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NEON Site-Level Plot Summary

Caribou-Poker Creeks Research Watershed (BONA)

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Site Background

The Bonanza/Caribou Creek (BONA) site is near Fairbanks, Alaska in the Caribou-Poker Creeks Research Watershed. The site is in Major Land Resource Area (MLRA) 231 – Interior Alaska Highlands. The site consists of 12,272 acres and moderately steep to steep hills and mountains, and flat-bottomed valleys. The BONA site has elevations ranging from 200 to 773 meters (660 to 2,537 feet) above sea level.

Site Information

The local bedrock at the BONA site is predominantly Birch Creek Schist that is blanketed with a layer of loess derived from the Tanana flats. North aspect slopes receive far less solar radiation and typically have permafrost and a thick organic mat. Steep north facing slopes also commonly slump or creep as they undergo seasonal freeze thaw cycles. This process results in solifluction lobes. Toe slope and valley bottom soils are derived primarily from silty alluvium and colluvium, and these soils typically have permafrost near the surface and frequently have thick organic horizons. These footslope and toeslope positions commonly have large masses of ground ice that, if thawed, can cause catastrophic subsidence called thermokarst. Land use is forest, with about 45 percent in mixed white spruce, aspen and paper birch, 45 percent stunted black spruce and ericaceous shrub and about 10 percent in subalpine birch alder shrub. Several forest fires have affected this area. Approximately 2200 acres was burned in 1999 for a prescribed burn called the Frost fire project. The southeast portion of the site was also burned in the 2004 Boundary fire. There is also field evidence of several other historical fires.

Major soil series on the site include: Gilmore and Steese on south facing slopes; Ester and Histic Pergelic Cryaquepts (Histoturbels) on north facing slopes; Goldstream, Saulich and Histic Pergelic Cryaquepts on alluvial fans, toe-slopes, and valley bottoms; Typic Cryochrepts and rock outcrops on higher elevation summits and shoulders; and a small area (~1 acre) of Jarvis and Salchachet, alluvial soils from the Chatanika River floodplain.

Analysis of Plots for Sampling

Soil map units from the North Star Area, Alaska Soil Survey and landform were the two major features employed for selecting plots to sample. Each plot was chosen based on best representation of the landform and potential to sample the most representative pedon for a soil series or component located within the site. The Soil Survey of the site consisted of 11 different map units, however, the pre-selected NEON plots occurred in only 7 of the map units. The analysis carried out for this effort resulted in 16 of the 34 potential plots being selected for field description, sampling, and lab characterization, and 8 additional plots were selected as alternates. The 18 plots not sampled either occurred in non-typical settings or were located in the same soil position as one of the chosen plots. The selected plots are located in map units that represent approximately 97.5 percent of the BONA site (Table 1). There were three map units at BONA that were not represented by NEON plots (Table 2). There was also one non-sampled soil map unit, Goldstream peat, which represents one percent of the total site area and occurs on only one distributed plot (BONA_029). This soil map unit and associated components are of minor extent within BONA.

Map unit symbol	Map Unit Name	% Total area
112	Gilmore silt loam, 12 to 45 percent slopes	39.5
118	Histic Pergelic Cryaquepts, fans, 1 to 20 percent slopes	9.5
119	Histic Pergelic Cryaquepts, 15 to 45 percent slopes	14.8
122	Histic Pergelic Cryaquepts-Typic Cryochrepts complex, 15 to 45 percent slopes	18.5
136	Steese-Gilmore complex, 10 to 45 percent slopes	4.5
138	Typic Cryochrepts-Rock outcrop complex, 6 to 35 percent slopes	10.7
	Total	**97.5**

Table 1. Names and areal coverages of soil map units that were sampled at BONA.

Map unit symbol	Map Unit Name	% Total site area
113	Gilmore-Ester complex, 15 to 45 percent slopes	1
120	Histic Pergelic Cryaquepts-Fubar complex, 3 to 7 percent slopes	.25
124	Jarvis-Salchaket complex, 0 to 3 percent slopes	0.01
	Total	**1.26**

Table 2. Names and areal coverages of soil map units that were not sampled at BONA.

Plot Findings

The 16 plots sampled represent six of the most extensive soil map units on the site. The major soil components sampled are Gilmore, Steese, Histic Pergelic Cryaquepts, Histic Pergelic Cryaquepts fans, and Typic Cryochrepts.

Landforms - Plot BONA_019 is on a convex crest. Plot BONA_003, 016, 018, 023, and 027 are on steep, north facing slopes. Plots BONA_001, 002, 007, 008, 013, 015, and 021 are located on south facing backslopes. Plots BONA_010, 022 and 028 are located on toeslopes and valley bottoms.

