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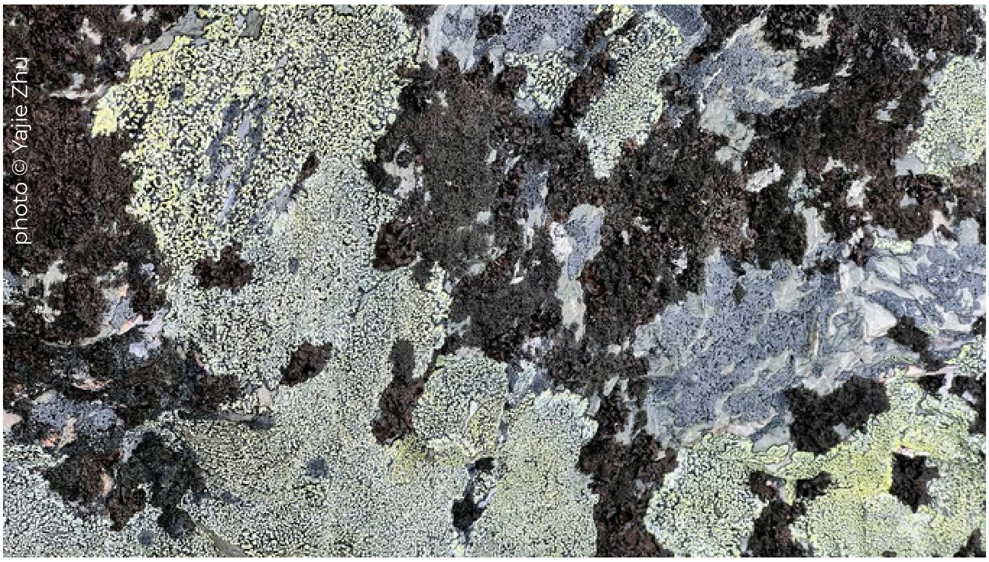
Ambassador Story

A hidden process shaping the tundra's future



Lichen mosaics: green, gray, and whitepatches covering the tundra surface

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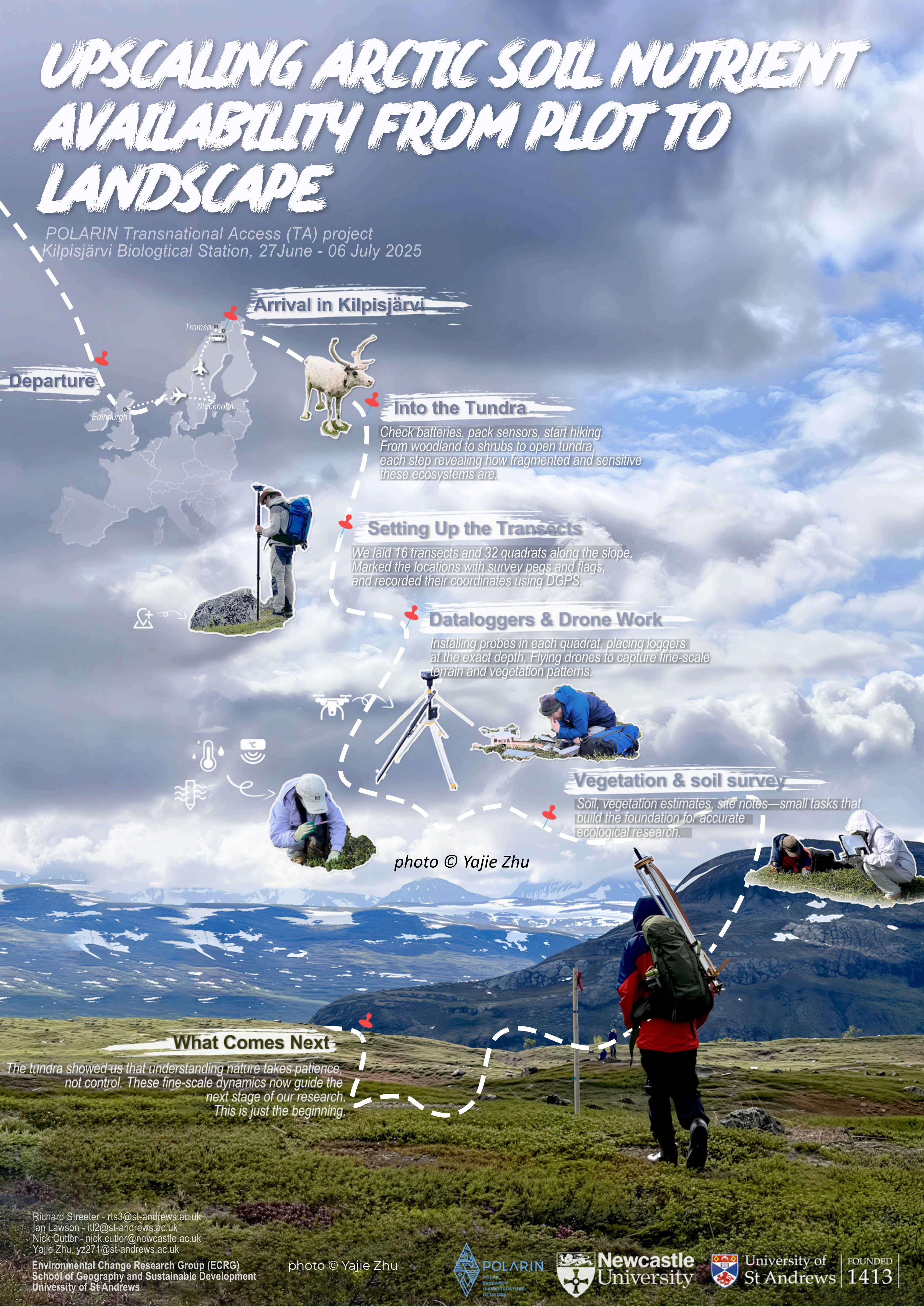

