Arctic Greening Database v0.1
(https://doi.org/10.5880/fidgeo.2025.074)

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Contributions

Following the CreDit taxonomy, the contributions are recognized as follows. **Conceptualization:** CM, SD, JA, KBW, MVdB, FW, SF, AF, AM, LB, JR, MM; **methodology:** AM, LB, JR, MM, MG, JA, FT, KBW, MVdB, FW, SF, AF; **validation:** all authors; **formal analysis:** AM, LB, JR, MM; **investigation:** all contributors, AM, LB, JR, MM; **resources:** CM, JA, SD, MG, FW, FT, KBW, AF, SF; **data curation:** AM, LB, JR, MM; **writing - original draft:** AM, LB, JR, MM; **writing - review & editing:** all authors; **visualization:** AM, LB, JR, MM; **supervision:** CM, JA, SD, KBW, MVdB, SF, AF; **project administration:** CM, JA, SD, KBW, MVdB, SF, AF, FW; **funding acquisition:** CM, JA, SD.

1. Licence

2. Citation

When using the data please cite:

Mainka, M.; Bakker, L.; Maier, A.; Ruethers, J.; Bakke Westergaard, K.; Fior, S.; Frossard, A.; Griepentrog, M.; Van de Broek, M.; Wilken, F, Dötterl, S.; Alexander, J.; Magnabosco, C.. (2025): Arctic Greening Database. v 0.1. GFZ Data Services. https://doi.org/10.5880/fidgeo.2025.074

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3. Overview

The Arctic Greening Database v0.1 is an open access database created as part of the ETH+ project Unraveling biogeochemical, microbial and vegetation feedbacks driving soil development and Arctic greening under a warming climate. The database contains data on soil, vegetation, microbial, and environmental properties from 14 tundra sites with heterogeneous environmental and ecological conditions on Svalbard, sampled during the growing seasons of 2022 and 2023. Spatially explicit field observations are combined with field and laboratory measurements to provide an interdisciplinary collection of data from a high-Arctic region. This database can be used to study linkages between vegetation, soil organic matter, the soil microbiome, and pedogenesis in the dynamic context of Arctic warming and greening. The database is structured hierarchically, connecting plot or landscape information on a broader level with more specific sample and plant species levels. The underlying concept of the present relational database is detailed in Section 4. Sampling and measurement procedures are described in Section 2. The metadata file accompanying a specific .csv file provides more detailed information on methods of data creation, data processing, units and data aggregation.

4. Description of project and rationale

The Arctic Greening Database (AGDB) is an integrated, interdisciplinary dataset created by the members of the research project Unraveling biogeochemical, microbial and vegetation feedbacks driving soil development and Arctic greening under a warming climate funded by the ETH+ Grants of ETH Zurich (grant no. ETH+-0320–2). The project was purposefully designed as an interdisciplinary project to better understand how processes at the plant-soil-microbiome interface jointly shape the complex dynamics of a changing Arctic ecosystem. More specifically, the project investigates to what extent soils that have developed on different geological parent materials, and their associated soil microbial communities, may affect vegetation changes reflected in patterns of Arctic greening and associated biogeochemical cycles. The project further investigates ecological and evolutionary aspects of plant interactions at the species level to study their implications for Arctic greening.

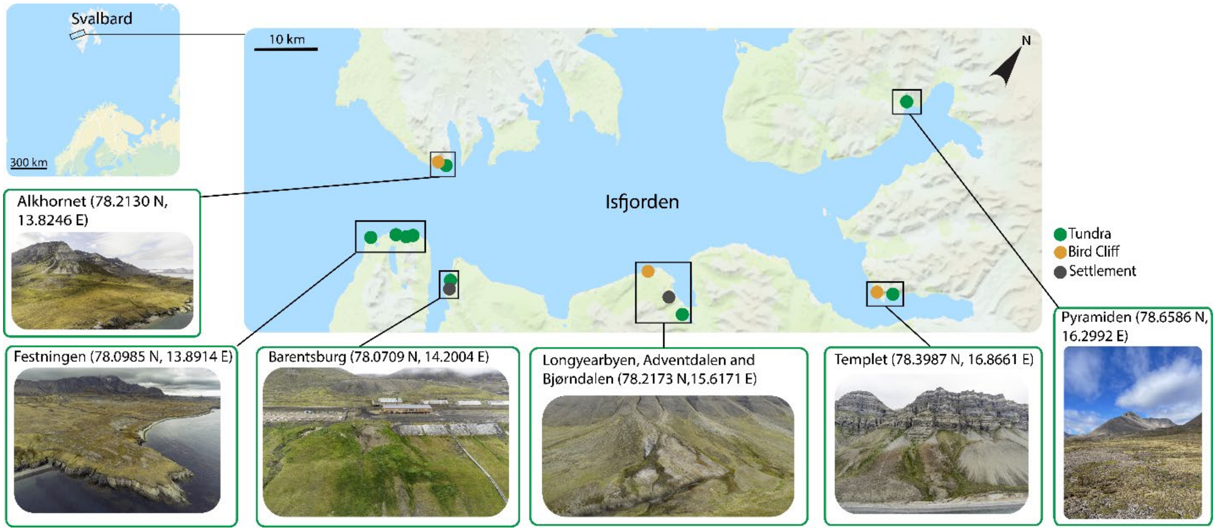

***Figure 1**: Overview of sampling sites around the Isfjorden, Svalbard. For every site a representative image was chosen. Map by © OpenStreetMap contributors. Image courtesy of Simone Fior and Annina Maier.*

