Laidlaw Cohort 2025

Summer 1 Reflective Report
Research Project and Personal Development

A toolkit for the conservation of grazing sites: Restoring Old Irish Goat herds to mitigate fire risk

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1 . Introduction

When I applied for the Laidlaw Programme, my goal was simple: to challenge myself in ways I hadn't before. I wanted to learn how to lead with purpose, to work on a project that genuinely mattered, and to push myself outside of my comfort zone. Growing up in Howth, I had seen the devastation caused by wildfires first-hand. When Fingal County Council introduced Old Irish Goats in 2021 to control the gorse, I saw how effective this nature-based solution was and how little formal data existed to measure its impact.

Through conversations with Fingal County Council and the Old Irish Goat Society (OIGS), I learned that they really wanted a Conservation Grazing Toolkit - a practical, easy-to-use resource for assessing vegetation risks, especially hazardous plants for the goats. They had the grazing programme, but they wanted a standardised way to collect and interpret data across sites. I immediately knew I wanted to take this on.

The project combined fieldwork, ecology, data analysis, and communication. All areas I was eager to develop. My goal was to deliver a toolkit that could be used by councils, NGOs, or volunteers to monitor grazing sites quickly and effectively. I also wanted to build skills in leadership, problem-solving, and collaboration along the way. Laidlaw felt like the perfect opportunity to learn while producing something of real value.

2. Research Project Experience

Project Overview

The goal of my research was to design a Conservation Grazing Toolkit that any land manager or volunteer group could use to assess hazardous plant species and guide safe, effective grazing plans. While Fingal County Council and OIGS had seen success in reducing wildfire risk with goat grazing, there was no consistent method to measure vegetation changes or identify risks to the goats themselves.

My project aimed to fill this gap by producing:

1. **A hazardous plant identification guide** with photos, toxicity information, and seasonal notes.

2. **A step-by-step fieldwork protocol** for surveying sites, collecting data, and producing results that could guide management decisions.

I structured the summer into five main stages:

- **Site mapping**: I identified 12 grazing sites across Howth Head and colour-coded them as *Active*, *Recently Grazed*, or *Ungrazed*. Active sites had ongoing grazing; Recently Grazed sites had goats within the last eight months; Ungrazed sites had no recent grazing activity. I created site maps with boundaries, area estimates, and grazing status using open-source mapping tools.
- **Quadrat sampling**: I surveyed 0.2% of each site using **1 m² quadrats**, spaced evenly according to site area. Each quadrat was labelled, photographed, and recorded in a field notebook for traceability.
- **Plant identification and stem counts**: Within each quadrat, I identified and counted stems for all plant species, focusing on hazardous plants such as bracken, ragwort, foxglove, and rhododendron.
- **Data analysis**: I calculated mean toxic stem counts per quadrat for each site and created heat maps to visualise toxicity levels. Bar charts compared toxic versus non-toxic vegetation across grazing categories.
- **Toolkit development**: I created both a *Quick Visual Guide* with icons and simple steps, and a *Detailed Protocol* with data sheets, mapping templates, and analysis instructions. A QR code linked directly to the toolkit on the final poster for easy access.

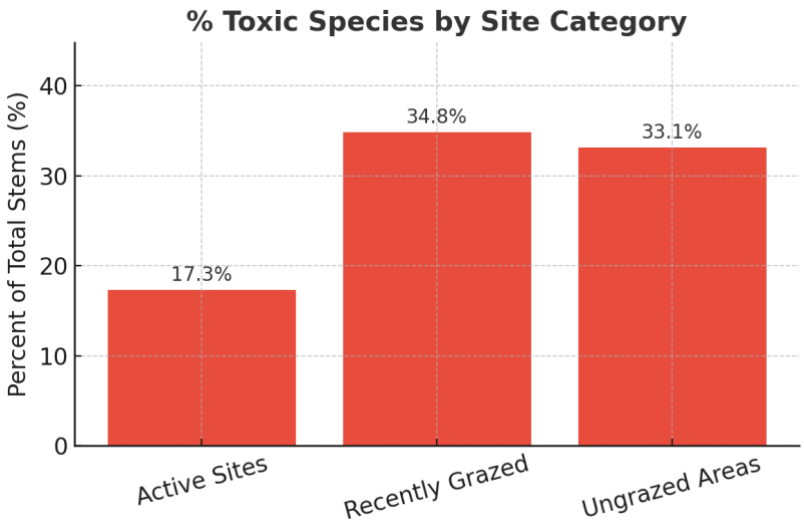
Findings

The field data revealed clear differences in vegetation based on grazing history:

- **Active sites** had the *lowest* toxic plant density - only **17% of stems** were toxic, compared to **35% in Recently Grazed** and **33% in Ungrazed** sites. Grasses dominated Active sites, covering nearly 70% of vegetation.