Parent Material—The most abundant soils at BONA are formed in colluvium derived from the birch creek schist and loess derived from the Tanana river valley. Parent material on toeslopes and valley bottoms is derived from silty slope alluvium and colluvium derived from the loess deposits up-slope. North facing slopes and valley bottoms are affected by permafrost. The annual freeze and thaw cycles cause the soils to churn and mix in a process called cryoturbation.

The dominant soils of the site, Gilmore and Steese, are formed in loess and colluvium on south facing slopes. Seven distributed plots were selected to represent these soils: BONA_001, 002, 007, 008, 013, 015 and 021. Soils of the north facing slopes, Ester and Histic Pergelic Cryaquepts, are in a loess shadow and usually have less silt than the south facing counterparts. With less solar radiation these north facing slopes usually develop thick organic layers and permafrost. Five distributed plots were selected to represent these soils: BONA_003, 016, 018, 023 and 027. One distributed plot - BONA_019 - was located in Typic Cryochrepts that form in colluvium and residuum on ridgetops and shoulders. The Histic Pergelic Cryaquepts, fans component formed in redeposited silt on toeslopes and in valley bottoms, and 3 distributed plots were selected to represent these soils: BONA_010, 023 and 028.

Summary of Soils

The most common soil at the BONA site is Gilmore found in soil map units 112 and 136 (Table 1). Plots sampled for Gilmore soils are BONA_001, 002, 007, 008, 013, 015 and 021. Gilmore soils are shallow, less than 50 cm (20 inches) to bedrock below mineral soil surface, and loamy skeletal (35 to 90 percent coarse fragments). None of the distributed plots sampled met both criteria. First, none of the plots sampled were shallow. Observed soil depths for plots BONA_001, 007, 008, 013, 015, and 021 ranged range from 58 to 73 cm (23 to 29 inches). Plot BONA_002 did not have bedrock within the observed depth of 110 cm. Second, plots BONA_002 and 008 have less than 35 percent coarse fragments. Plots BONA_001, 007, 013, 015 and 021 did however have greater than 35 percent coarse fragments in the control section.

The second most common soil in the North Star Area, Alaska soil mapping are the Histic Pergelic Cryaquepts on hills. This component is found in map unit 119 and 122 (this component name is based on an older version of soil taxonomy before the Gelisol order was recognized. The current soil Taxonomic classification would be Typic Histoturbels)(Table 1). Plots sampled for Histic Pergelic Cryaquepts are BONA_003, 016, 018, 023 and 027. The defining features of these soils are a thick organic layer (20 to 40 cm) or Histic epipedon, cryoturbation or frost churning of the soil, permafrost, hydric soil conditions and bedrock that is shallow to moderately deep. None of the sites observed had a Histic epipedon, hydric soil conditions or permafrost. Considering the fire history of the area this is not unusual: the permafrost of interior Alaska is subgelic (+1 to -4 C) and any disturbance to the insulating organic mat can cause the permafrost to melt and the soil to drain. Two of the sites, BONA_003 and 023, did have identifiable relic cryoturbation as evidence of their once frozen state.

The Histic Pergelic Cryaquepts, fans soil is found in map unit 118 (this component name is based on an older version of soil taxonomy before the Gelisol order was recognized. The current

soil Taxonomic classification would be Typic Histoturbels)(Table 1). Plots sampled in this map unit are BONA_010, 022 and 028. The defining features of these soils are a Histic epipedon, cryoturbation, permafrost and hydric soil conditions. None of the plots sampled had a Histic epipedon, although BONA_010 and 022 had permafrost, cryoturbation and hydric soil conditions. BONA_010 and 022 were both significantly burned in the Boundary fire that may have affected the organic layer thickness. BONA_028 was on a flood plain or alluvial terrace and had stratified textures and horizontal organic strata throughout the profile. During field sampling, it was noted that there was evidence of an active thermokarst in the vicinity of BONA_028. Thermokarst occur when large blocks of ground ice melt, leaving a void in the soil. Eventually the overlying soil material collapses, causing a large hole at the surface. These holes can be large enough to topple trees or make roads impassable.

One distributed plot - BONA_019 - was chosen to represent the Typic Cryochrepts in map units 138 and 122 (this component name is based on an older version of soil taxonomy. The current taxonomic name would be Typic Eutrocryepts)(Table 1). Defining characteristics for this component are a thin to moderately deep gravely solum with a cambic horizon or weak soil development, a soil color redder than the parent material, and soil structure. This soil also has a lithic or paralithic contact at 40 to 120 cm (16 to 47 inches). The sampled pedon has Bw horizon colors of 10YR 3/3 and 4/4, which is one hue redder than the typical 2.5Y color of the parent material. The Bw horizon also has a weakly expressed subangular blocky structure. This soil has a lithic contact at 67 cm (26 inches).