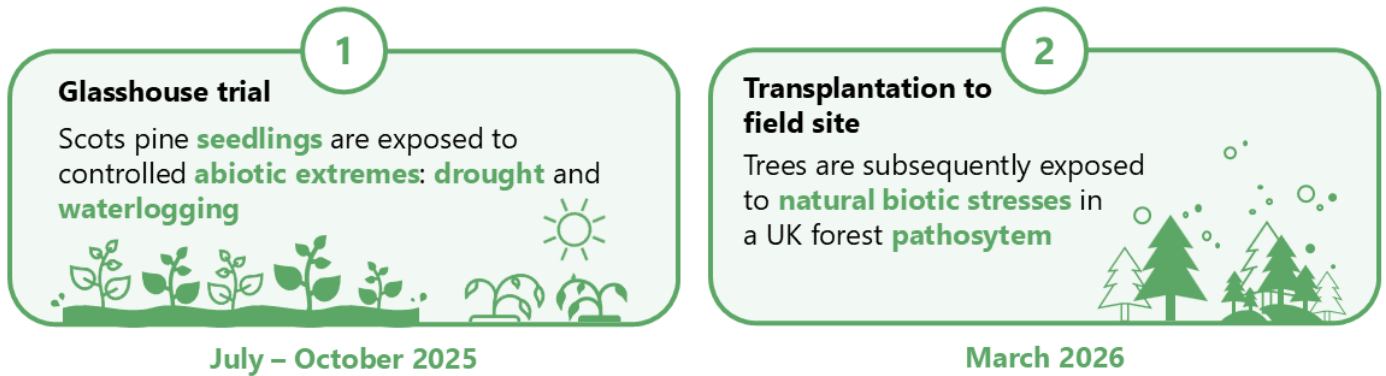


What led me to this internship?

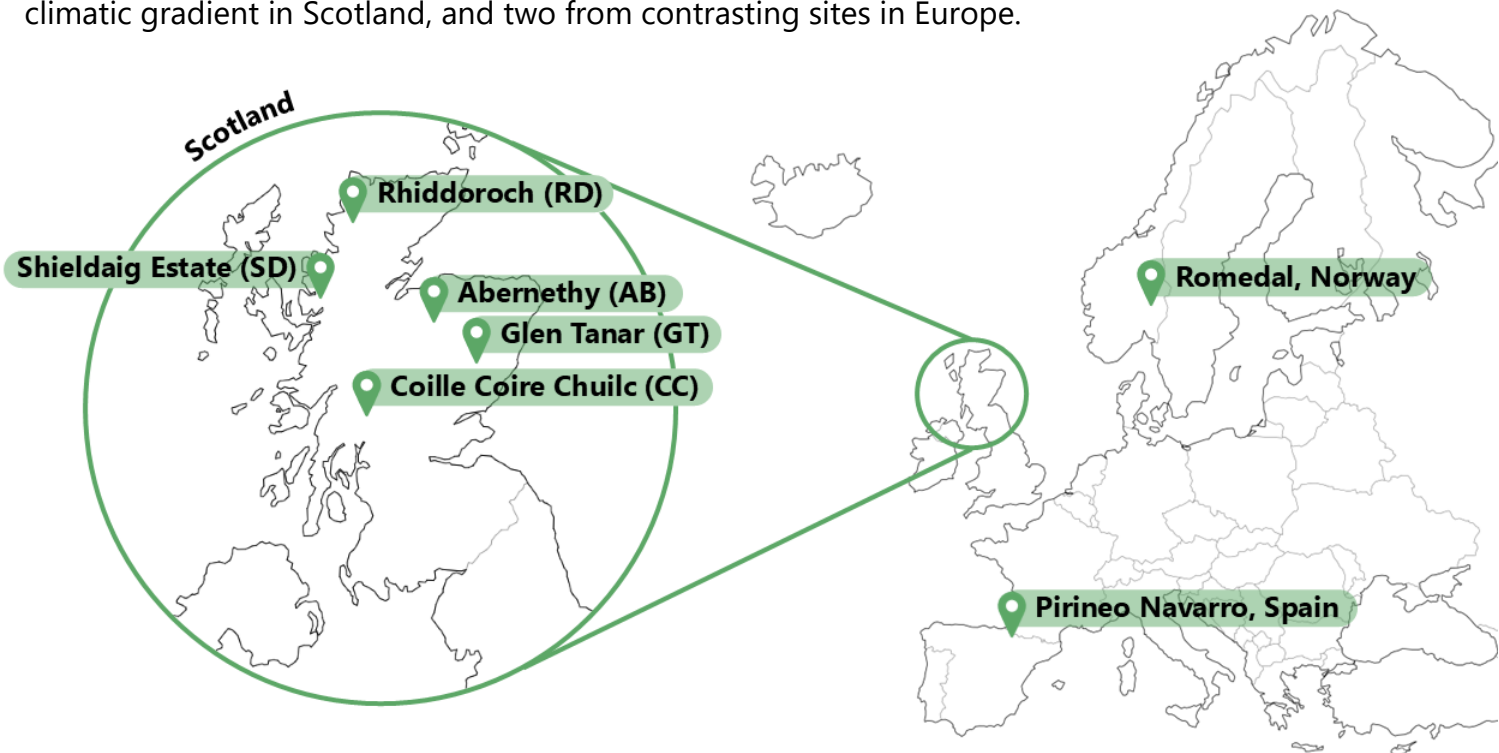
In the summer of 2025, I completed my undergraduate degree, where I specialised in plant sciences, with a focus on ecology and conservation. After graduating, I felt unsure of what I wanted to do – but I knew I wanted to build on what I learned in my degree and perhaps gain a greater understanding in other related fields. I thought about doing a master’s degree, but given the cost of further study, I was hesitant to dive straight into further education. This internship offered a great balance: it gave me the chance to grow skills in area such as modelling and statistical biology, learn more about forestry and forest conservation, and contribute meaningfully to an ongoing study that could add to our existing knowledge of Scots pine.

