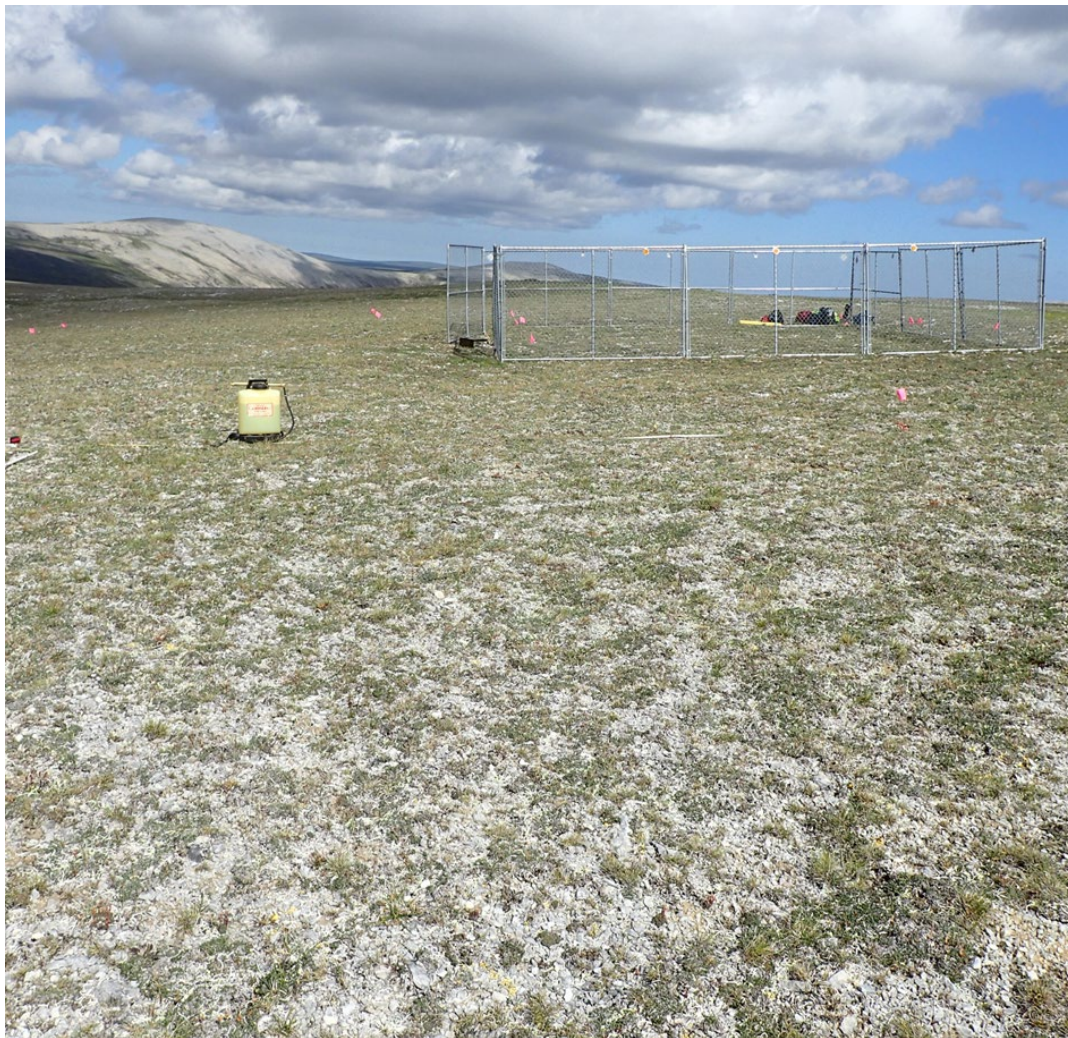




Grazing Exclosures in Bering Land Bridge National Preserve

2012-2022 Data Report

Natural Resource Data Series NPS/BELA/NRDS—2024/1406



**ON THIS PAGE**

The grazing enclosure at 5SB.

NPS Photo by Justin Terzi.

