USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Soil and Plant Science Division

Technical Soil Services

Alaska Soil Survey Region

High Tunnel and Ground Subsidence

Wasilla, Alaska, Major Land Resource Area (MLRA) Soil Survey Office (SSO)

Purpose

On June 5, a team from the Wasilla, Alaska, MLRA SSO accompanied by Soil Conservationist Matt Kugel from the Wasilla Field Office visited a producer near the Matanuska Glacier. The producer had requested technical assistance evaluating soil conditions in a newly constructed high tunnel and an area of mass subsidence elsewhere on the property.

Background

The producer was initially concerned about the lack of organic matter and the presence of rock fragments, which make excavation difficult. Upon investigation, it became clear that much of the issue was related to a compacted surface layer likely left over from residential construction more than 50 years ago (fig. 1). Beneath this disturbed material, the native soil profile was better developed, showing characteristics consistent with glacial till and loess-derived silts and sands typical of the area. Once the compacted layer was broken up, the underlying soil was significantly easier to work with and showed potential for productive use with the addition of fertilizer in the form of organic matter. The team described the soil profile as follows:

- ^C horizon: 0 to 20 cm; dark grayish brown sandy loam; about 30 percent gravels and occasional cobbles. Compacted fill material likely from construction of the home and other structures.
- A horizon: 20 to 22 cm; dark brown sandy loam; very high in organic matter.
- Bw horizon formed from windblown sands and silt: 22 to 50 cm; brown; sandy loam or fine sandy loam; with some redder mottles.
- 2C horizon: 50 cm and deeper; very gravelly sandy loam with 40 percent rock fragments mostly in the form of channers less than 20-mm wide. Formed from gray gravely and sandy glacial till.

Figure 1.—A soil profile from a high tunnel. Notice the original surface buried under construction fill.

The producer also pointed out an area on the property experiencing significant subsidence, or sinking, resulting in a large surface void now covered with plywood for safety (fig. 2). Based on visible linear features and site context, the likely cause is thawing of permafrost, or ground ice, near the boundary of a black spruce stand recently cleared for home construction. Removal of insulating original plants and organic layers in the soil may have increased heat transfer into the soil, which would increase thaw. Some soils in the area are underlain by sometimes very coarse glacially derived sands and gravels (outwash) that can facilitate rapid water movement and instability when frozen ground degrades. While observations suggest thaw-related subsidence, the precise cause, rate of development, and long-term implications are uncertain.

Figure 2.—Matt Kugel showing the depth and size of the subsidence.

Key Outcomes

The team found that the compacted fill layer inside the high tunnel was the main issue limiting good soil conditions. Once this layer was broken up, the native soil underneath was much easier to work with and showed good potential for growing plants with added organic matter. They determined that the sinking ground on the property is likely caused by thawing permafrost, which helped the landowner understand what is happening and what signs to watch for in the future.