5. Study area description

5.1. Location and climate

The study area is situated between 78-79 °N latitude across the broad fjord Isfjorden with side fjords, in the Western part of Svalbard's largest island, Spitsbergen (see Figure 1). Settlements in the area are Longyearbyen, Barentsburg and Pyramiden. Samples were taken from various sites that are detailed in Table 1. Svalbard's high-Arctic climate is moderated by the North Atlantic Current (Köppen climate ET). Regional climatic gradients are dominant; while the coastal areas in the West have an oceanic climate, the interior fjord regions and valleys have more of a continental climate (Arnesen et al, 2018). The mean annual temperature at the study sites ranges from -7.3 and -4.8 °C. The total annual precipitation ranges from264 and 576 mm yr-1 (Worldclim v2.1, 1970-2000) (Fick & Hijmans, 2017).

5.2. Geology

The geology of the Svalbard archipelago is highly variable as the area underwent multiple orogenetic developments and tectonic events (see Figure 2). In consequence, rocks from an uncommonly wide range of geological periods (up to ages of ca. 1.8 Ma) and distinct geochemical composition compose the surface of Svalbard (Elvevold et al. 2007; Elling et al. 2016) (see Figure 2). Our study sites cover very different ages of geological parent material from Quaternary to Neoproterozoic ages (650-540 Ma BP). The rock types found are sedimentary rocks of varying grain sizes and mineral composition (sand-, siltstone, diamictite, shale), metamorphic rocks (phyllite) as well as carbonate-containing rocks (dolomite, limestone) (see Table 1).

5.1. Land cover/vegetation

Svalbard's land area is mainly covered by glaciers (62 %), while 24 % are non-vegetated areas, and only 14 % are covered by different Arctic vegetation communities such as Dryas tundra, Arctic meadows, wet marsh or swamp tundra, etc. (Johansen et al. 2012). In general, the vegetated areas in Svalbard are mostly located in the lowlands and can be divided based on their moisture regime (swamp vegetation vs. drier, more exposed locations), topographic position which also co-determines the timing of the snowmelt (e.g. snowbed communities) (Elvebakk, 1994; Elvebakk, 2005). Svalbard's vegetation is undergoing drastic changes through fast warming rates as well as non-native species that were introduced by early settlers and nowadays mostly by increased human activity (Ware et al.

2012; Bartlett et al. 2021; Wasowicz et al. 2020). The dominant bioclimatic zones and vegetation types on our sampling sites are listed in Table 1. The classification follows a bio-climatic structuring that also considers bedrock substrate, hydrology, erosion and manuring that is specified in Elvebakk (1994).

5.2. Soil types, land use/disturbance history

Svalbard's soil landscape predominantly features poorly developed Leptosols, Regosols, and, in certain areas, Cryosols and Gleysols. These soils typically range in depth from 1 to 30 centimeters, with an average depth of 5 to 10 centimeters (Iavid et al., 2018). Thus, they are situated in the active layer that thaws in summer and varies from 0.3 to 3 m depth. Below the active layer a continuous permafrost layer extends downwards. The presence of permafrost begins from the sea level onwards (Dallmann, 2019). In this dataset, all soil samples were taken from the active layer. Sampled, whole soil profile depths range between a minimum of 26 cm to a maximum of 55 cm.

A notable aspect of soil development in Svalbard is the intensively naturally fertilized areas around large seabird colonies, which support richer plant life and result in thicker organic layers compared to the surrounding tundra (Odasz, 1994). Additionally, more fertile and disturbed soils are found near human settlements, particularly in areas associated with animal husbandry. Human activities such as whaling have been prevalent along Svalbard's western fjords from the early 17th century onwards and was changed for coal mining in the 20th century. Eventually, in the second half of the 20th century more and more humans reached the archipelago – mostly for tourism but also for other purposes, e.g. scientific activities (Hisdal, 1998).