- **Recently Grazed sites** showed transition patterns: toxic plants were declining, but densities remained higher than in Active sites.
- **Ungrazed sites** had persistent bracken and gorse, with some quadrats recording over 25 toxic stems per m².

Figure 1: Percentage of toxic plants by grazing category



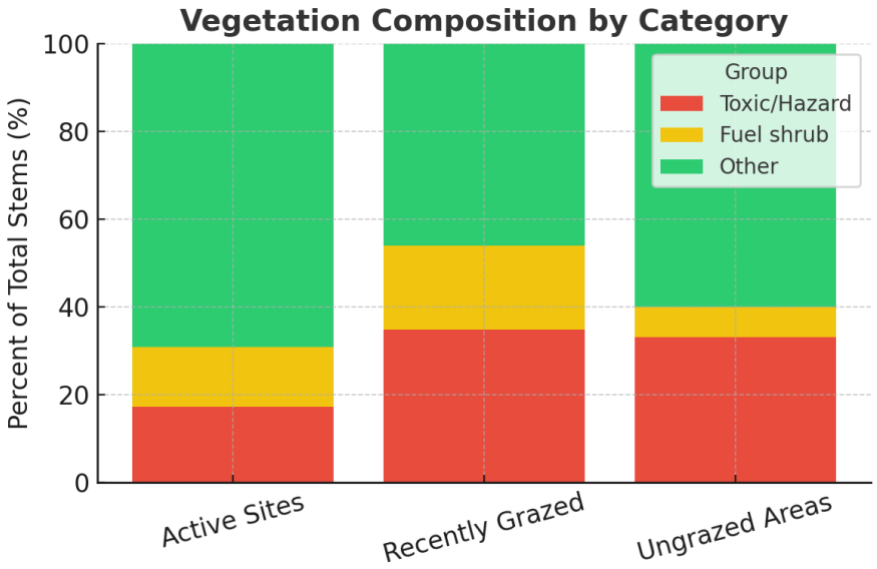
Active sites had the lowest proportion of toxic stems. Bars show percentage of total stems classified as toxic by category.

Terrain also influenced results:

- **Mountainous sites (1–3)** had the *highest* toxic plant loads. Steep slopes may limit grazing intensity and favour hardy, fire-prone species.
- **Central meadow sites (4–7)** had mixed outcomes: Site 5 had high toxic densities, while Site 6 had almost none, possibly due to different grazing histories.
- **Coastal fringe sites (8–12)** had consistently *low* toxic plant counts, suggesting **salty winds and exposure** may naturally limit these species.

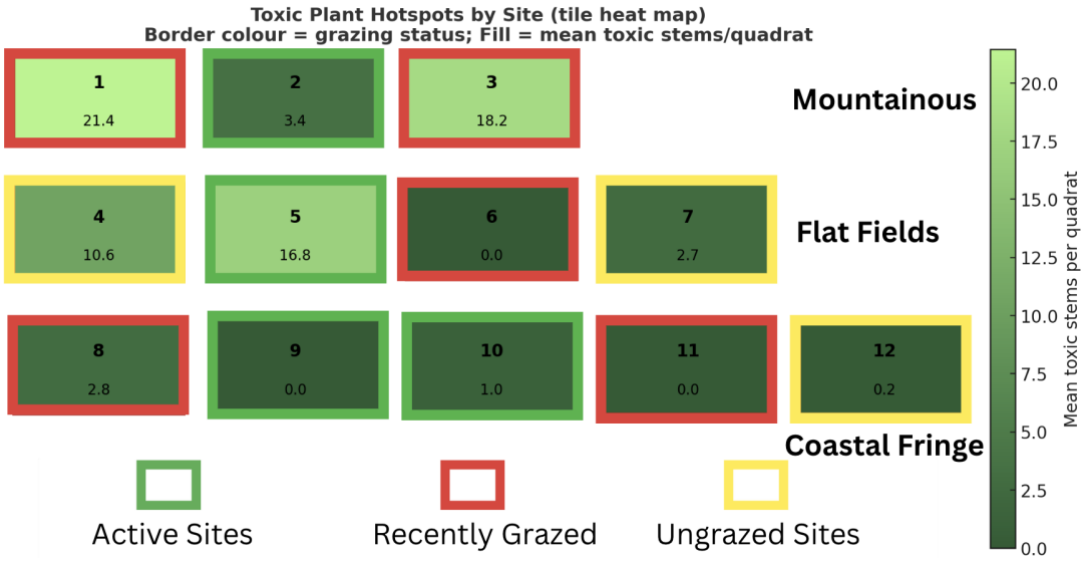
Importantly, sites with **repeated grazing cycles** showed suppressed toxic plant regrowth, highlighting rotational grazing as a potential long-term management strategy

Figure 2: Vegetation composition by grazing category



Composition of vegetation by category showing toxic species, fuel shrubs, and grasses/other.