ON THE COVER

The grazing enclosure at 7SB, on the Lost Jim Lava Flow.

NPS Photo by Carol Gales.

Grazing Exclosures in Bering Land Bridge National Preserve

2012-2022 Data Report

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Abstract

To monitor the impact of grazing by caribou and other ungulates on vegetation in Bering Land Bridge National Park, 17 exclosures were installed in the summer of 2012 and one in 2007. These exclosures consist of 9 by 9 m of chainlink fencing, which prevented grazers from reaching vegetation plots within. Two plots within the fencing were paired with two unexclosed plots outside the fencing. All plots were measured in 2012 for lichen, bryophyte and vascular plant cover and species composition by point intercept methods. The first remeasure of the plots took place in 2022. This report summarizes the purpose of the exclosures, the methodology, changes to the methodology over time, the data structure of the database and preliminary results of re-measure data collected in 2022.

Acknowledgments

Thanks to Tara Whitesell, Jim Dory, Anaka Mines, Carol Gales, Graham Linden and Marci Johnson for assistance with initial exclosure installation and data collection in 2012. Thanks to Marty Byrne and Justin Terzi for data collection in 2022. And many thanks to BELA staff, for administrative and logistical support.

Introduction

Bering Land Bridge National Preserve (BELA) was designated a unit of the National Park System in 1980 in part because of the value of its subsistence resources and importance to wildlife populations. BELA has historically been the winter home of the Western Arctic Caribou Herd (WAH), a vital resource for subsistence hunters in northwest Alaska. Following their reintroduction to the Seward Peninsula in 1970 and 1981, muskox have sporadically made the preserve their home. Additionally, BELA's enabling legislation provides for long-term reindeer grazing according to sound range management practices that do not degrade preserve resources (ANILCA 1980). The combined effects of reindeer and caribou grazing have reduced lichen cover in BELA, with locally severe impacts (Holt et al. 2008). Loss of lichens has been noted throughout the western arctic caribou herd winter range, and is apparently due to the combined effects of grazing, fires, and climate change (Joly et al. 2007, Joly et al. 2010).

Monitoring grazing is a priority for maintaining the health of the WAH, reindeer herds, tundra habitat, and other ecosystem functions. Grazing exclosures (alternatively termed enclosures) are widely used tool which allow land managers to determine the impact of herbivory on vegetation, the quality of available forage, and the length of time needed for recovery from grazing. Exclosures are constructed by erecting fencing that prevents the animals of interest from accessing a designated area. Exclosed plots are paired with control plots which are unfenced.

Previous exclosure studies on the Seward Peninsula could not be maintained long-term because of their construction; wooden fenceposts pounded into the tundra were heaved out by frost action. Thus, a grazing exclosure using free-standing fencing was proposed for BELA. The exclosures were designed to last 30-50 years and serve as a benchmark for grazing conditions for multiple decades. Incorporated as a Vital Sign under Terrestrial Vegetation and Soils, the protocol for grazing exclosures in BELA was formally published in 2016 (Swanson & Neitlich 2016).

Seventeen exclosures were constructed in BELA in 2012 to join the exclosure constructed in 2007. Each site had two fenced and two unfenced plots, for a total of 72 plots. Vegetation plots in each exclosure were surveyed in 2012 and again in 2022. The purpose of this report is to provide data summaries for 2012 and 2022, note changes in the protocol and sample pool, summarize the structure of the database, and allow timely further analysis of these data.