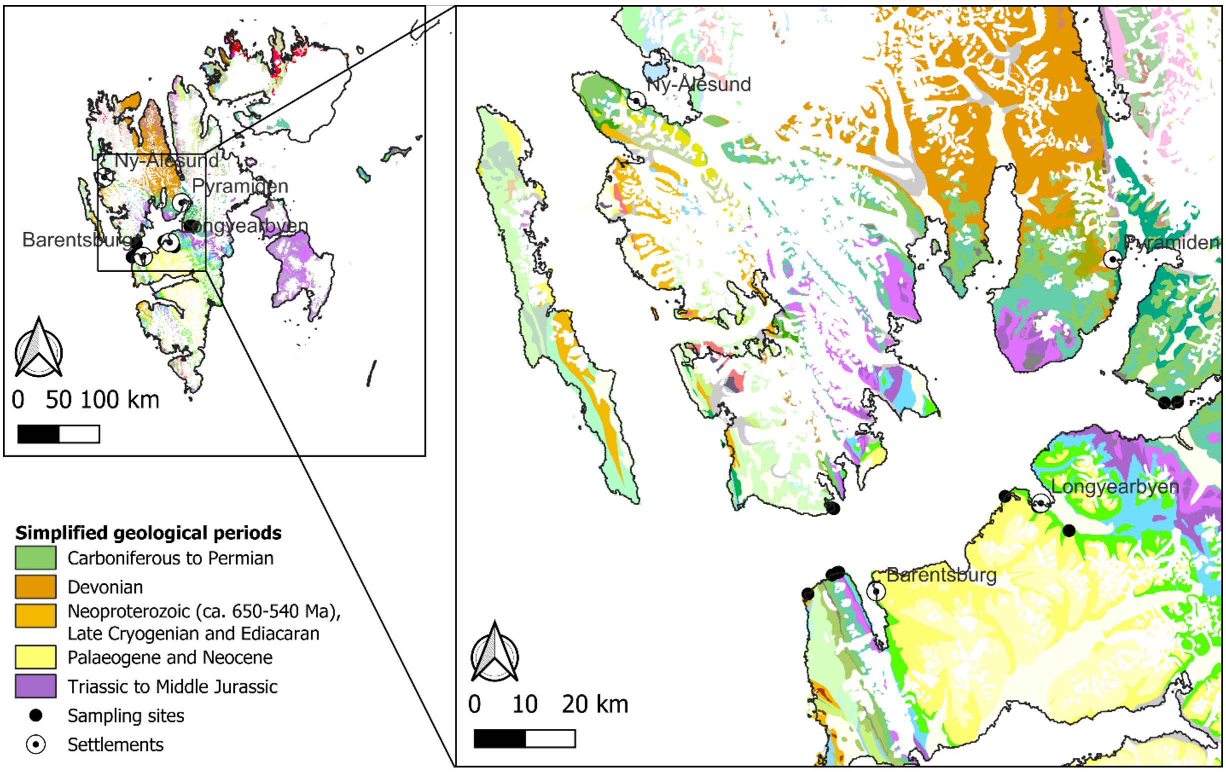

__Figure 2:__ Geological map of Svalbard in 1:250,000 (important settlements were added as orientation). Sampling sites are shown in black. The simplified geological units given in the legend summarize the relevant geologies underlying our sampling sites. Sites span a geological age from recent to Neoproterozoic sediments as old as ca. 650 – 540 Ma BP. For a detailed overview we refer the reader to the Geological Map of Svalbard (1:250,000) (Norwegian Polar Institute, 2016) and the Geoscience Atlas of Svalbard (Dallmann, 2019).

Table 1: *Overview of site properties. Climate data is taken from WorldClim v2.1 (1970-2000) (Fick & Hijmans, 2017). Elevation is taken from ArcticDEM (2 m resolution) (Porter et al. 2023). Geological units were taken from Geoscience Atlas of Svalbard (Dallmann 2019). The bioclimatic zones and dominant vegetation types are given as described by Elvebakk (1994; 2005).*

Site	Environment	MAT (°C)	MAP (mm yr^{-1})	Elevation (m.a.s.l)	Geological parent material	Bioclimatic zones and dominant vegetation type
Alkhornet	Tundra	-4.9	528	51	Phyllite and greenschist. Late Cryogenian to Ediacaran (ca. 650-540 Ma BP (Neoproterozoic).	Northern Arctic Tundra zone (Mesic, circumneutral tundra characterised by *Luzula nivalis*)
	Bird cliff	-5.3 to -5.1	549	82	Carbonate rocks	
Adventdalen	Tundra	-6.3	363	93 - 96	Shale and sandstone. Triassic - Middle Jurassic.	Middle Arctic Tundra zone (*Cassiope tetragona* tundra)
Bjørndalen	Bird cliff	-6.4	440 - 444	49 - 55		
Longyearbyen	Settlement	-5.4	333	65 - 72		
Barentsburg	Tundra	-5.2	575 - 576	65		
	Settlement	-4.8	550	65 - 74		
Festningen	Tundra	-4.8/-4.7	541 - 555	45 - 55	Dark shale, siltstone, sandstone from Triassic-middle Jurassic. Diamictite from Neoproterozoic.	Northern Arctic Tundra zone (Mesic, circumneutral tundra characterised by *Luzula nivalis* & mesic, acidic tundra characterised by *Luzula confusa*)
Templet	Tundra	-5.9	252 - 255	40 - 49	Sediment deposits (glaci-fluvial and marine). Pleistocene and Holocene.	Middle Arctic Tundra zone (*Dryas octopetala* tundra on dry calcareous substrates)
	Bird cliff	-7.0	322 - 328	58 - 131		
Pyramiden	Tundra	-7.3	264 - 306	90 - 102	Red sandstone and shale Devonian	Middle Arctic Tundra zone (*Cassiope tetragona* tundra)

