



Reindeer pulling sleighs in Breivikeidet, Norway. Photograph: Morten Falch Sortland/Getty

The long read

‘The treeline is out of control’: how the climate crisis is turning the Arctic green

In northern Norway, trees are rapidly taking over the tundra and threatening an ancient way of life that depends on snow and ice

by **Ben Rawlence**

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Itafjord is a wide expanse of black water on the edge of the Barents Sea, ringed with mountains. Alta is a relatively large town in the Finnmark province, the crown of the horse's mane that forms Norway's jagged coastline and Europe's northern shore. Here at sea level the most northerly trees in Europe are moving upslope, gobbling up the tundra as they go. The people and animals that live here are trying to make sense of the rapid changes with a mixture of confusion, denial and panic.

Dawn at 70 degrees north during winter lasts nearly the whole day. The sun never rises, the day is permanently on the verge of breaking. It is disorienting. On the way to city hall from the guesthouse, I spied few pedestrians. Alta is a town built along American principles – that is to say a town built for a world in which petrol is cheap and cars are taken for granted. It is a landscape of shopping malls, gas stations and spaced-out residential suburbs. Normally at this time of year it isn't safe to be outside for long without wearing animal skins, but on the day of my visit it was only -1C.

All along the road to the city centre were rows of young Scots pines, their orangey bark contrasting with the fresh dusting of snow. Intermingled with the pines were shorter, ragged-looking trees with lumpy trunks, wizened branches and fine twigs like gnarled fingers: *Betula pubescens*, downy birch. It is these

trees that had brought me here, to the office of Hallgeir Strifeldt, the director of planning for the municipality of Alta, at 9am on a Monday in the middle of winter.

As the planet warms, the **Arctic** treeline is accelerating towards the pole, turning the white landscape to green. The trees used to creep forward a few centimetres every year; now they are leaping north at a rate of 40 to 50 metres a year. In the European Arctic, the birch is the leader of the pack.

Downy birch is one of few broadleaved deciduous trees in the Arctic and it is hardier even than most conifers. Its “down” is a soft coating of hairs that acts like a fur coat in the punishing cold. Often found cooperating with pines and spruce at lower latitudes and altitudes, above a certain point the birch leaves the others behind and goes on alone for hundreds of miles.

It might be unprepossessing, even ugly, with its stumpy branches and pockmarked bark, but this tough little tree is a survivor and a pioneer, essential to nearly all life in the Arctic. Used by humans for tools, houses, fuel, food and medicine, it is home to microbes, fungi and insects central to the food chain, and it is critical for sheltering other plants needed to make a forest. The downy birch dictates the terms of what can grow, survive and move in the areas in which it takes hold. And, as the Arctic heats up, that range is expanding fast.

Alta’s town hall is a modern timber-clad building radiating orange light. The entrance vestibule is a two-stage affair, like a submarine airlock, where you must pass through a bath of blasting hot air. When I arrived, the receptionist was in a good mood. She, like everyone in Alta, was relieved. Finally, there was some snow and finally the temperature was below freezing, even if only just.

“It gets very dark when we don’t have any snow,” said Strifeldt, ensconced in his modern office. Winters have been getting gradually warmer in recent years, but the warmth when I visited was, he said, “extreme”. The whole community had been in a state of panic, reindeer herders posting photos of a snowless tundra on Facebook.



Guardian graphic

Strifeldt is a city dweller, a mild man with rimless glasses and a reserved air. He is also half-Sami, the indigenous people of Arctic Europe who share DNA and a common linguistic heritage with the peoples of the circumpolar region, from Finland to Russia across the Bering Strait to Alaska, Labrador and back to Greenland. The Sami used to migrate across the land without hindrance, but now the 80,000 who remain find themselves instead citizens of one of four different modern nations: Norway, Sweden, Finland or Russia. They are the only indigenous group in Europe recognised by the United Nations.

Reindeer are central to Strifeldt's identity, as they are for all Sami. His mother's family were reindeer herders, but when his grandmother died in childbirth on the plateau, his grandfather brought his infant mother to Alta, and left her with a Norwegian family to raise. The grandfather went back to his herds beneath the wide skies of the plateau, to his *laavo* – a traditional tent much like a tipi – and married again. Hallgeir has a foot in the city and the laavo. When I saw him later that week at a Sami cultural event, he was wearing the traditional Sami felt jacket embroidered with gold, a silk scarf, reindeer-skin trousers and boots and an elaborately worked silver belt.