What was my internship project?

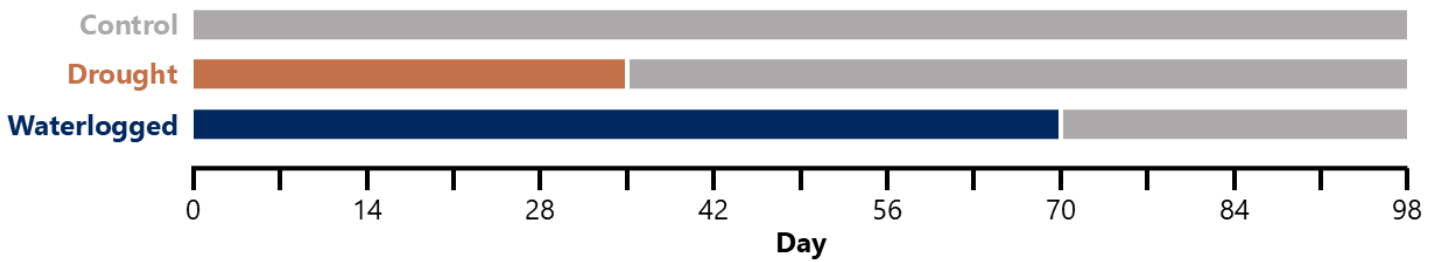
My work was part of a long-term project investigating the resilience of Scots pine. This project aims to look at the compound threat of (1) abiotic stresses of drought and waterlogging; and (2) biotic stresses, such as exposure to needle blight caused by the pathogen *Dothistroma*.










Seedlings were sourced from a range of provenances: five from across a climatic gradient in Scotland, and two from contrasting sites in Europe.



My role focused on the glasshouse trial. This was a 98-day experiment, where one-year-old trees of the seven provenances were split evenly between three treatments: **control** (soil moisture maintained at around 40%), **drought** (35 days unwatered), and **waterlogged** (70 days in standing water).