5.3. Topography

Svalbard experienced varying degrees of glaciation during the Holocene. The last glacial retreat started from the West around 15,100 – 14,200 BP and advanced rapidly. Glaciers retreated during the climatic optimum (10,000 – 5,000 BP), and began advancing again approximately 2500 BP and during the little ice age (1350 – 1850 AD) (Mangerud and Svendsen, 1992; Dallmann, 2019). Glaciation is a key process that determines not only topography through the formation of typical U-shaped valleys (e.g. Adventdalen or Pyramiden) but also through isostatic uplift following de-glaciation that resulted in marine terraces (e.g. Festningen).

The sites described in this dataset are mostly located on stable landscape positions in U-shaped valleys or coastal lowlands covering an elevation range from 33 to 158 m a.s.l. (Porter et al. 2023) (see Table 1). Depending on the landscape position, the contribution of unconsolidated material differs. While sites further away from the coastline have received more material from glacifluvial deposits and moraines, coastal lowlands are characterized by marine deposits as well as slope deposits (Kristiansen & Sollid, 1986).

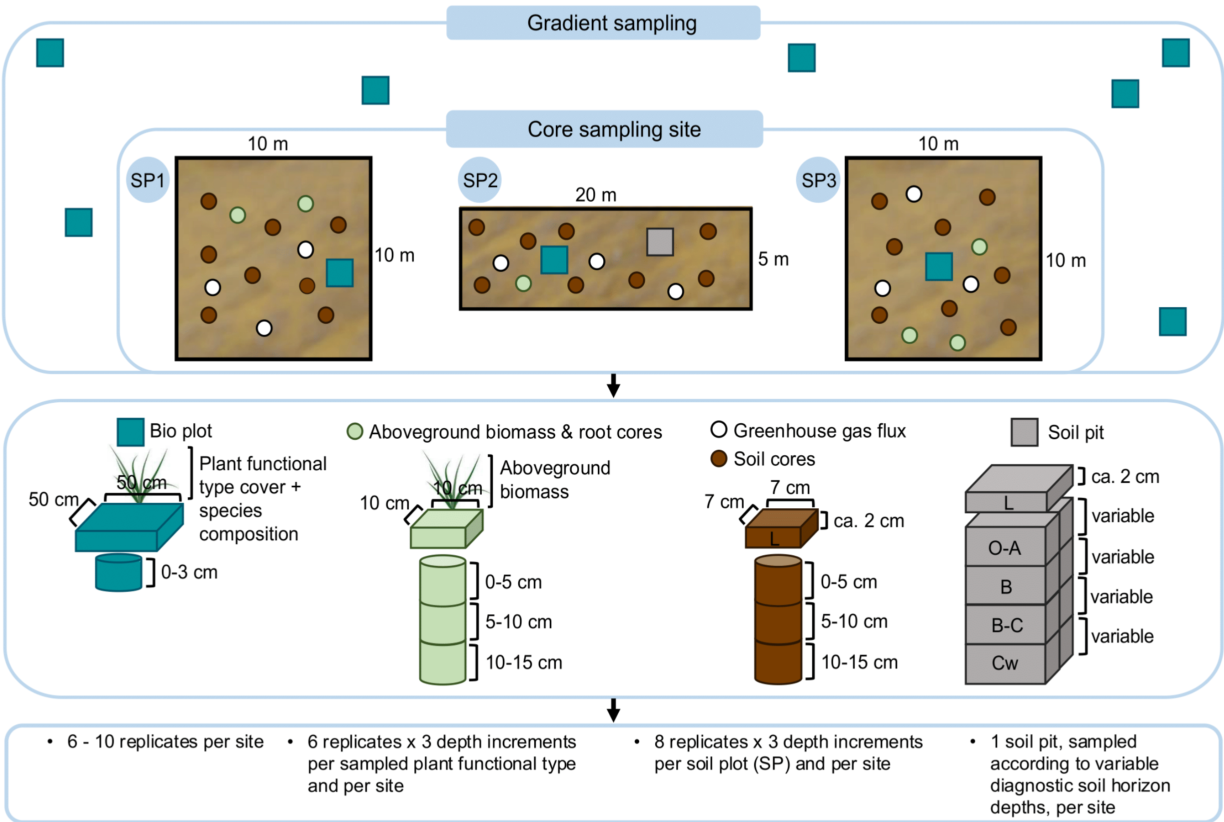

Figure 3: *Idealized sampling setup employed on the sites described above. The core sampling site consists of three to four soil plots (SP), the surrounding area outside represents the gradient sampling area. While the core of the site is meant to be representative of the dominant feature of a site (i.e. natural tundra, bird cliff or settlement), the gradient area intends to cover more specific features of each location (i.e. microtopography, elevation, fertility (in case of bird cliff and settlements). The bio plots are depicted as teal-coloured squares within the soil plots, and outside of them in the gradient sampling area. The grey square depicts the soil pit, the brown, light green and white dots represent soil core, biomass sampling and greenhouse gas measurement locations within the soil plots. Sampling depths for the soil pit, soil cores, biomass samples and bio plots are shown in detail in the lowest panel.*