Reindeer are endearing animals, with their wide brown eyes, furry antlers, soft fur and enormous snow-proof padded hooves. Sami herders recognise every member of their herd individually. Love is an insufficient word for the

relationship: codependency comes closer. The people move because the reindeer move in search of grazing. Their culture has evolved around the migratory needs of the herds. But the breakdown in weather is upsetting this cycle. The Sami are among the first victims of climate breakdown, forced to contemplate a little earlier than the rest of us the collapse of a whole culture.

The reindeer are the only pillar left of what was once a more diversified civilisation. The forest Sami are long gone, forced by the Norwegian government over a century ago to choose between reindeer husbandry or assimilation. The integration of the fishing Sami has taken longer, but the collapse in cod stocks has helped accelerate the move to the towns, a process that it is Strifeldt's job to manage. Alta is a boom town of 20,000 inhabitants, growing as the countryside all around is drained of people.

Reindeer herding is valued by the rest of Norway and so it has persisted. The Norwegian state sees reindeer as a farmed resource, with quotas and subsidies and strict controls on culls. To the official mind they are a commodity, a useful export from the otherwise unproductive vast plateau of the north, but for the Sami the reindeer's significance is not only economic and cultural, it is also symbolic. "Reindeer are life. They are everything. Without reindeer, we die," Strifeldt told me.

And now reindeer herding, a way of life that has survived intact for 10,000 years, is under threat. This time it is not the Norwegian government that poses the greatest danger, but the climate. Warmer winters are deadly for the reindeer in two ways: one is short and sharp, leading to a quick death – ice; the other is slow but sure – too many trees.



nce upon a time, the first snows of winter would fall some time in October, initially on the tundra, the plateau above the treeline, and then on the pine and birch forests of the river valleys and the coasts. Shortly after, the mercury in the thermometer would descend below freezing and stay there until April or May, when the snow would begin to melt and the rivers would rush with the clear

turquoise of superoxygenated ice. Until 2005, the average winter temperature in the region was -15C and it would reliably sink below -40C at least once during the winter, eliminating even the hardiest of all insect larvae, a process that kept the Arctic pest-free in the summer.

This world of winter was dark and cold and dry. At those temperatures there was no moisture at all. The snowpack was the consistency of sand, made up of several layers of large snow crystals. At -40C or -50C in the middle of winter, the quality and nature of snow crystals is critical to the survival of humans and animals alike.

When the temperature climbs back up towards zero or, even worse, above it, this delicate winter ecosystem collapses. Even a little warming of the snow can create havoc. Moisture starts to appear in the snowpack at -5C or -6C, at which point it loses its sand-like quality, and the snow starts to compact under the reindeer's hooves, ruining the grazing beneath. If the thermometer goes all the way into the positive, as it has done increasingly in recent years, it is a catastrophe. Melting snow or rain will freeze when the temperature goes negative again, forming a crust of ice over the ground, locking the vegetation away from the browsing reindeer. This happened in 2013 and again in 2017. Tens of thousands of reindeer died; some herders lost more than a third of their animals.

In the past 130 years, the temperature has crept above zero three times during winter – two of these times were in the past decade. From now on, the projections say every winter will experience days above zero. Reindeer herds can be up to 20,000 or 30,000 strong, and they are spread out across thousands of square miles of the Finnmark plateau. Artificial feeding is impractical, not to mention far too expensive. Something is going to have to give.

Warmer winters mean that the reindeer herds need more space in which to feed. Competition for the grassy tundra of the plateau is increasing from other reindeer, from windfarms, pylons, roads and mines. But the most formidable challenger is the humble downy birch.



Downy birch trees in Rondane national park, Norway. Photograph: Kevin Pronnecke/Getty Images/imageBroker RF

The office next to Strifeldt's belongs to Tor Håvard Sund, manager of the Finnmark forest service. Sund is a large man in a checked shirt with an open face and a warm smile. As we were talking, we consulted the huge map that forms one wall of his office, but he quickly got frustrated.

“When was this map printed?” he asked. We located the date in small print at the edge: 1994. “This is totally useless,” he said. “We need new maps. The treeline is out of control.”

Several interlinked factors affect the habitable range of tree species: the availability of sunlight, water and nutrients are prerequisites, but these interact with other variables such as wind and temperature. Tiny gradations in altitude or latitude can mark large differences in vegetation. The downy birch detected the current warming trend much earlier than most scientists. This tree loves the warmer weather. It used to be confined to the dips and gullies on the plateau, away from the icy winds, but, unleashed by the warmth, it is storming over the top and out into the open, moving upslope at the rate of 40m a year. An enormous amount of territory is being transformed from tundra into woodland.