During the trial, various measurements were taken. This included weekly measurements, which allowed us to keep track of changes throughout the course of the trial, as well as data taken before and after the 98-day trial period.

Weekly	Pre- and post-treatment
<p> Soil moisture to quantify the treatments.</p> <p> Visual health encompasses how healthy the plant <i>looks</i>.</p> <p> F_v/F_m measures the maximum efficiency of PSII, essentially indicating photosynthetic capacity.</p>	<p> Height from the soil to the tips of the growing bud.</p> <p> Electrolyte leakage indicates the stability of needle cell membranes.</p> <p> Water-use efficiency tells us how effectively water is converted into biomass.</p> <p> Soil cores allow us to investigate root variables.</p>



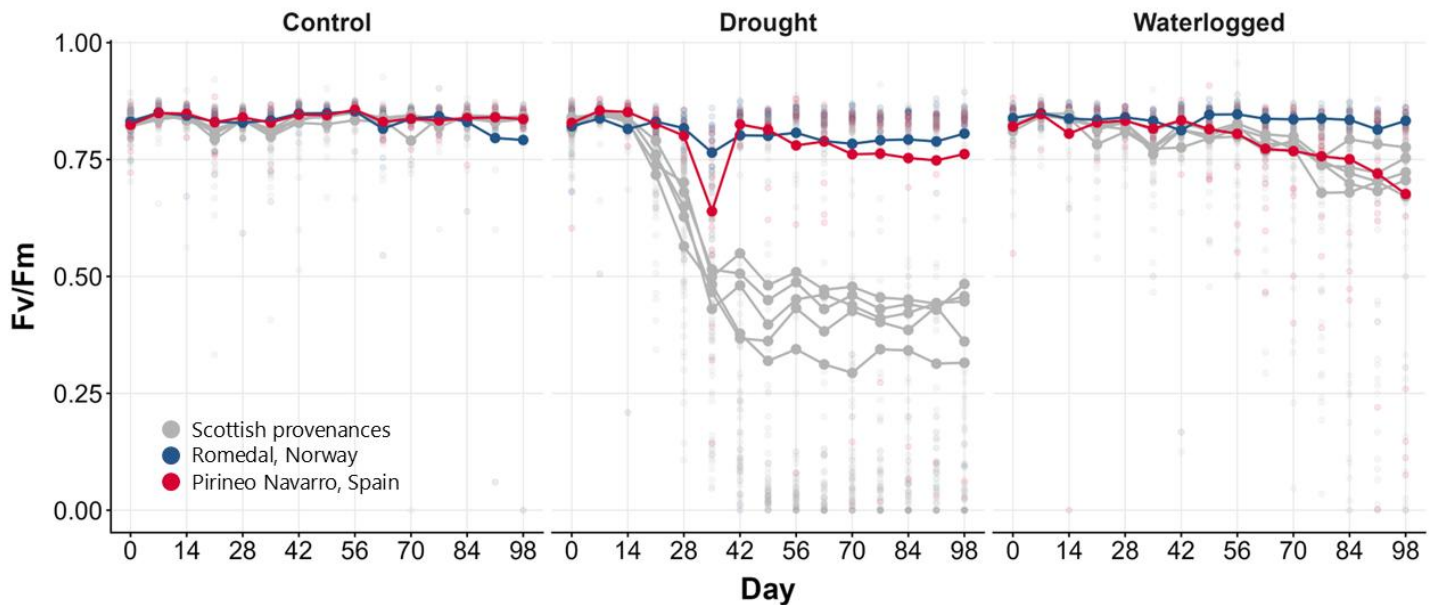
Through this abiotic trial, I aimed to answer the following key questions:

1. **How does Scots pine respond physiologically to the different stresses of drought and waterlogging?**
2. **How do these responses vary between provenances?**
3. **Is there evidence of local adaptation to climatic conditions?** (For example, do trees from areas with lower annual precipitation show a higher resilience to drought?)