Figure 3: Tile heat map of toxic hotspots by site



Per-site mean toxic stems per quadrat. Borders indicate grazing status; fill shows relative toxicity.

Table 1: Key hazardous plants for goats, seasonal risk and management notes

Species	Main toxins or risk	When risk is highest	Typical goat behaviour	Management note
Bracken	Ptaquiloside (carcinogenic)	Late summer–autumn (mature fronds)	Goats may eat young shoots if hungry; avoid mature fronds	Cut or graze before fronds mature; rotate grazing areas
Ragwort	Pyrrolizidine alkaloids (liver damage)	Summer flowering stage	Generally avoided if other forage available	Remove before flowering; never in hay or silage
Rhododendron	Grayanotoxins (cardiac + digestive effects)	All year, esp. winter–spring	Often avoided unless forage is scarce	Mechanical removal or fencing around shrubs
Foxglove	Cardiac glycosides (heart failure)	Spring–summer flowering	Usually avoided unless very hungry	Pull before flowering; avoid accidental ingestion
Yew	Taxine alkaloids (highly toxic)	Autumn–winter (fallen leaves)	Goats may browse leaves if accessible	Fence off yew trees; never dispose cuttings in grazing areas
Hemlock	Coniine alkaloids (neurotoxin)	Spring–early summer	Generally avoided unless little forage	Identify early and remove manually or chemically
Buttercup	Protoanemonin (irritant)	Spring–early summer (flowering)	Usually avoided when fresh; toxins lost in hay	Not usually a major risk; manage pasture density
Cherry Laurel	Cyanogenic glycosides (cyanide risk)	All year, esp. winter–spring	Leaves browsed if forage scarce; clippings highly toxic	Fence trees; never dump garden clippings in fields
Bluebell	Glycosides (digestive irritation)	Spring (flowering and leaves)	Rarely eaten unless little alternative forage	Not usually serious; monitor if grazing early spring woodlands
Acorns (Oak Trees)	Tannins (renal/liver damage)	Autumn (fallen acorns)	Goats may eat fallen acorns if forage low	Limit access during autumn; remove fallen acorns if possible

Key hazardous plants for goats, seasonal risk and management notes.

Achievements

By the end of the summer, I had delivered:

- **Conservation Grazing Toolkit**: A downloadable resource with a Quick Visual Guide and a Detailed Field Protocol. https://drive.google.com/file/d/1tuDx_nUeg4yUpOAvNmzfGEhNMrkHn0qS/view?usp=sharing
- **Hazardous Plant Guide**: Photos, toxicity information, and seasonal risk notes for all key species. (See table 1)
- **Data visualisations**: Heat maps and bar charts comparing toxic plant densities across sites. (See figure 3)
- **Final research poster & QR code**: A professional poster summarising methods, findings, and toolkit access. https://drive.google.com/file/d/1A2gFEF6ZxS_g2H0W4mj_LjySTZkjtbEr/view?usp=sharing

The toolkit means Fingal County Council and OIGS can now monitor grazing sites consistently and adapt the methods for future use across Ireland.

Challenges

Several challenges pushed me to adapt:

- **Weather disruptions**: Fieldwork was delayed by rain and wind, forcing me to rework schedules and safety plans.
- **Difficult terrain**: Mountainous sites limited quadrat placement and required additional care for data consistency.
- **Species identification**: Some plants were hard to identify at immature growth stages; I had to cross-check specimens online and consult local goat herder.
- **Data entry errors**: Early inconsistencies in field notes led me to redesign data sheets for clarity and accuracy.
- **Learning new analysis tools**: I had never made heat maps before; learning to use mapping software took longer than expected but proved invaluable by the end.

These challenges taught me resilience, problem-solving, and adaptability - skills as valuable as the research itself.

Reflections on Research Skills

This project accelerated my research skills in several ways:

- **Fieldwork planning**: I learned to design surveys, anticipate logistical issues, and standardise data collection methods.
- **Data management**: Creating clear data sheets and quality checks helped me avoid early mistakes.
- **Analysis & visualisation**: I gained confidence producing heat maps, bar charts, and summary tables for technical and non-technical audiences.
- **Scientific communication**: Developing the toolkit, hazardous plant guide, and final poster taught me to present complex findings clearly and visually.
- **Collaboration**: Working with Fingal County Council, OIGS, and my supervisor showed me how academic research can directly meet stakeholder needs.