On the face of it, more trees might sound like a good thing. The problem is that the greening of the tundra further accelerates the warming process, as the birch improves the soil and warms it with microbial activity, melting the permafrost

and releasing methane – a greenhouse gas 85 times more powerful than carbon dioxide in its warming effects over a shorter timeframe.

Birch is a pioneer tree. In spring it can sense when the nights are getting shorter and the temperature is warmer, and when the timing is right, it flowers with two sets of catkins. After pollination the downy buds covered in fine hair break open to release countless little winged seeds on to the wind. A good year for seed dispersal is called a mast year. Every year is a mast year these days. Before, the growing season was May to October; now it is April to November.

“Sooner or later, the whole of the plateau will be covered in trees,” said Sund.

It takes 160 years for an old-growth pine and birch forest to form – one that is suitable for reindeer to graze in. In Norway, aggressive tree growth is now creating havoc. The birch is racing over the tundra faster than the pines can keep up.

This is bad news for the reindeer and the humans who rely on them. Upright birch forests don't develop a canopy; they are more like thickets. Without a canopy, they trap more snow, their mass forming a windbreak for drifts too deep for the reindeer to walk or dig through. Their roots warm the ground below, causing ice and melt around them. In time, a hectare of birch will deposit three to four tonnes of leaf litter on the ground, further improving the organic composition of the soil and encouraging other plants. Reindeer do nibble the twigs of young birch, “but even if you doubled the number of reindeer in Finnmark county you could not stop the birch”, said Sund.

Every year more and more herders beg Sund to cut the birch to protect the precious tundra habitat needed for reindeer. And so the herders who traditionally considered themselves a part of the natural world, not distinct from it, are fighting a losing battle against nature.

Sund was blunt: “The Sami will need to find another lifestyle.”

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n spring and summer the Sami bring their herds of reindeer to the coast. It used to be common in springtime to see herds swimming across a fjord to reach the lush grass of an untouched island, the herders and their dogs following in kayaks or rowing boats. These days most herds make the crossing in ferries that are otherwise used for cars.

In summer, many Sami are dispersed with the herds, living in laavo, their traditional tents made of woven wool stretched over an interlocking pyramid of birch poles. Children, off school for the holidays, will still often spend weeks at their family's summer place, rarely venturing home. It was only recently that herding families began to settle predominantly in one location, required by government edicts to live by a road and to send their children to government schools – an attempt to clip the wings of the nomads and keep them where they could be seen, and their animals taxed. Before, herding was a family affair; now it is mostly a male activity as women look after school-age children.



Reindeer fighting in Alta, Norway. Photograph: Manuel Romaris/Getty Images

In autumn and winter, though, the herds return to the plateau, to their “winter place”. It is during winter that Sámi socialising takes place, when herds are gathered on the plateau mostly within striking distance – a day’s hard riding by snowmobile – of the centre of Sami cultural life, the town of Kautokeino.

It is Kautokeino that hosts Sámi University of Applied Sciences, the Sami cultural centre, the Beaivváš Sámi Theatre and the International Centre for Reindeer Husbandry. For the hub of Europe’s oldest continuous civilisation – a way of life essentially intact for more than 10,000 years – it is surprisingly small. There are only 1,500 permanent inhabitants. Photos from the 1950s show the buildings of Kautokeino surrounded by the unbroken white of snowy tundra without a tree in sight; now it is in the middle of a birch forest.

From Alta, I took the road to Kautokeino, 80 miles south. The road starts among the mixed pine and birch forests that border the River Alta. Then it climbs swiftly through a narrow gorge beneath sheer towering cliffs hundreds of metres high, up on to the plateau above. As I drove, all along the roadside shrubby birch kept close company with the car. Only once, when a mountain rose above the level of the open river valley, was there a flashing glimpse of unforested tundra: smooth unblemished snow cut by a line of bent and twisted little figures, a battalion of birch marching upward.

A short distance from Kautokeino the road crested a ridge, and below, the plateau unfurled in a wide vista. From this vantage point the plague of trees was frighteningly clear. As far as the eye could see the tundra of the plateau was flecked with black streaks. It was a beautiful scene, but the fact that the trees shouldn’t be there and the river should be rock-hard – with ice several metres thick, capable of sustaining the weight of a herd of reindeer or an articulated truck – made the beauty of the vision hard to absorb. On this winter day, at this spot in the Arctic Circle, at -1C (14 degrees above average for this time of year), it was hard to avoid the feeling that if there is a tipping point in Earth’s climatic equilibrium, we have already left it far behind.

