

## **The Shifting Northern Tree Line**

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With all the talk these days about artificial global warming, it's easy to lose sight of the fact that climatic changes of sizeable proportions have taken place in the past that were entirely natural. Among the most spectacular episodes of climatic change was that which gave rise to the massive glaciers of the last Ice Age.

Between 14,000 and 7,000 radiocarbon years ago, the climate of Canada went from one extreme to the other – from conditions that supported the existence of an ice cap several kilometres thick, to a reversal that caused the long-term melting and eventual disappearance of the continental ice sheet altogether. The warming trend began when the glacier still covered all of Manitoba, and as time went on, the melting ice sheet progressively diminished in size; glacial lakes that bordered it gradually drained away, and more and more of the North became habitable by plants, animals and people. The trend toward greater warmth culminated in temperatures that were higher than those of today. It's this latter scenario, the so-called "Altithermal" and its effect on plants and animals that I want to talk about here.

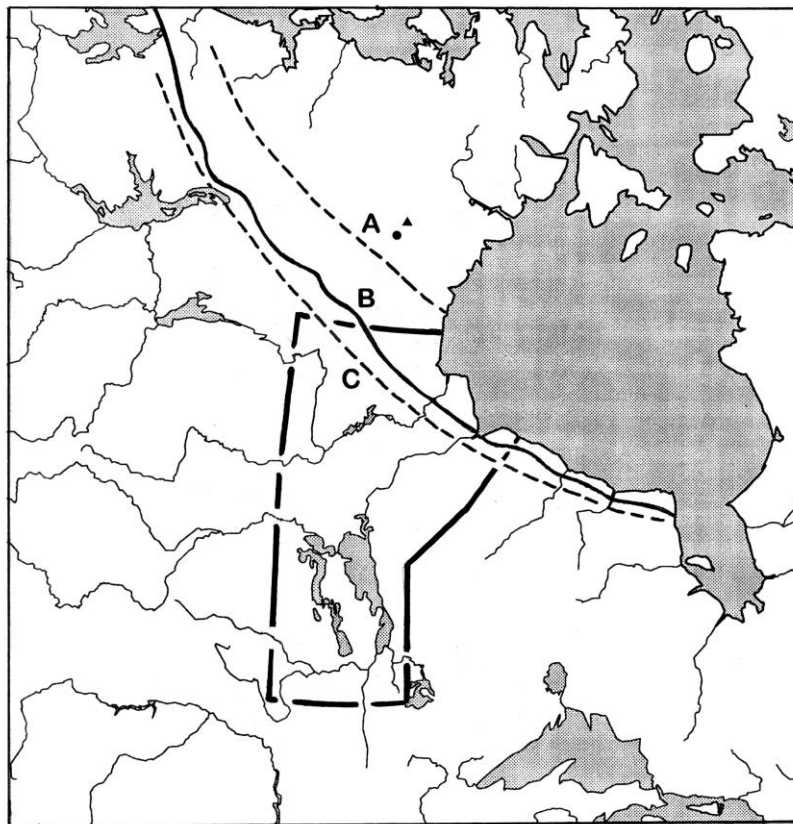
"Altithermal" (literally meaning "high heat") is one of those high-octane words that earth scientists use to represent the warm post-glacial climate of between ca. 7,000 and 5,000 years ago. The question is, how did the Altithermal express itself in northern Manitoba and southern Nunavut?

The boundary between open tundra (the barrens) and continuous northern woodland (the taiga) is known as the "tree line." The tree line also marks the border between the mean summer position of the Arctic front and the warmer air masses of tropical and Pacific origin to the south of it (the map shows the approximate position of the tree line today). Throughout the long period of deglaciation, the tree line was of course situated well to the south (i.e., along the southern edges of the ice sheet or the margins of the proglacial lakes), but as time went on, the ice sheet receded ever northward and the proglacial lakes disappeared. Along with them went the migrating position of the Arctic front, and the tree line followed suit.

By 6,000 years ago if not a bit earlier, the taiga/tundra boundary was positioned along a diagonal track through the Dubawnt Lake area in Nunavut (Figure 1). This area is tundra today, but back then it was covered by continuous spruce woodland, thanks to the relatively mild climate. To put it another way, the tree line at that time, as shown on the

map, was located at least 280 kilometres north of where it sits now! This northern extension of the woodland remained in place for some 2,500 years.

How do we know all these details? For one thing, localized clumps of spruce trees are found growing today in favourable situations out on the barrens north of the modern tree line. These wooded “islands” are looked upon as isolated relics from a time when spruce trees were the rule rather than the exception, as is now the case. Elsewhere in the modern tundra, ancient forest soils (podzols), now buried beneath wind-blown sand, have been discovered and dated by the radiocarbon method. These “fossil” soils indicate the former presence of trees during the long-gone Altithermal time period in the North.



*Approximate positions of the tree line through time: A = 3,500 years ago; B= modern; C = 2,900 years ago, and locations of places mentioned in the text: ▲ = Grant Lake, ● = Dubawnt Lake.*

As the warmer climate and the woodland vegetation zone shifted northward, so too did animals, notably caribou, and bands of people who hunted them. In southern Nunavut,

archaeologists have found the remains of campsites of the “Grant Lake complex” (Figure 1) of the Northern Plano tradition. These ancient features were left behind by people whose ancestors had lived on the grasslands far to the south. Like the receding ice margin, the migrating Arctic front, the shifting tree line, and the northward colonizing plants and animals, successive generations of people slowly but surely made their way northward to the country to the west of Hudson Bay. The Nunavut campsites were situated in places near where caribou could be intercepted as the herds were migrating southward into the taiga from their tundra calving grounds to the north.

Of course, the Altithermal didn't last forever -- in fact it came to a rather abrupt end around 3,500 years ago. The Arctic front shifted southward, bringing a colder, drier climate to the region. The drier summers made the taiga vulnerable to fire from lightning strikes, as indicated by deposits of charcoal lying on top of the buried podzols I spoke about earlier. After the trees burned down they couldn't regenerate in most places because of the harsh, dry climate that now prevailed. As a result, tundra vegetation took over, expanding southward onto terrain previously covered by taiga. Indeed, around 2,900 years ago the forest edge was actually lying some 50 kilometres *south* of the position now occupied by the modern tree line (Figure 1).

This southward expansion of tundra at the expense of taiga probably necessitated some adjustment to the annual movements of the seasonally migrating caribou. But more serious were the fires; these can have disastrous effects on the lichens on which the caribou feed, not only in the short term but in the long run as well (it can take more than a century for lichens to return to an area swept by fire). The disappearance of the herds must surely have created hardships for the resident northern Shield Archaic people for whom the caribou was the staff of life, because they apparently abandoned the region shortly afterwards.

With the increasing trend to global warming predicted for the 21<sup>st</sup> Century, will we once again see the tree line shifting northwards as it did with the waning of the Ice Age and the onset of the Altithermal all those centuries ago?