ATLAS Field Report: Snow Weather and Shrubs: Pathways of Change in the Arctic Winter-Spring 2001

Matthew Sturm, Glen Liston, Jon Holmgren, Chuck Racine, Peter Olson, Ken Tape
CRREL, Colorado State University, University of Alaska-Anchorage, University of Alaska-Fairbanks

Winter, 2000-2001: During the winter of 2000-2001 we visited Council five times, commuting by snow machine from Nome. During each visit we observed the build-up of snow in five different types of vegetation: forest, deep shrub, moderate shrub, low shrub, and tundra. These locations are the same ones used by other ATLAS projects. At each site, snow depth distribution was measured along transects ranging in length from 100 to 1000 m. One of these transects crosses from the tundra into the shrubs and trees near Bear River, a zone where a large number of tree seedlings have been observed. The tree seedling zone coincides with a deep drift that forms on the on the windward edge of the shrub-tundra transition. Vertical snow temperature profiles were measured hourly by data loggers at each vegetation site, and at 21 additional sites where mini-data loggers were installed. Of particular interest to us was how shrubs were laid down by the snow load during the winter. This lay-down process showed distinct variation from one type of vegetation to another. Snow properties (density, stratigraphy) were also recorded along transect lines by vegetation type. Unlike snow on the North Slope, in Council winter thaws were more prevalent, so the snow had more features related to melting and water percolation. Also, snow basal temperatures tended to hover around 0°C, except in a few isolated wind-scoured spots. In contrast, on the North Slope, snow basal temperatures average about –15°C. Again, these thermal attributes seemed to differentiate by vegetation type.

Spring, 2001: In April, four of us went to Council and spent 10 days installing towers and cableways for our snow melt experiment. In each of the 5 types of vegetation, a 50 meter long cable was installed over typical vegetation types and snow cover. The cable had swages every meter and was tensioned using a ratchet pulley. A trolley that rode on the cable carried an albedo meter (upward and downward looking radiometers) and a remotely-triggered digital camera. This equipment was designed to allow us to measure the albedo of the combined snow and vegetation both before and during the snow melt. Our hope was to watch the evolution of the albedo and from the data derive parameterizations of albedo evolution as a function of snow depth and vegetation structure. Adjacent to each cableway, a 100-m line of fixed snow depth stakes were installed so that we could monitor the melt of the snow without disturbing the snow near the albedo line. Initial readings of albedo and initial photographs were obtained after the cableways were set up.

Snowmelt, 2001: On May 3, four of us went to Council to monitor the snow melt and the evolution of the surface albedo during the melt. It turned out to be the all-time record cold May for Nome and Council, and the second-to-record deepest snow pack. Consequently, it was an unusually late break-up. The melt finally finished on June 11th. During that period, we made about 16 sets of albedo and photo measurements at each of the vegetation sites. In addition, the melt rate was monitored in detail on stake lines and in snow pits. These data are still being analyzed. In August, we will return and make detailed measurements of the shrub vegetation beneath each albedo cableway. Results already show, however, that there is an optimum shrub height for lowering the albedo of the snow during melt. Larger shrubs and trees shade the snow; smaller shrubs are laid down and are buried by the snow. This optimum was realized at the shrub site near Ophir Creek, where birch shrubs stand about 1.8 m tall in the summer.

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