Ultimately, however, this trial aims to look at how the compound stresses of abiotic and biotic factors work *together* to influence growth and survival in Scots pine. Continued monitoring of the trees at the field site should provide an insight into this – but this work will be carried out after my internship has finished!

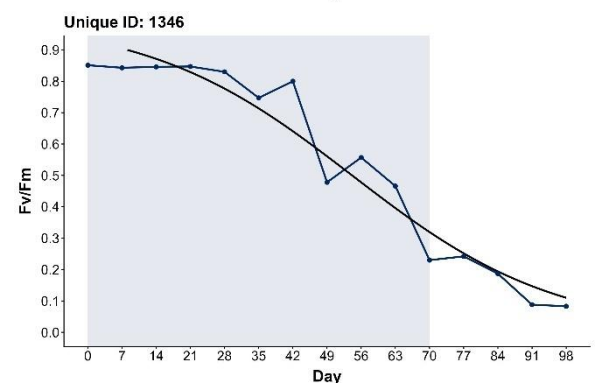
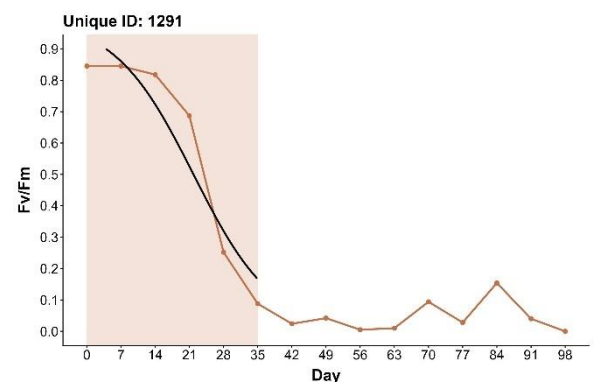
What did I take away from this experience?

My focus was on analysing the data we collected from the glasshouse trial. I spent a lot of time exploring the dataset to get a feel for what it looked like and figuring out the best way to approach the analysis.



Here, I took a look at the F_v/F_m responses displayed by the different provenances (Scottish provenances in grey, Norway in blue, and Spain in red) across the three different treatments. The lines show the mean values for each provenance each week, while the smaller, semi-transparent points represent the raw data values. It is noticeable that fewer seedlings declined in F_v/F_m under waterlogging than in the droughted treatment. Spanish and Norwegian provenances appeared more resilient to drought than Scottish provenances.

The analysis took a lot of creative thinking and problem solving. With such a large dataset and so many variables, I had to consider which ones were really worth digging into and how to pick apart the seedling responses we were seeing. At the start of the internship, I spent many hours combing through related literature, exploring which methods I could apply to my own analyses. This gave me some great starting points – but as is often the case with ecological data, the analysis was rarely straightforward! Throughout this internship, though, I have grown in confidence in modelling responses and working with different statistical approaches. This included using beta regressions to predict the decline in F_v/F_m over time, and logistic regressions to determine which variables influenced seedling survival.



Using beta regression to model F_v/F_m response in two example seedlings (droughted individual in orange; waterlogged in blue).

Not all my internship was spent in RStudio though! I spent plenty of time out in the glasshouses taking measurements, as well as helping label and organise seedlings ready for their transplantation to the field site. I also got involved in laboratory work, processing pine needles and measuring electrolyte leakage (which even involved putting the needles in the autoclave!), as well as preparing samples for carbon isotope analysis (a proxy for water-use efficiency in plants). Additionally, I spent time out doing fieldwork, which included helping with tree planting. All of this gave me a much better understanding of the practical side of tree research and conservation.

There are so many different projects all being carried out at Forest Research. During busier times for some projects, I offered to lend a hand in places. Through this, I gained a broader view of the work carried out in forestry and tree breeding, and as a result have a more rounded understanding of the work in this field.