UPSCALING ARCTIC SOIL NUTRIENT AVAILABILITY FROM PLOT TO LANDSCAPE
POLARIN Transnational Access (TA) project
Kilpisjärvi Biologtical Station, 27June - 06 July 2025
Arrival in Kilpisjärvi
Tromsø
Departure
Edinburgh
Stockholm
Into the Tundra
Check batteries, pack sensors, start hiking. From woodland to shrubs to open tundra, each step revealing how fragmented and sensitive these ecosystems are.
Setting Up the Transects
We laid 16 transects and 32 quadrats along the slope. Marked the locations with survey pegs and flags, and recorded their coordinates using DGPS.
Dataloggers & Drone Work
Installing probes in each quadrat, placing loggers at the exact depth, Flying drones to capture fine-scale terrain and vegetation patterns.
Vegetation & soil survey
Soil, vegetation estimates, site notes—small tasks that build the foundation for accurate ecological research.
photo © Yajie Zhu
What Comes Next
The tundra showed us that understanding nature takes patience, not control. These fine-scale dynamics now guide the next stage of our research. This is just the beginning.
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A hidden process shaping the tundra’s future

—— University of St Andrews Team, POLARIN Fieldwork in June 2025
Project: USNA-PL Upscaling estimates of Arctic Soil nutrient Availability from Plot to Landscape

Our Research and Motivation

Not for Reindeer. For the Changing Tundra. Tiny, hidden shifts in soil and vegetation are reshaping one of Earth’s fastest-moving ecosystems. So last summer, our team: ecologists, botanists, and a curious newcomer— joined POLARIN to pursue one essential question:

In a tundra where soil conditions limit plant growth, how will vegetation respond as the climate changes?

PolarChallenges, why it Matters

The Arctic tundra unfolds like a mosaic of green, grey, and white, sensitive, fragmented, and constantly shifting. A small hollow fed by melting snow can support thriving moss, while a ridge just a meter away may be so dry that only a few lichens persist. **These micro-scale contrasts are invisible to satellites and difficult for models to capture, yet they reveal the most immediate stories of a warming climate.**

Tundra vegetation in early summer, Kilpisjärvi, Finland

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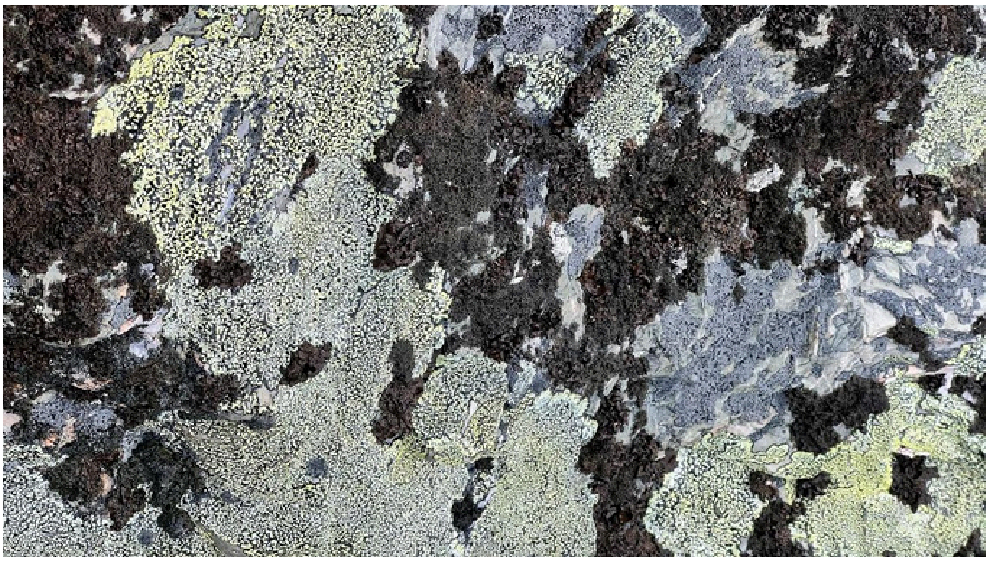

Lichen mosaics: green, gray, and whitepatches covering the tundra surface. Photo © Yajie Zhu.