Table 1. Landcover class for enclosure sites. See Jorgenson et al. 2009 for more details on the classes,

Landcover Class	Number of Enclosures	Site Names
Upland Moist Dwarf Birch Tussock and Ericaceous Shrub Tundras	3	9M, 3L, 4L
Upland Moist Sedge-Dryas Meadow	3	10LB, 15L, 11L
Alpine Alkaline Dry Dryas Shrub and Barrens	3	D, 8S, 5SB
Alpine Nonalkaline Dry Dryas Shrub and Barrens	3	15SA, 12SB, 5S
Upland Dry Lichen Barrens (Lava Flow sites)	3	3sc3, LAFLT, 7SB
Kuzitrin Lake Intensive Recovery Sites (on Landcover Types above)	3	KUZ15, KUZ10, KUZ13

Sampling methodology

Two 4x8m plots were located inside and outside the enclosures (Figure 2a). Lichen, moss and vascular plants and a ground cover were recorded along 100 points along transect lines (Figure 2b). Ocular estimates of functional group cover are recorded for each functional group (e.g., graminoids, shrubs, lichens.) Plots were searched for lichen and vascular plant species not recorded on the transects in order to estimate species richness. Full protocol of species and site data are described in Swanson & Neitlich 2016.

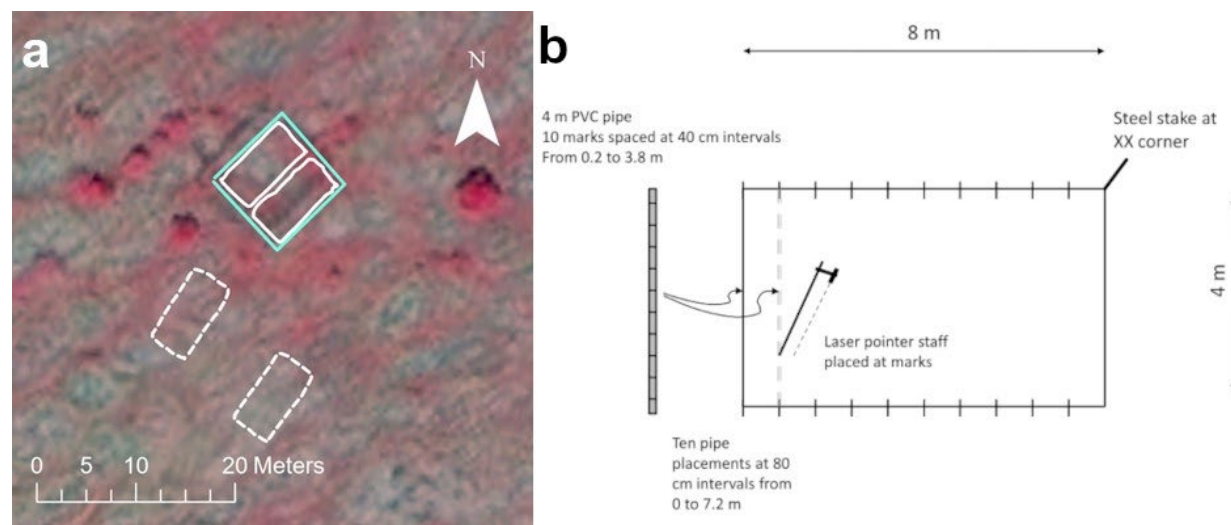


Figure 2. (a) Example site layout on color infrared imagery (Site 11L). Two plots (solid white lines) are located inside the enclosure perimeter (blue line) and two plots outside (dashed white lines). (b) Plot dimensions and location of point intercept measurements.

Changes to the SOP

The enclosures were regularly visited enroute to other fieldwork in the intervening years, to assess damage and monitor the status of the fencing. Several of the high elevation enclosures had to be reinforced with steel cables and anchors due to high wind speeds collapsing the fencing inward. Site

KUZ13, one of the Kuzitrin recovery sites at 708 m elevation (the highest of the study sites), was found wrecked beyond recovery in 2013 and the fencing was removed.

During fieldwork in 2022, due to the increase in expense in aviation and very limited time for sampling, the procedure for vascular plant species searches in the plots was simplified. For plants in which field ID to species is difficult, we recorded the genus instead of making collections. (Data from 2012 can be simplified to match the 2022 data for analyses.) This change only affects plot search vascular plant diversity data, not the transect data.

Data Format

Data are presented in an Access database, with data from 2012 and 2022 combined in linked tables (Figure 3). There are 6 data tables, containing the collected site, GPS, plant and ground data, 3 look-up tables, 3 explanatory metadata tables and several existing queries to summarize data. Two ‘revisionlog’ tables explain post-field changes to 2012 data, where missing or erroneous data points were corrected. Data are also contained in flat csv files in a zip folder, for accessibility.

