

NSF-ATLAS Winter C-flux Project
Soils and Soil Organic Carbon
Barrow to Council Study Transects
Project Overview

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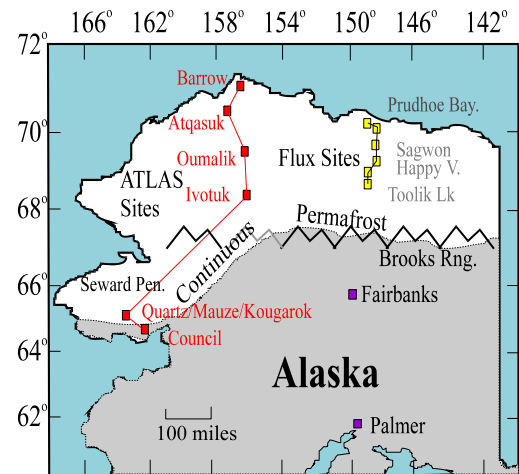


Figure 1. Study Sites

Objectives: Soils studies undertaken for this project had three component goals:

First to describe and classify the soils found on major landscape units and ecosystems across the arctic (see links to: [Transect Soils Morphological Descriptions](#), and individual Seward Pen. sites on [Soils data sheets](#)),

Second to enter basic descriptive, chemical and physical soils data for these arctic sites into the national soils data base (see links to files: [Transect Soils Physiochemical Properties](#) and [Soils site data sheets](#) for each Seward Pen. site and on the web at USDA-NRCS database at <http://ssldata.nrcs.usda.gov/querypage.asp>), and

Third to determine the amount and quality of organic carbon present with regard to potential for winter respiration of CO₂ to the atmosphere (see link to files: [Organic carbon soil stocks](#), [Low-temperature soil respiration studies](#) summary and [Comparison of transect soil profiles low temperature respiration](#))

Field Work: In this study the Seward Peninsula Quartz-Mauze-Kougarok and Council study sites were representative of the southern end-boundary of the “Arctic” and the transition zone of tundra to forested landscapes and soils in Alaska. The Seward Peninsula area is rather unique in this respect for Alaska because the Brooks mountain range occupies this transition zone across the rest of the state to the east. The ATLAS-winter flux soils study sites on the Seward Peninsula were co-located with plots established for other project components such as those for the CO₂ flux measurements and vegetation study plots. Soils were studied at each site by opening a soils pit (dimensions of approximately 1m x 1m to a 1m depth) that exposed soil horizons (ie. characteristic horizontal layers resulting from soil forming processes) present at the site. The pit location was chosen to be representative of that site (landscape position, vegetation stand, and micro-environment or micro-topography). Site characteristics were described in the field and soils were classified using *Soil Taxonomy*, the US soil classification

system (see links to: [Soils site data sheets](#) and [Transect Soils Morphological Descriptions](#)). Samples were collected from each soil horizon for lab determination of chemical and physical properties with separate parallel samples collected for analysis of low-temperature soil biological activity. Samples taken for determination of biological activity were kept frozen. Samples were brought back to the University of Alaska Fairbanks soils laboratory in Palmer, Alaska with subsamples sent to the USDA-NRCS National Soil Survey Laboratory in Lincoln, NE (for soil physiochemical data see links to files: [Soils site data sheets](#) for each site, [Transect Soils Physiochemical Properties](#) for all Arctic sites, and on the web USDA-NRCS database at <http://ssldata.nrcs.usda.gov/querypage.asp>). Soil biological CO₂ respiration studies were carried out at the Palmer laboratory using the frozen-preserved samples to determine the relative rates of respiration of different soils in the frozen vs unfrozen state and to relate the rates of respiration to soil organic carbon amounts and forms in the soils (see link to file: [Low-temperature soil respiration studies](#), or for a more comprehensive discussion of results see: Michaelson, G.J. and C.L. Ping. Soil organic carbon and CO₂ respiration at subzero temperature in soils of Arctic Alaska, *J. of Geophy. Res.* 108(D2), 8164, doi:10.1029/2001JD000920, 2003). Soil organic carbon stocks (OC) were calculated for each site based on field horizon observations and lab soil OC analysis results (see link to file: [Organic carbon soil stocks](#)). All site soil profiles under the different vegetation types across the Arctic transect were compared for their relative low-temperature respiration potential (see link to [Comparison of transect soil profiles low temperature respiration](#)).

