

Internship Diary

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Centre for Forest Protection intern with the Scots pine resilience project (2025-2026)

I'm writing this as I come to the end of my 4.5-month internship working on the Scots pine resilience project at Forest Research. This project explores the role of intraspecific (within-species) variation in resilience to environmental stress: experiments conducted so far involved growing trees from seed collected from wild populations across Scotland and other European countries, then exposing the seedlings to drought and flooding treatments in a greenhouse trial and assessing health outcomes across origin populations. My own research position examining the role of root systems in stress resilience has been a perfect way to build on my professional and educational background in horticulture, ecology and soil science, helping me to develop skills and experience that will be invaluable in my future career supporting resilience in plant/soil systems.



Sunset at the Northern Research Station, Roslin, Scotland, with Scots pines and the Pentland hills in the background



Scots pine, fields and snowy hills on my daily walk to work.

Being based at the Northern Research Station in Scotland has been an amazing experience: working at a site which is both rural, surrounded by forests, fields and the stunning Pentland Hills national park, as well as situated at the heart of a thriving biological research community, I've benefited from visits to the UK Centre for Ecology and Hydrology (a collaborator institution on the project), as well from scenic walks through the surrounding fields which are used for agricultural research and education by Edinburgh University and Scotland's Rural College.

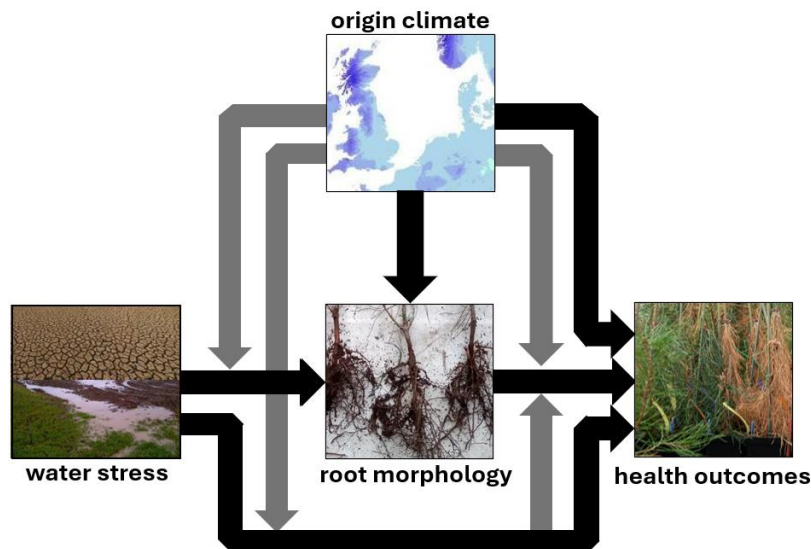
Working on important research within a larger team has been a great experience. It's been an honour to be able to contribute to work that could help to protect our iconic and threatened Caledonian pinewoods as well as to support sustainable, resilient timber production systems. It's been especially rewarding to be given personal responsibility for delivering research results relating to a specific area of the project, developing my own methods for measuring root traits as well as for statistically modelling their variability across populations and their relationships to health outcomes, whilst learning to efficiently manage my own time in order to process and analyse several hundred soil samples in just a few months.

Much of my time has been spent in the lab, where I picked through tiny soil samples under a microscope, extracting fragments of root which I then cleaned, weighed and scanned before using WinRHIZO root analysis software to estimate metrics like



Extracting root fragments from soil samples with tweezers

root length and surface area. Processing these samples, which often contained only tiny, damaged root fragments, was an interesting challenge which pushed me to think creatively, developing alternative analysis such as manually counting root forks when automated analyses failed. My ongoing statistical analyses have been similarly challenging, requiring me to develop creative modelling techniques to pick apart sources of variation in the limited data to try to understand whether root morphology differs between populations; whether adaptation to local climatic conditions explains these differences; and whether differences in rooting can explain tree health outcomes under water stress. This experience working with roots will be helpful in my future career working on resilience in plant-soil systems, whilst experiencing the challenges inherent to analysing limited biological data could be useful in a wide range of real-world research contexts where data is often limited and unreliable.



Representation of the model structure I developed to test hypotheses about how root morphology variables (such as root tissue density or frequency of root branching) might mediate the effects of water stress treatments and seedling origin climate on health outcomes.

Black arrows indicate direct effects of variables on other variables, whilst grey arrows leading into black arrows indicate interaction effects, where the effect of one variable on another is modified depending on the value of a third variable.

Water stress affects roots, which in turn affect health outcomes. Water stress can also directly affect health outcomes via other pathways that are independent of its effects on roots (bottom black arrow). In addition to affecting roots, water stress can also modify the effect of roots on health outcomes. Seedling origin climate can modify the effects of water stress on both roots and health outcomes, and can also directly affect both roots and health outcomes.

In addition to the technical data analysis that's made up the bulk of my internship, I've also had the chance to help with field trials, spending time in the greenhouse labelling and sorting trees as well as visiting field sites to plant trees and plan future trials. This included visits to a commercial Scots Pine forestry site at Tentsmuir in Fife and a visit to Mar Lodge Estate in the Scottish highlands. Seeing the estate's remnant ancient pinewoods as well as younger trees that have been beginning to regenerate thanks to conservation efforts was a beautiful and emotional experience which helped me to see the broader conservation importance of the project.



Left: moving potted Scots pine in preparation for field planting. Right: Planting birch and alder.



Remnant ancient Caledonian pinewoods at Mar Lodge Estate (above), and young Scots pine regenerating nearby thanks to conservation efforts (below)



I also got to go on a trip to the Wakehurst Millenium Seed Bank and adjacent botanical gardens, organised by the Centre for Forest Protection staff to bring together all the interns working at Forest Research and Kew Gardens in person. There, we received guided tours of both the botanic gardens and the seed bank, where we were shown the laboratories and vaults used to process and preserve seeds from endangered wild populations. We also received presentations about research being conducted at Wakehurst to identify plant genotypes likely to thrive or struggle under projected future climate scenarios. Learning about conservation and research work at Wakehurst helped me to consider how insights from my own research on Scots pine resilience could contribute to addressing broader questions about the role of intraspecific variation in ecological resilience.



Top: Wakehurst gardens. Bottom: exterior of the Millenium Seed Bank

Working at Forest Research and contributing to research with real-world importance has been a very enjoyable experience which has reassured me that my career decisions to date have put me on the right path. I had previously wondered if my practical horticulture background would be a hindrance in moving towards a more scientific career; if anything, it's been the opposite, as my practical experience has been immeasurably useful in my current Forest Research position. I would encourage others with practical backgrounds working with trees or plants to consider getting involved with forest research or broader ecology and plant science as potential entry points to a scientific career, and I would likewise encourage those interested in biological sciences to consider how developing practical experience with plants could support their career and their research. Being able to integrate my practical and academic interests at Forest Research has made me excited about the prospect of pursuing further positions related to forestry, an area which I previously had little knowledge of. Ultimately, this internship has given me confidence in my ability to thrive in a professional research environment, as well as in my decision to pursue a career working on resilience in plant-soil systems.

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