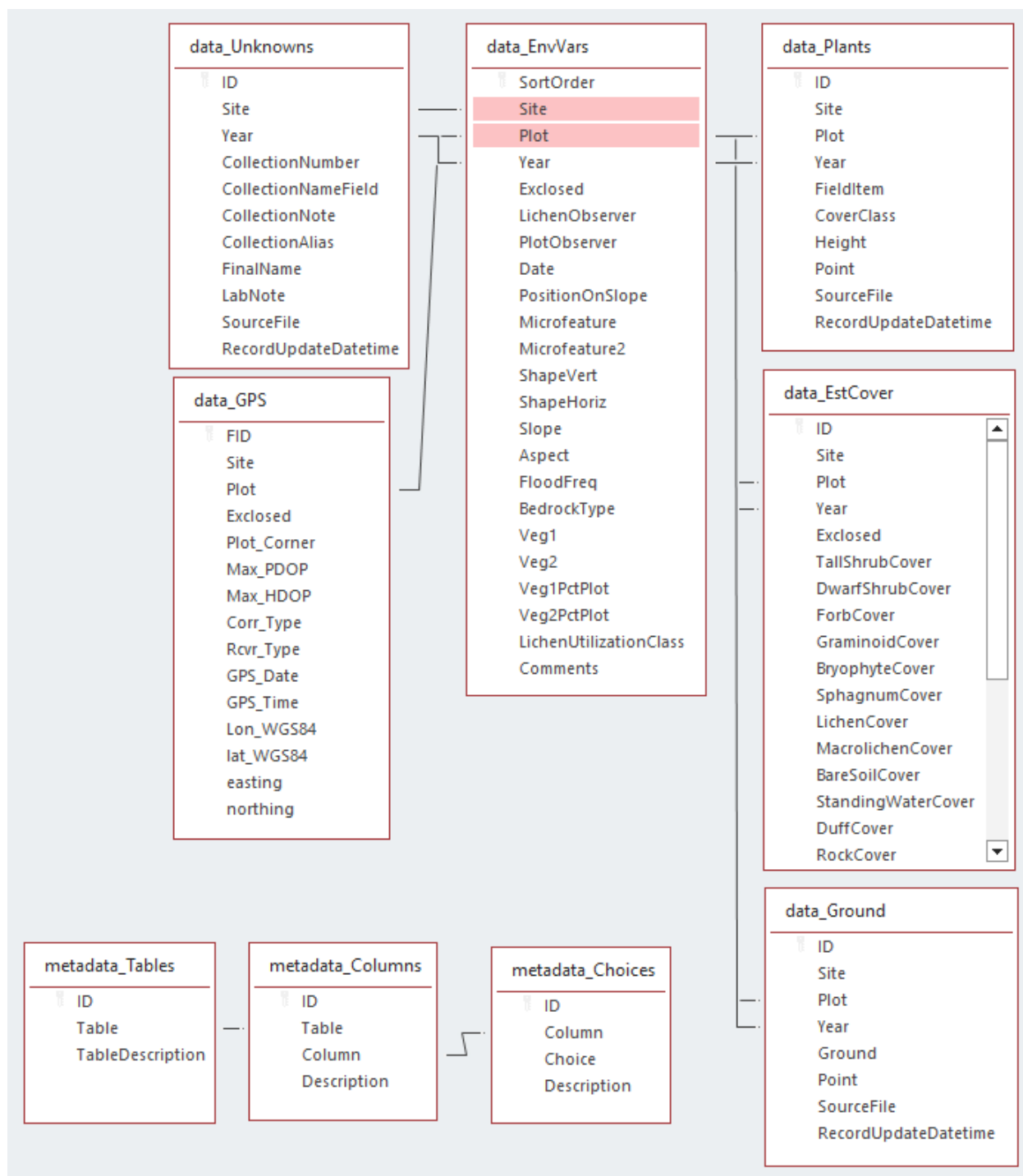


Figure 3. Diagram showing linked relationships between tables in the Access database containing the data for this project.