Lots of people are tracking how polar ecosystems respond to climate change, and these subtle shifts in tundra vegetation have become hard to ignore. They appear closely tied to microtopography: small changes in elevation alter soil moisture and nutrient availability, shaping patterns of vegetation now and in the future. But to understand such highly fragmented landscapes, large-scale remote sensing is not enough. **We need finer, ground-based observations, data that can support precise land-surface models (LSMs) and reliable measurements of soil nutrient dynamics. Those insights can only be gained by working directly in the tundra.**

Thanks to support from POLARIN, this became possible. After snowmelt, we travelled to Mount Saana in northern Finland, where sensors and drones allowed us to collect high-resolution data in space and time. Because of this invaluable chance, **we were able to see how the plants and soil interact within the real complexity of the environment.**

Working with POLARIN

Our fieldwork really began long before we ever set foot in the Finland. **For weeks we combed through every detail: gear checks, permit paperwork, equipment availability, endless conversations about what could go wrong in high-latitude weather.** Every item ticked off the list made the expedition feel a little more real.

With two oversized equipment cases in tow, we hopped between flights and finally reached Kilpisjärvi, where Norway, Finland, and Sweden meet. The moment we stepped out of the bus, we were welcomed by a glass-still lake and a soft, muted sky. Even the air felt unusually quiet.

Kilpisjärvi: where Norway, Finland, and Sweden converge. Photo © Yajie Zhu.

Our base was the **Kilpisjärvi Biological Station** at the foot of the mountain, right beside a silent lake. Mornings quickly fell into a routine: check the gear, check the batteries, and start hiking before the wind decided to join the day. We passed through lush woodland, over low shrubs and thick moss carpets, climbing toward the ridge where our transects would eventually take shape.

After an initial round of surveying, our main effort shifted to sixteen transects stretched across the slope. We spent a good while laying out thirty-two quadrats, tiny windows where the landscape's subtle changes finally became measurable, from the ridge tops down into the small hollows. Once everything was marked, the workflow settled into a steady, almost meditative pattern: placing flags, logging coordinates, measuring vegetation, sampling soils, repeat.

Quadrat 8DLH equipped with in situ Plant Root Simulator (PRS) probes and Delta-T sensors. Photo © Yajie Zhu.

Our daily kit was simple: a DGPS system, that day's sensors, and the usual tools for vegetation and soil work. Installing sensors, however, was an exercise in patience. Nutrient probes had to fit snugly into the organic layer, loggers had to sit at exactly the right depth, and noting every small detail so nothing would be misinterpreted months later when analysing the data back in the UK. Drone days required a bit more equipment, but the drone behaved beautifully, circling above us and tracing clean flight lines that captured the fine structure of the terrain and vegetation.

Flight operations with the DJI Phantom4RTK (20-MP RGB camera) and base station. Photo © Yajie Zhu.

Reflections and Advice for Future Users

By the time we sealed the final sample, the site had stopped feeling like a distant coordinate on a map. Our work in Finland changed the way we think about both “data” and “distance.” **It reminded us that understanding a landscape takes patience and attentive observation, not control.**

Being in the field made our research questions feel far more tangible. We often rely on weather records, topographic data, and satellite images to infer environmental processes, yet the real landscape is messier than the datasets suggest. **Effects that look trivial in theory can reveal subtle, meaningful differences on the ground.** We began to realize how the natural world’s small, constant fluctuations introduce uncertainty into even the most carefully designed measurements. **Field data feels more “alive”: we not only have to track these changes, but also learn when to interpret them and when to let them go, and reconsider how future models might better account for this kind of dynamic adaptation.**

Fieldwork became a practice that engaged our bodies, senses, and judgment all at once. Abstract concepts took on new meaning along the hillside; the processes behind our datasets became things we could see and touch. And it is precisely this slightly imperfect field data that supports our hypotheses, and sparks new scientific questions.

Researchers from around the world at the Kilpisjärvi Biological Research Station.
Photo © Yajie Zhu.

Looking Ahead

Fieldwork brought our attention back to the heart of the project and made the direction of the next stage much clearer. The data we collected, especially the fine-scale interactions among soil, topography, and vegetation, has become the foundation for everything that follows.

Our next step is to dive into these samples and observations, and to build a deeper understanding of how tundra ecosystems respond to environmental change. Fieldwork is never the end of the research process. It raises new questions, sharpens the focus of the study, and provides the empirical grounding needed to move forward.

The support from POLARIN allowed us to work in a region where logistics alone canbe incredibly challenging, and to carry out observations that are essential for understanding polar ecosystems. We are truly grateful for this opportunity, and for the role POLARIN plays in helping early-career researchers engage deeply with Arctic science.


Photo © Yajie Zhu.

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