Tree planting



The glasshouse trial



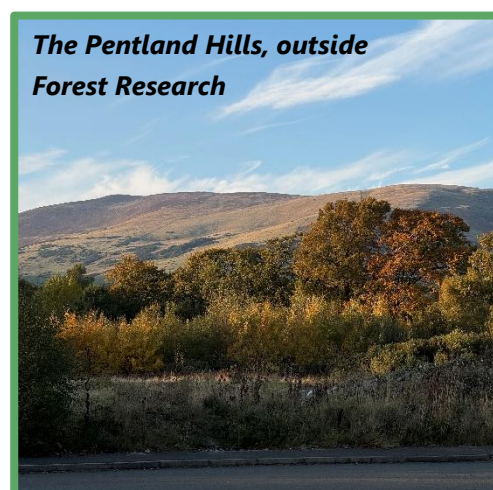
Scots pine in the glasshouse



Ready for the catwalk



A lovely view for planting trees!

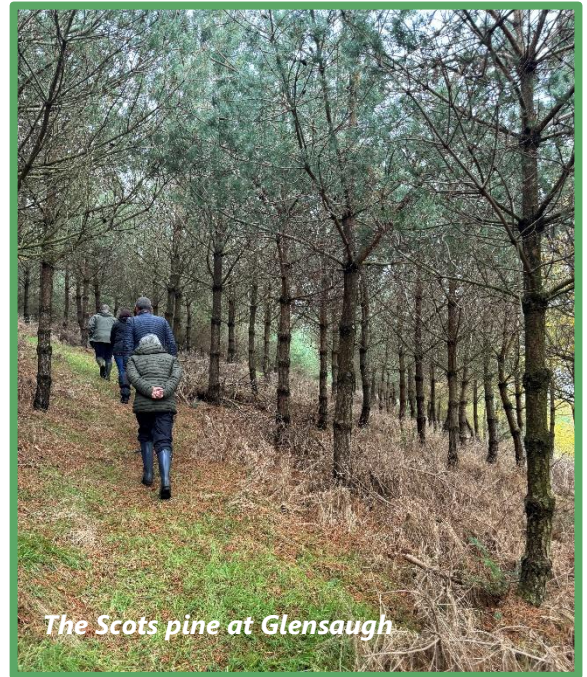


The Pentland Hills, outside Forest Research

What were the highlights?

In November, I attended the Scots Pine Research Day, where I learned a lot about all the different work carried out on Scots pine, ranging from research into the genetic structure of Scotland's pine trees to their resistance to fungal pathogens. Additionally, I got to see a mature Scots pine field trial at Glensaugh. It was great to see the results from many decades of work into this area!

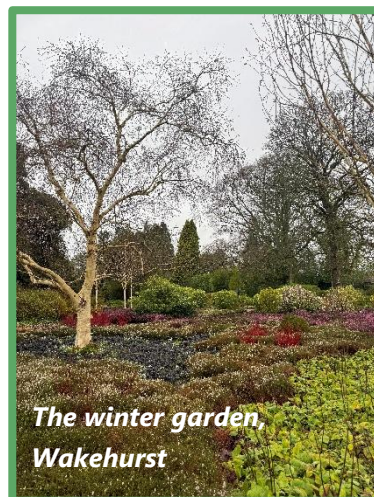
In February, I travelled down to Wakehurst to meet all the other interns, including those at Kew. Learning about the seed bank and its international importance was fascinating, while the gardens were lovely, even during winter!