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n my first morning in Kautokeino, the town was half-asleep, deadened by the dark and the cold. It was now -8C, still not cold enough, the woman in my guesthouse complained. The sky was overcast, and without its clear dome, the light was a kind of murky soup. The river beneath the bridge was moving in a slow sweep past the dark church on its spit of land.

But the petrol station was different. The forecourt was blazing with white lights. Queues of huge pickup trucks, many outfitted by the same Arctic Truck Co with enormous snow tyres, sat with their engines running, filling the crisp air with clouds of diesel fumes. Behind each one was a trailer carrying a snowmobile or quad bike or both. Men wrapped head to toe in snow suits and fox-fur hats clambered down and filled batches of jerrycans with fuel. They bought energy snacks, then they jumped into their massive polluting machines, pushed them into gear and roared off into the murk that passes for morning. They were the reindeer herders, off to do their check on their animals. Some might be back tonight; some might be gone for weeks; some might not come back at all.

In a yellow one-storey house on the outskirts of Kautokeino, Berit Utsi held her two-year-old son to her chest and looked out into the mounting dark at the lake covered by a paper-thin sheet of ice and ringed with birch trees. The secretary of the local reindeer herders' association, she had agreed to talk to me about the problems caused by the advancing trees.

“It’s not our culture to make a drama,” she said. “Everyone kept a calm exterior but inside we were all very worried.” She was speaking of the incredibly warm winter, which had just been blessed with its first snow. But Utsi’s worries were not over. Her husband, a reindeer herder, was still out there. This is a very stressful time for herders even in a good year: moving the herds from autumn to winter grazing, keeping the herd together over hundreds of square kilometres.



A Sami camp in Norway. Photograph: Age Fotostock/Alamy

Apart from the previous week, when he had come back for a few days because she'd had an operation, Utsi's husband had been out on the plateau with the herds for two months straight. The family's entire income and savings are invested in the herd. One animal is worth over €1,200 (£1,100) at the abattoir, and every part of the carcass – skin, antlers, hooves and sinews – is used by the Sami for clothes, tools and handicrafts. The high stakes encourage risk.

“There have been a lot of accidents lately,” Utsi said. A “point check” – driving a perimeter all around the herd – is the daily routine of a herder. “People have been driving snowmobiles on stones, hitting trees and crashing, ending up in hospital ... or maybe the ice is strong enough to carry the reindeer, but the quad bike falls in. Last year two people went through the ice and did not come up,” she said.

When she was a teenager, Utsi tried working in a town but she missed her reindeer. She grew up with them, spending every summer with her family and the animals. She remembers the tundra with fewer trees when she was a child. She feels the change as a loss, but like most Sami I met she is pragmatic: “We adapt, we always have.”

But the changing weather and the advance of the trees combined with other pressures on grazing – roads, mines, wind turbines – mean that the economics of reindeer herding are becoming harder and harder. And, to make matters

worse, the government is aware of the shrinking grazing and demands ever larger culls of animals every year. Her family needs another income.

The birch is almost as essential to traditional Sami life on the tundra as the reindeer – crucial for shelter, insulation, sleds, skis and snow-shoes, and for fuel. Its tannins and oils are used in treating clothes and skins and making oiled paper. Its bark was used for canoe skins and fermented in seawater. Utsi's modern kitchen was still full of the traditional handicrafts of the nomads, made on her summer trips to the mountains. Her wooden spoons and ladles were all carved from birch. Cups and bowls on a shelf were also carved from birch, while the handles of handmade knives were of antler and bone. In a small pot on the worktop were shavings of birch bark for tisanes and medicinal brews.

“But now the trees have become too much,” said Utsi, frowning. She was studying to become a teacher.

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everyone knows someone who has given up their reindeer. Those who continue are either the herding aristocracy, who are so rich in animals that they can weather the storms for the moment, or else they are true devotees: possibly addicts, possibly mad. I am not sure which epithet best describes Issát, but his experience perfectly captures the cognitive dissonance forced upon us by global heating. Rationally, we know what is happening and what is likely to happen. But practically and emotionally it seems we will do everything we possibly can to avoid accepting the facts.

I met Issát in his nondescript office in the back of a municipal building in Kautokeino at 9pm at the end of a long day. His organisation, Protect Sápmi, is an NGO that provides legal advice to Sami communities challenging the takeover of their land by multinationals and government parastatal organisations, and it is overwhelmed. The warming Arctic has led to massive interest in “opening up” the north not just in Norway but all over the circumpolar world: Russia, Greenland, Alaska, Canada.