Seward Peninsula Study Sites Sampled:

Quartz Crk./Mauze Crk./Kougarok R. (Site Name, Soil Classification, Location)

Moist Acidic Tundra, *Coarse-loamy, mixed, superactive, subgelic, Ruptic-Histic Aquiturbel (65° 27.126' N, 164° 37.709' W, Mauze Crk.)*

Lichen Stripe-Stripe Area, *Coarse-loamy, mixed, active, subgelic Typic Aquiturbel (Walker veg. plot Mauze Crk.)*

Inter-Stripe shrub, *Loamy-skeletal, mixed, active, subgelic, Aquic Haplorthel (Walker veg. plot Mauze Crk.)*

Tall Shrub Site, *Loamy-skeletal, mixed, active, frigid Typic Cryaquept (65° 27' 14.41" N, 164° 37' 54.72" W, Mauze Crk.)*

Moist Acidic Tundra, *Fine-silty, mixed, superactive, subgelic, Ruptic-Histic Aquiturbel (Hinzman Tower Kougarok R/Quartz Crk.)*

Council (Site Name, Soil Classification, Location)

Tundra Site, Moist Acidic Tundra, *Loamy, mixed, dysic, subgelic Fluvaquentic Hemistel (64° 50' 32.6" N.; 163° 41' 39.2" W)*

Open-Shrub Site, *Loamy-skeletal, mixed, active, frigid Histic Cryaquept, (64° 53' 29" N, 163° 38' 57.6" W)*

Shrub Site, *Loamy-skeletal, mixed, superactive, frigid Lithic Eutrocryept (64° 56' 09" N, 163° 44' 14.6" W)*

Open Woodland Site, *Coarse-silty, mixed, superactive, frigid, Typic Eutrocryept (64° 53' 59" N., 163° 40' 01" W.)*

Forest Site, *Coarse-loamy, mixed, superactive, frigid Andic Eutrocryept, (64° 54' 27" N., 163° 40' 24.5" W.)*

Barren Nonacidic Site, *Loamy-skeletal, mixed, superactive, calcareous, frigid Lithic Cryorthent (64° 43.556' N., 163° 56.688' W.)*

Barren Acidic Site, *Loamy-skeletal, mixed, superactive, subgelic Aquic Dystocryept (64° 43.560' N, 163° 56.311' W)*

Other Arctic Study Sites Sampled:

Barrow Flux Tower, NOAA Station BEO, Fine-loamy, mixed, superactive, pergelic Typic Aquiturbel (71° 19' 20" N Long. 156° 36' 35.1" W.)

Barrow BEO, Coarse-loamy, mixed, superactive, pergelic, Ruptic Histoturbel, (71° 19.333'N, 156° 36.585'W.)

Barrow Central Marsh, Coarse-loamy, mixed, superactive, pergelic, Ruptic Historthel, (71° 18' 45"N, 156° 35' 40"W)

Atqasuk 1 - low tussock moist nonacidic tundra, Sandy, mixed, active, pergelic Psammentic Aquorthel (70° 27' 55.5" N; Long. 157° 27' 02" W.)

Atqasuk 2 - polygon rim, wet tundra, Sandy, mixed, superactive, pergelic Typic Historthel (70° 28' 14.4" N; Long. 157° 24' 27.9" W.)

Atqasuk 3 - broad (15m) ridge/rim of low center polygons, moist tundra, Sandy, mixed, superactive, pergelic Typic Umbriturbel (70° 28' 14.4" N; Long. 157° 24' 27.9" W)

Oumalik 1 - Moist Nonacidic Tundra, Coarse-silty, mixed, superactive, pergelic Glacic Aquiturbel (68° 44' 7"N, 155° 51' 59.6"W)

Oumalik 2 - Moist Acidic Tundra, Fine-silty, mixed, superactive, pergelic Ruptic Histoturbel (68° 43' 58.8"N, 155° 51' 40"W)

Ivotuk Site #1, Moist Acidic Tundra, Fine-loamy, mixed, superactive, pergelic Ruptic Histoturbel (68° 29' 14.7"N, 155° 44' 22.7"W)

Ivotuk Site #2, Shrubs, Fine-loamy, mixed, superactive, pergelic Glacic Histoturbel (68° 28' 52"N, 155° 44' 37.4"W)

Ivotuk Site #3, Moist Nonacidic Tundra Fine-loamy, mixed, superactive, pergelic Typic Haplorthel (68° 28' 43"N, 155° 43' 57"W)

Ivotuk Site #4, Moist Acidic Tundra, Fine-loamy, mixed, superactive, pergelic Ruptic Histoturbel (68° 28' 51"N, 155° 44' 33.4"W)

Prudhoe Bay Betty Pingo Site, Moist Nonacidic Tundra, Typic Molliturbel (70° 17' 01" N, 148° 53' 57" W)

Prudhoe Bay Mile 411 Dalton Highway, Wet Nonacidic Tundra, Fine-silty, mixed, gelic, calcareous, Ruptic-Histic Aquiturbel

Sagwon Hills Flux Site 3, Moist Nonacidic Tundra, Mollic Aquiturbel (69° 46' 26" N, 148° 40' 22" W)

Sagwon Hills Flux Site 4, Moist Acidic Tundra, Ruptic-Histic Aquiturbel (69° 26' 06" N, 148° 48' 34" W)

Happy Valley Flux Site, Moist Acidic Tundra, Typic Aquaturbel (69° 08' 47" N, 148° 51' 14" W)

Toolik Lake, Moist Acidic Tundra, (Eriophorum Tussock-Intertussock), Fine-loamy, mixed, gelic, Ruptic-Histic Aquiturbel

Overall Project Findings: see link to [Project findings and contributions](#)