6. Sampling design

The present dataset comprises 8 sites with 14 distinct environments (nine tundra environments, three bird cliff environments, and two settlement environments, see Figure 1). We sampled these environments following a specific sampling design which is detailed in this section (see Figure 3). At each site and respective environment, we established and sampled two types of plots ("soil plots" and "bio plots") (see Figure 3). Soil plots were established to characterize the spatial variability of soils within a representative area of the dominant landscape features. The bio plots were established to cover and characterize a wider range of spatial variability, from within the soil plots, which made up the core sampling site, out to the surrounding area.

6.1. Soil plot

Three to four soil plots were established per site, each covering 100 m2. We selected areas representative of the dominant landscape features of the different respective sites and environments based on visual examination (i.e. the plots covered areas that were not clearly affected by a specific landscape feature, e.g. microtopography). Soil plot samples are composites of eight soil cores per plot to cover the spatial heterogeneity within each plot. The eight soil cores were randomly taken within the soil plot. First, we collected litter within a 7 cm x 7 cm square. Then, we used a 110 cm^3 bulk density sampler to extract soil at 0-5, 5-10 and 10-15 cm depth increments (see Figure 3). A pedogenetic horizon was then assigned to the depth-explicit samples based on field assessment of their organic matter content, mineral matrix and other physicochemical parameters. The main horizons are denoted as L horizon (organic layer), accumulated dead plant biomass (litter) that lies on top of the soil; O horizon (organic layer), the very organic rich uppermost part of the soil, which contains a large amount of plant litter in various stages of decomposition; A horizon (surface soil), which is rich in organic matter, but is intermixed with minerals; B horizon (subsoil layer), which contains less organic matter than the A horizon and where oxidized minerals such as iron oxides accumulate; C horizon (substratum layer), which mainly consists of the more or less weathered mineral parent material (Amelung et al., 2018).

We complemented the soil sampling in the soil plots with vegetation cover estimation (on plant functional type level), by sampling above- and belowground biomass per plant functional type and by taking greenhouse gas flux measurements. Our goal was to quantify biomass input of organic matter to soils through biomass productivity and microbial turnover through greenhouse gas flux measurements. Biomass samples exist for a selection of tundra sites (Festningen, Adventdalen, Alkornet, Pyramiden) per plant functional type (where we sampled only the most dominant plant functional types per site). The sampling followed the scheme detailed in Figure 3. Per plant functional type, we took a total of six replicates, spread across the total number of sampled soil plots. Living aboveground biomass samples were taken within a 10 cm x 10 cm square, covered homogeneously by the plant functional type of interest. Subsequently, we collected belowground root biomass samples underneath the respective square. Finally, we measured greenhouse gas fluxes on each soil plot (CO2, CH4). Fluxes were derived from continuous measurements of three triplicates per soil plot under light and dark conditions. Hereby concentrations were measured over the course of 5 minutes using an in situ portable greenhouse gas analyzer.

6.2. Bio plots

We established six to ten bio plots per site (50 cm x 50 cm). In each bio plot, we identified vascular plant species, and recorded vegetation cover data. Plant species identification was conducted by botanists with Arctic expertise. For species that were not identifiable in the field, we collected and preserved samples and identified them later in the laboratory. Species names were verified and corrected according to the database at svalbardflora.no. The first three bio plots at each site were located within the first three respective soil plots to represent the dominant core sampling environment (tundra, bird cliff, or settlement). The bio plots sampled outside the core area cover visually observed spatial variation in vegetation patterns and/or microtopography. At tundra sites, we focused on including features such as mounds and ditches, while at bird cliffs and settlement sites, bio plots were arranged to capture a gradient from the core sampling site to the surrounding native tundra. Data of site properties such as soil temperature, soil moisture and conductivity as well as soil substrate depth were measured in each bio plot (example see Figure 3). For a detailed analysis of soil properties and microbial communities, we created a composite sample from the uppermost 3 cm of soil at the four corners of each bio plot.

7. Database structure

7.1. General description

The Arctic Greening Database consists of data, metadata, a change log file, and a description document. The data folder contains the tables stored in comma separated values files (.csv). Principal categories for table names are “veg_”, which indicates that a table contains vegetation-related information, “soil_” for soil-related information (including greenhouse gas fluxes), and “microbio_” for microbial-related information. In addition to these three broader categories, a table with general environmental site conditions (site_properties) is provided, as well as two tables with general information at the soil and bio plot-level (plot_level_info) and sample-level (sample_level_info) for all types of data categories (soil, microbio, vegetation) (see Figure 4). In a separate metadata folder, the metadata files for the respective data tables can be found as pdf files.

