

Tiny but tenacious: Arctic-alpine plants are engineers and warning bells

May 24 2023, by Sarah H. Watts



Purple saxifrage, snow pearlwort and drooping saxifrage (left to right). Credit: Sarah Watts, Author provided

When most people consider the arctic, or high-altitude mountain landscapes, they think of endless snow, ice and bare rock. But pastel-colored flowers, sometimes just a few millimeters wide, bloom in these dramatic places too. The miniature flowers not only weather some of the toughest habitats on Earth, but can also help engineer the landscape for other species.

Don't be fooled by their delicate petals. Some [species](#) of rock jasmine and sandwort grow at [well over 6,000 meters](#) on Mount Everest, while [purple saxifrage](#) flourishes on the northernmost point of land in the world—Kaffeklubben Island, north of Greenland—and throughout the Arctic, Alaska and the tips of the European Alps.

Plants in freezing [cold environments](#) are typically small and often form as ground-hugging rosettes, or dense tufts with short stems, known as cushions. Antarctic pearlwort [sits no more than 5cm high](#) and displays a tight bunch of minute yellow blooms. The [summits of the Scottish Highlands](#), where temperatures can drop to -27°C in winter, are home to [tiny flowers](#) also found in the Arctic, such as moss campion, dwarf willow, trailing azalea and starry saxifrage.

Although plants such as these may appear fragile, their minute size helps them cope with freezing weather and fierce winds. Low stature and tightly packed leaves act as an aerodynamic trap and storage system for water and solar radiation. Microspaces within the dense, dome-like foliage are efficient structures for retaining moisture and heat. An arctic-alpine cushion's internal temperature [can be \$15^{\circ}\text{C}\$ warmer than its surroundings](#).

Pioneer plants



Trailing azalea has tiny pink flowers. Credit: Sarah Watts, Author provided

Cushion plants and mosses can be integral to their [local environment](#) (known as [keystone species](#)) and [ecosystem engineers](#) because they stabilize their harsh microclimate, and are often the first to colonize bare ground. As the cushions grow, they [improve the moisture and nutrient content](#) of thin soils by [accumulating organic material](#) both directly within the plant itself, and through their root systems. By [buffering temperature extremes](#), cushions reduce the frost risk in their immediate surroundings. These processes create a habitat more suitable for less stress-tolerant plant species including arctic-alpines in the [daisy](#) and [pea](#)

families.

Cushion formers are therefore vital ["nurse" plants](#) in mountain and polar regions. They also shelter [small arthropods](#) including [beetles](#) and tiny wingless insects called [springtails](#).

These animals may in turn [pollinate the plants they take refuge in](#), and provide food for others higher up the food chain.

An alarming trend

However, these tiny arctic-alpine plants are now sounding a warning bell for the loss of biodiversity (the richness and variety of living things on earth) due to climate change. The plants have an [important relationship with snow](#), which offers them protection from disturbance and erosion. But rising temperatures are causing earlier snow melt, allowing the spread of other species previously restricted to lower altitudes and latitudes. Consequently, [taller generalist plants](#), such as common grasses and [sedges](#) are crowding out the smaller arctic-alpines.



Moss campion is a mountain wildflower. Credit: Sarah Watts, Author provided

High mountain areas are [warming at twice the global average](#) and are [geographically isolated](#) from other places with similar climates, leaving the specialist flowers nowhere to relocate to.

Arctic-alpine plant numbers are plummeting [in Britain](#) and climate change is impacting numbers [across the world](#), threatening the future of species that depend on them. [Snow pearlwort](#), a cushion plant usually no bigger than a penny, is the [first flowering plant in Britain](#) to have its [International Union Conservation of Nature](#) status moved from

vulnerable to endangered due to [climate change](#). Our research using [long-term monitoring data from the Scottish Highlands](#) has shown that snow pearlwort, mountain sandwort and drooping saxifrage are withdrawing uphill and face mountaintop extinction because there is no higher ground left for them to retreat to as temperatures rise.

If we lose these plants from their British mountaintop outposts—at the edge of where they occur globally—this will signal that their strongholds in the Arctic and the Alps are also in danger.

Polar and mountain regions are havens for biodiversity, nurturing [species found nowhere else in the world](#). We risk losing [the cultural and inspirational value](#) that rare species give us, with implications for the preservation of our natural heritage.

Plants are the building blocks of habitats and food webs on which other lifeforms across the planet depend, but they are frequently overlooked in conservation news stories. There's a name for this phenomenon—[plant blindness](#). Scientists, nature writers and the media usually turn to [trees](#) or species with [large colorful flowers](#) to open people's eyes to the importance of plant life.

But we must celebrate and protect our tiniest of [plants](#). If we don't the spectrum of diversity across earth's extremes will be lost for generations to come.

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