Norway is self-sufficient in renewable energy but there is huge demand from Germany, the UK and the Netherlands, and windfarms in the Arctic Circle are rapidly colonising the few remaining treeless mountain ranges in Finnmark. The Sami people are supposed to control 96% of the land of Finnmark according to a **recent law**, and the Norwegian government is supposed to follow the UN principles of “free, prior and informed consent” for the alienation of indigenous land, but it doesn't.



A Sami reindeer herder in Finnmark, Norway. Photograph: Jonathan Donovan

At the end of our discussion, at around 11pm, when I was ready for bed, Issát announced that he would now begin his “second job”, reindeer herding. He invited me to come along. His home was up the hill, a terrace house in a small housing estate resembling many others in Europe. While I waited outside, Issát went in to kiss his wife and his four sleeping children and to put on his reindeer herding clothes: two pairs of thick wool socks, thermals, down trousers, a fleece, a knee-length outer coat, a snowmobile jacket, thick rubber snow boots, mittens and a battered old reindeer-skin hat lined with fox fur. He emerged 10 minutes later. Without his glasses and suit and neatly cut hair he was transformed. No longer the quiet, diffident legal expert, he had become an action man.

Outside, it was only -5C, but we had to be prepared to be out all night if an animal was lost or we had an accident. Shortly before I visited, a herder was trapped under a snowmobile for 12 hours before his friends came looking for

him. Issát whistled to his dog, who jumped up on the back of his quad bike next to me – she knew where we were going.

The quad took us out of town, past the scraggy birch struggling up the hill until the clumps got shorter and shorter. We sped past the “60” sign and up on to the plateau. At the top the trees were only head-high. Issát slowed down and steered the quad to one side of the road. Standing up, he peered into the beams of his headlights tracing the edge of the asphalt, looking for tracks.

Where the snow was disturbed he moved especially slowly. Marks in the snow mean his reindeer have crossed the road and strayed. The trees cause the reindeer to roam more widely, which means more conflicts over territory and grazing areas, and more disputes with neighbours. Issát must patrol every night to make sure his reindeer are on the right side of the road. The changes are increasing tensions in the Sami community.

Back on the bike, we sped on across open ground untrampled by reindeer, looking for tracks. Issát spied one, then many, heading in the wrong direction. He swerved at speed, following the tracks. The quad bike briefly left the ground then landed with a crack on a frozen lake. Issát held his breath as the ice creaked and strained, issuing an occasional report like a gunshot. Twice in the previous month he had gone through the ice. Last time he got soaked in a shallow pool up to his chest, and the bike had to be winched out, taking several days to dry out in the garage.

“This is the most dangerous job in Norway!” he said with a grin.

After an hour and a half, Issát slid the bike to a stop.

“They should be here.”

“Do you have GPS?” I asked.

There were 10 reindeer in the herd tagged with GPS, but Issát’s phone was out of juice. In any case, he prefers not to use it. He turned off the engine and the lights, and listened for the bells that some of the reindeer wear. The silence was immense. Nothing.

“Oh well,” he said, turning the key and twisting the bike towards home. Issát told me his brother could continue the search in the morning. Issát knows that herding reindeer this way is no longer viable, though he spends all day arguing

with the government and mining companies for compensation on the basis that it is. As the quad bike whined down the hill back towards the sleeping town in the valley below, the trees by the roadside gradually increased again in height and the howls of the dogs of Kautokeino filled the night air. A wolf had been sighted nearby in recent days – another consequence of the expanding forest. Issát pulled up outside his house shuttered in darkness, and I climbed down, stiff with cold. As he unwrapped his outer clothes and went inside to bed, a light came on in his sister's house next door. His niece Māret was just waking up.

It was the day of a big meeting, the 50th anniversary of the Norwegian Sámi Association. Māret is a chef and today she would be cooking for the 200 delegates. Māret is famous among her people. She is one of a few Sámi chefs trying to preserve its cuisine and traditional practices around food and the medicinal uses of plants. “I want to make people think through their stomachs!” she said. “I can make a protest through my food. Everything is from nature.”

That day, Sami representatives from all over the north of Norway would gather to discuss the new reindeer law, proposed mining and windfarm developments in Finnmark and Tromsø, and a climate crisis adaptation fund to help the Sami transition to new livelihoods. But Māret sees the problem as much larger than Norway. “Someone has to pay for this life, this lifestyle – and it seems it is the animals and our indigenous way of living. That is the cost.”