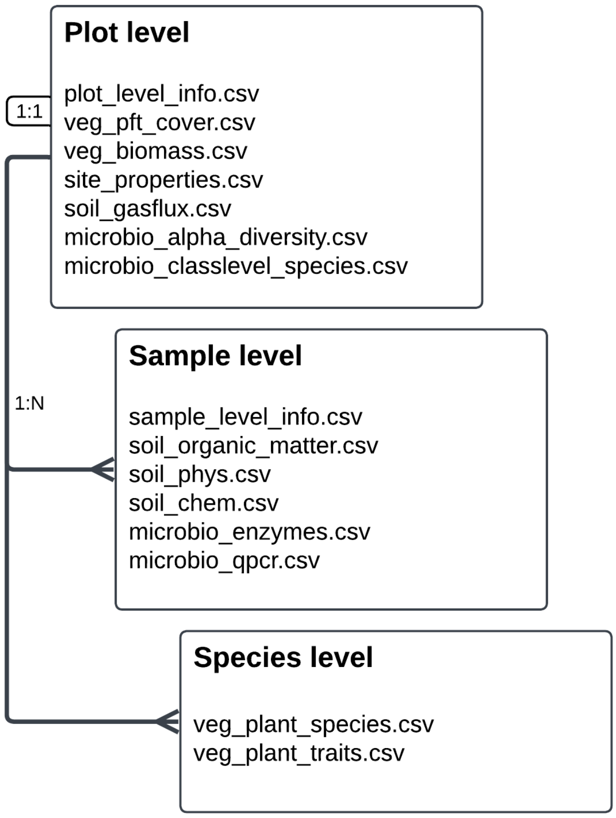

***Figure 4**: Structure of the database. The arrows between levels indicate one-to-many relationships (1:N). Inside each level the relations are one-to-one (1:1). One-to-many relationships indicate that, for instance, one row on the plot-level has many corresponding rows on the sample level since multiple samples were taken on each plot.*

Level 1 is the plot level (includes both soil and bio plots). The central table containing general information is “plot_level_info” with information on coordinates, geology, etc. The data tables on this level comprise data on vegetation (PFT cover, above- and belowground biomass), microbial characteristics (e.g. alpha_diversity), and soil greenhouse gas fluxes. The primary key is **plot_id** and can be used to connect to the sample level using “sample_level_info” as linking table and “veg_plant_species” or “veg_plant_traits” at species level.

Level 2 is the sample level. Soil-specific and microbial laboratory measurements are stored on this level. Tables on this level contain data on soil organic matter properties (soil_organic_matter.csv), soil physical values (soil_phys.csv), soil chemistry (soil_chem.csv), and microbial biomass (qPCR.csv). The primary key is **sample_id**.

Level 3 is the plant species level. It represents an additional level of detail with species-specific information for each plot. It can be linked to the plot level using the plot_id column in plot_level_info. The primary key is **species_id**. The relationship between species_id and sample_id is many-to-many resulting in query results with an impractically large number of rows. We therefore recommend first aggregating data on plot-level before combining these levels (see demo files in the documentation of the database).

8. Data overview

The present dataset spans a wide range of geo-ecological conditions as specified in Section 2. In this section, a more quantitative overview is given of the geochemical, soil, and microbial properties and measurements included in the *Arctic Greening Database*.