The Scots pine at Glensaugh

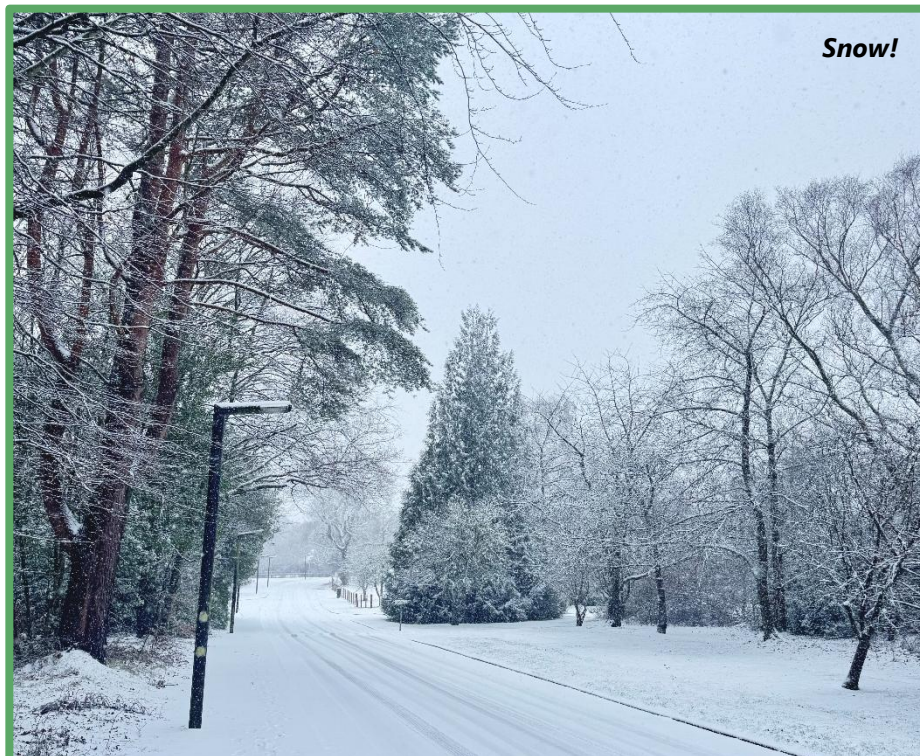


A grumpy-looking pheasant, Wakehurst



The winter garden, Wakehurst

Forest Research saw a nice dusting of snow in February too – although it only lasted a morning.



Snow!



The glasshouse in the snow

A fieldwork trip to the Cairngorms was another highlight, and an incredible opportunity to see natural Scots pine regeneration in areas where deer were excluded. We also saw both UK species of eagle, and a mountain hare!

And finally – since it was my first time living in Edinburgh, it was amazing to experience the city and east coast of Scotland.

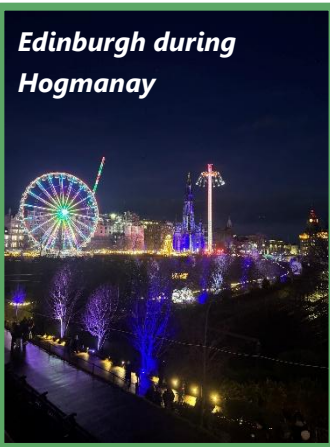
The Cairngorms



A golden eagle (you'll have to take my word for it)



Edinburgh during Hogmanay



Exploring Edinburgh

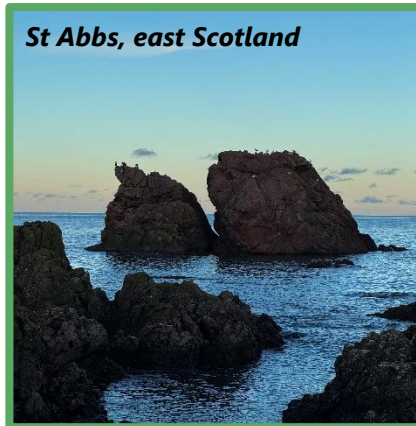


A grey seal with its mum

From the top of Arthur's seat



St Abbs, east Scotland



Baby seal!



So, what's next for me?

This internship gave me the chance to apply myself to an ongoing research project and make a small but meaningful addition to our understanding of Scots pine. It also highlighted how much more there is for me to learn and provided a short break from formal education, while still growing my skills as a scientist. I'm really looking forward to starting a master's degree focusing on crop sciences in October 2026 – but until then, I'm keen to see what opportunities come my way!