Seeing council staff discuss applying the toolkit to other sites was one of the most rewarding outcomes - proof that the work had real-world value.

3. Leadership Development

Working with Fingal County Council, OIGS, and my supervisor taught me a huge amount about collaboration, communication, and leadership.

I started the summer seeing myself mainly as a researcher. But coordinating fieldwork, aligning with multiple stakeholders, and delivering outputs on time required me to step into leadership roles naturally. For example, I scheduled meetings with the council to share progress, gathered feedback on the hazardous plant guide, and adjusted the toolkit layout based on their suggestions. Balancing different perspectives - academic, practical, and ecological - taught me to listen first, then make decisions confidently.

Time management was another leadership lesson. Fieldwork days depended on weather, site access, and volunteer availability, so I created contingency plans and kept

communication clear and consistent. When unexpected delays happened, I had backup tasks, data entry, map design, or poster drafting, to keep momentum.

This project confirmed that I enjoy research far more than I expected. I liked the rhythm of fieldwork feeding into analysis, and analysis feeding back into better questions. I found real satisfaction in turning messy notes into clear visuals that decision-makers could use. It has made me certain that I want to pursue a research pathway after my degree. I've already begun looking into doctoral opportunities and started the initial planning stage for a PhD, most likely in wastewater treatment, with a strong engineering focus that combines lab and field-based work.

4. Personal Growth & Reflection

This project pushed me far outside my comfort zone, and I can see how much I've grown because of it.

Confidence was the biggest change. At the start, I doubted whether I could design a full field protocol and deliver something councils would actually use. By the end, seeing the toolkit completed, with a QR code on my poster linking directly to it, was incredibly rewarding.

I also developed technical skills I hadn't expected. Learning GIS mapping and heat map analysis was challenging, but now I can create professional visualisations that communicate results instantly. Those skills will be invaluable in future research and coursework.

Most importantly, I learned about my working style. I like structure and preparation, but this project taught me to adapt when things change - whether it was weather delays, plant ID challenges, or unexpected results. I'm coming away more resilient, organised, and open to problem-solving on the go.

5. Next Steps & Future Impact

Fingal County Council and OIGS now have a practical toolkit they can apply across all grazing sites across Ireland and beyond. Because the protocol is simple and low-cost, it can be rolled out to other County Councils across Ireland.

Future work could expand the project in three ways:

1. **Seasonal studies**: Repeating surveys across spring, summer, and autumn to track how plant risks change over time.
2. **New locations**: Testing the toolkit on other Irish sites, or even internationally in wildfire-prone areas like California or southern Europe.
3. **Goat behaviour research**: Linking vegetation data with grazing patterns to see how goats select or avoid certain plants.

Long-term, I see this project as a practical extension of what I study in Environmental Science & Engineering. Many of our modules focus on nature-based solutions, ecological engineering, and sustainable land management, but this summer was the first time I applied those concepts in the field. It reinforced how much I enjoy work that bridges academic research with real-world environmental challenges, turning classroom theory into practical impact.

6. Conclusion

Looking back on Summer 1, I'm struck by how much I learned in just a few months. I arrived hoping to build research and leadership skills; I'm leaving with new technical abilities, stronger confidence, and a toolkit that councils are already planning to use.

I learned that research rarely goes perfectly - weather changes, data gets messy, methods need adapting - but problem-solving through those challenges is where the real growth happens. I also learned that leadership isn't always about titles or big gestures. Sometimes it's about keeping a project moving, making decisions under uncertainty, and communicating clearly with everyone involved.

Looking back, this summer has been transformative. It gave me my first real taste of independent research - the planning, the setbacks, the small wins that build into something tangible - and I found I loved the entire process. It taught me how to take an idea from fieldwork to analysis to a resource that others can use. It built my confidence, sharpened my technical skills, and confirmed that research will be a big part of my future. I've already started exploring doctoral pathways in environmental engineering,

particularly in areas like wastewater treatment, where I can combine rigorous technical methods with practical impact. What excites me most is knowing that the skills I built this summer – data analysis, problem-solving, collaboration, and clear communication - will carry into whatever challenges come next.

7 . Fieldwork Photos

Old Irish Goats grazing on Howth Head
The goat herd at work maintaining firebreaks and reducing hazardous vegetation in summer 2025.

Fieldwork and survey images
Selection of photos showing quadrat sampling during vegetation surveys across Howth Head.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