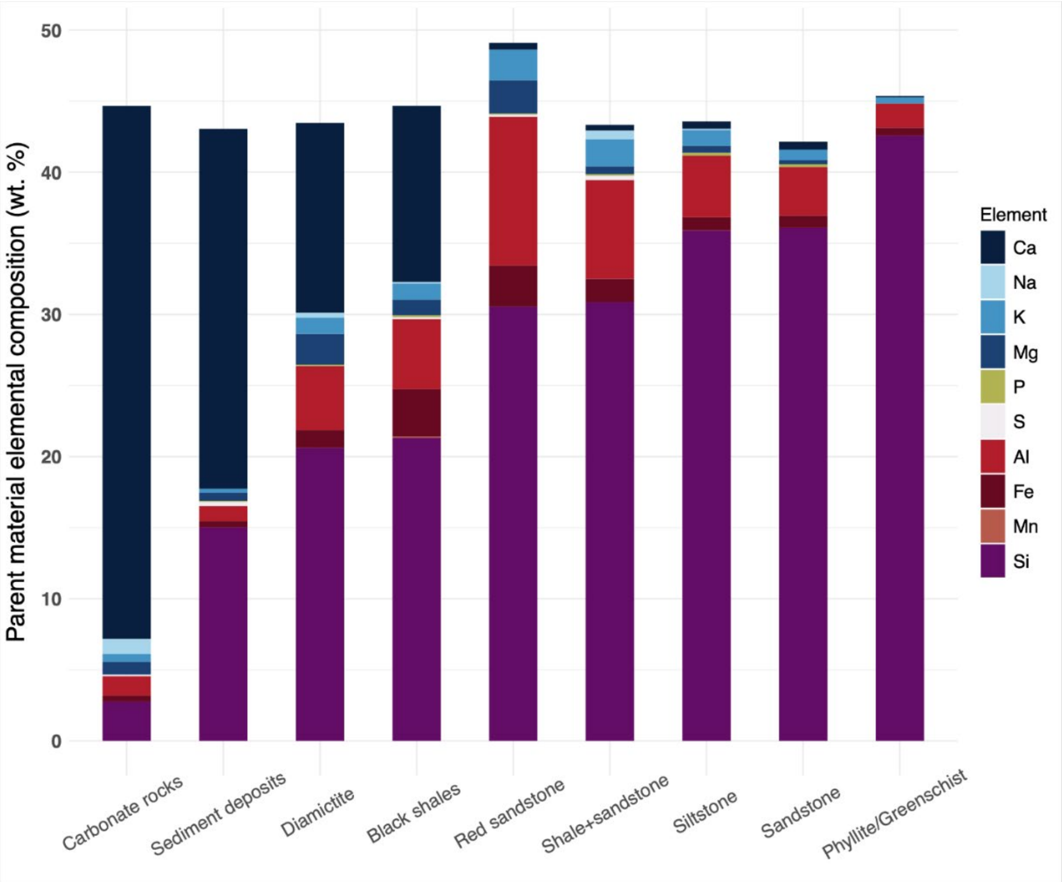

Figure 5: Geochemical compositions of sampled parent materials determined by XRF analysis. Values are reported as elemental concentrations (wt. %), not oxide equivalents. Figure by Annina Maier.

First, the geochemical composition of the parent material at the different sampled sites is displayed in Figure 5. A range of soils developed on four different, carbonate-containing parent materials were sampled, coinciding with a higher pH, i.e. soils developed on carbonate rocks, sediment deposits, diamictite and black shales. Additionally, soils developed on five different, carbonate-free parent materials such as red sandstone, shale and sandstone, siltstone, sandstone and phyllite/greenschist were sampled. All parent materials comprised sedimentary rocks, except for phyllite/greenschist which is of metamorphic origin. The sampled parent materials cover a gradient of silicium percentages ranging from less than 5 to more than 40 %. They also cover a gradient of aluminum and iron percentages ranging from 1.1 to 10.5 % and 0.4 to 3.3 % respectively.

***Table 2**: Soil characteristics across environments (T = Tundra, B = Bird cliff, D = Settlement). Values shown are minimum–maximum ranges and means ± standard errors (SE). TC = Total Carbon, TN = Total Nitrogen, $F^{14}C$ = Fraction Modern, CEC_{eff} = effective cation exchange capacity, TRB = total reserve of base cations.*

	Tundra (T) $n = 295$		**Bird cliff (B)** $n = 118$		**Settlement (D)** $n = 83$	
	min–max	mean ± SE	min–max	mean ± SE	min–max	mean ± SE
Soil organic matter						
TC (%)	0.00–32.10	15.20 ± 0.59	4.53–32.01	20.13 ± 0.81	1.74–30.80	17.29 ± 0.96
TN (%)	0.05–2.02	0.98 ± 0.04	0.36–2.48	1.38 ± 0.06	0.15–1.79	1.03 ± 0.06
TC:TN (–)	0.00–34.54	15.18 ± 0.28	10.68–21.23	14.87 ± 0.24	8.41–35.73	16.80 ± 0.40
$F^{14}C$ (–)	0.15–1.13	0.76 ± 0.02	0.76–1.11	0.93 ± 0.02	0.36–0.97	0.61 ± 0.04
Soil chemistry						
pH ($CaCl_2$)	4.27–7.58	5.74 ± 0.04	4.30–7.88	5.87 ± 0.07	5.02–7.09	5.88 ± 0.05
CEC_{eff} ($cmol_c$/kg)	2.07–73.98	30.90 ± 1.06	9.96–72.73	43.16 ± 1.66	6.37–69.01	31.96 ± 1.75
TRB (g kg^{-1})	1.19–126.70	20.19 ± 2.61	4.42–265.63	69.93 ± 19.80	3.80–29.58	13.06 ± 2.06
Total Si (%)	2.37–4.42	17.84 ± 0.54.35	0.11–32.11	12.46 ± 0.76	5.40–39.50	16.02 ± 0.83
Total Ca (g kg^{-1})	0.48–99.88	11.25 ± 1.96	1.09–250.50	61.08 ± 19.45	0.73–24.94	7.96 ± 2.05
Total Al (g kg^{-1})	1.28–113.38	14.89 ± 1.87	0.00–20.78	8.32 ± 1.39	4.27–23.98	12.26 ± 1.23
Total Fe (g kg^{-1})	2.91–168.88	25.11 ± 2.77	0.03–39.56	17.52 ± 2.73	10.30–38.23	26.67 ± 1.90
Total Mn (g kg^{-1})	0.02–1.22	0.46 ± 0.03	0.00–0.75	0.20 ± 0.05	0.07–0.79	0.27 ± 0.04
Total P (g kg^{-1})	0.01–5.13	1.04 ± 0.11	0.01–6.03	1.39 ± 0.36	0.30–7.52	2.60 ± 0.54
Soil physics						
Sand (%)	0.00–92.43	49.55 ± 1.14	0.00–66.88	41.06 ± 1.67	18.43–69.40	48.71 ± 1.57
Silt+clay (%)	7.57–100.00	50.45 ± 1.14	33.12–100.00	58.94 ± 1.67	30.60–81.57	51.29 ± 1.57
Water content (%)	6.00–77.00	38.99 ± 1.72	10.00–81.00	60.34 ± 2.49	9.00–78.00	44.55 ± 4.22
Stone content (%)	0.00–89.00	14.46 ± 1.52	0.00–85.00	3.82 ± 1.98	0.00–110.00	18.83 ± 4.39

Secondly, the ranges of important soil properties are shown in Table 2. The table structures soil properties as the database itself in properties related to soil organic matter (total Carbon (TC) and Nitrogen (TN), soil chemistry (e.g., pH, effective cation exchange capacity (CECeff, etc.), and soil physical parameters (e.g., soil texture (sand, silt and clay)).

The broad range of soil properties is also reflected in soil microbial parameters (see Table 3). Averages and ranges of qPCR gene copy numbers for bacteria (16S) and fungi (ITS) are listed. The microbial community composition is shown through ratios and diversity indices.

The distinct ecological settings are also reflected in the vegetation communities (see Table 4). Most variation among plots can be found in graminoid and woody plant cover. Furthermore, human (settlements) and natural influence (bird cliffs) are reflected in the vegetation communities as well as moisture- and topography-related aspects. In total, we have observed 66 different vascular plant species (out of which eight are non-native) across our study plots.

Table 3: *Soil microbial community parameters across environments (T = Tundra, B = Bird cliff, D = Settlement). Values shown are minimum–maximum ranges and means ± standard errors (SE), the qPCR primers used for copy numbers were 515F-926R for 16S region and ITS3 and ITS4 for the ITS2 region.*

	Tundra (T)		Bird cliff (B)		Settlement (D)	
	min–max	mean ± SE	min–max	mean ± SE	min–max	mean ± SE
	$n = 53$		$n = 40$		$n = 29$	
Microbial qPCR copy numbers						
16S (copy numbers g^{-1})	3.857×10^9– 2.004×10^{11}	$5.551 \times 10^9 \pm$ 6.922×10^8	9.908×10^8– 2.157×10^{10}	$5.602 \times 10^9 \pm$ 8.053×10^8	7.905×10^8– 1.577×10^{10}	$7.192 \times 10^9 \pm$ 7.021×10^8
ITS (copy numbers g^{-1})	5.771×10^7– 3.792×10^9	$7.943^8 \pm$ 1.091^8	4.113×10^7– 4.277×10^9	$9.996 \times 10^8 \pm$ 1.825×10^8	2.784×10^8– 4.703×10^9	$1.890 \times 10^9 \pm$ 2.396×10^8
ITS to 16S ratio (–)	0.03–1.00	0.19 ± 0.03	0.02–1.73	0.27 ± 0.06	0.04–1.48	0.32 ± 0.06
Microbial alpha diversity						
Prokaryotic Shannon Index (–)	6.54–7.73	7.19 ± 0.13	7.07–7.77	7.49 ± 0.08	6.36–7.68	6.95 ± 0.13
Observed prokaryotic diversity (–)	3086.70– 9243.00	6129.72 ± 730.82	3539.70– 9157.00	7055.90 ± 714.46	2895.30– 8099.30	5548.20 ± 631.64

Table 4: Plant functional type cover at different sites and environments (mean ± standard deviation) in percent cover. Higher standard deviations are due to the inclusion of both core and gradient plots.

	Tundra (T) $n = 80$		Bird cliff (B) $n = 34$		Settlement (D) $n = 28$	
	min–max	mean ± SE	min–max	mean ± SE	min–max	mean ± SE
Vegetation cover (%)						
Graminoid	0–95	14 ± 17	2–90	41 ± 26	0–100	68 ± 34
Forb	0–40	9 ± 8	0–90	32 ± 24	2–90	22 ± 22
Bryophyte	0–99	55 ± 33	1–95	69 ± 30	0–100	45 ± 34
Lichen	0–70	6 ± 12	0–5	1 ± 2	0–1	0 ± 0
Woody	0–93	30 ± 23	0–60	11 ± 16	0–75	5 ± 17
Cushion	0–25	2 ± 5	0–10	0 ± 2	0–0	0 ± 0
Non-vegetated	0–148	26 ± 27	0–50	11 ± 12	0–76	8 ± 15

9. Database maintenance, access, and reporting issues

The database will be updated with curated data generated over the course of the project. This version is therefore considered a version under development (v0.X). To keep track of version changes, a change_log.txt file is provided. Users are encouraged to provide feedback to the corresponding author.

To facilitate the use of the database, simple querying and plotting exercises are provided in a separate folder called *demo*. The folder contains several use cases in R language on how to navigate the different levels of the database. The use cases are meant to illustrate the underlying logic and present a generalizable workflow of querying, plotting and saving data from the dataset.

10. References

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