Results

Data Collected

During installation in 2012, 144 plots at 18 sites were located and measured. In 2022, 120 plots at 15 sites were re-measured, due to weather and aviation constraints. A total of 11,480 distinct plant hits were recorded in 2012, and a total of 9,026 distinct plants hits were recorded in 2022. A total of 172 plants and lichens were collected in 2012, and 23 lichen and vascular plant specimens were collected in 2022. Two hundred at sixty-five unique taxa were recorded. Species recorded in more than half (> 9) of the sites are summarized in Table 2.

Table 2. Most common species recorded, 2012 and 2022 combined.

Species	Growth form	<i>n</i> Sites
moss, other	bryophyte	18
<i>Polytrichum</i>	bryophyte	13
<i>Arctous alpina</i>	forb	11
<i>Carex bigelowii</i>	graminoid	9
<i>Empetrum hermaphroditum</i>	dwarf shrub	11
<i>Loiseleuria procumbens</i>	dwarf shrub	10
<i>Salix phlebophylla</i>	dwarf shrub	13
<i>Vaccinium vitis-idaea</i>	dwarf shrub	14
<i>Betula nana</i>	shrub	11
<i>Ledum palustre</i>	shrub	12
<i>Vaccinium uliginosum</i>	shrub	12
crustose lichen, other	crustose lichen	17
<i>Ochrolechia frigida</i>	crustose lichen	9
<i>Pertusaria dactylina</i>	crustose lichen	12
<i>Alectoria nigricans</i>	macrolichen	16
<i>Alectoria ochroleuca</i>	macrolichen	14
<i>Asahinea chrysanthia</i>	macrolichen	12
<i>Bryocaulon divergens</i>	macrolichen	16
<i>Bryoria nitidula</i>	macrolichen	9
<i>Cetraria cucullata</i>	macrolichen	18
<i>Cetraria islandica</i>	macrolichen	13

Table 2 (continued). Most common species recorded, 2012 and 2022 combined.

Species	Growth form	<i>n</i> Sites
<i>Cetraria kamczatica</i>	macrolichen	12
<i>Cetraria laevigata</i>	macrolichen	16
<i>Cetraria nigricans</i>	macrolichen	10
<i>Cetraria nivalis</i>	macrolichen	17
<i>Cladina arbuscula</i>	macrolichen	15
<i>Cladina rangiferina</i>	macrolichen	10
<i>Cladina stygia</i>	macrolichen	14
<i>Cladonia amaurocraea</i>	macrolichen	14
<i>Cladonia bellidiflora</i>	macrolichen	10
<i>Cladonia borealis</i>	macrolichen	14
<i>Cladonia coccifera</i>	macrolichen	12
<i>Cladonia crispata</i>	macrolichen	11
<i>Cladonia gracilis</i>	macrolichen	13
<i>Cladonia macrophylla</i>	macrolichen	9
<i>Cladonia maxima</i>	macrolichen	10
<i>Cladonia pyxidata</i>	macrolichen	10
<i>Cladonia uncialis</i>	macrolichen	13
<i>Dactylina arctica</i>	macrolichen	10
<i>Parmelia omphalodes</i>	macrolichen	9
<i>Sphaerophorus globosus</i>	macrolichen	12
<i>Stereocaulon paschale</i>	macrolichen	11
<i>Thamnolia vermicularis</i>	macrolichen	18
<i>Umbilicaria hyperborea</i>	macrolichen	10
<i>Umbilicaria proboscidea</i>	macrolichen	9

Vegetation Change

Figure 4 displays species richness by functional group. Plots from the Kuzitrin recovery sites (unsampled in 2022) were excluded for data consistency. From 2012 to 2022, for all plots combined, we detected a modest increase in number of shrub species, an increase in bryophytes species (likely due to increase in observer expertise), a decrease in forb and macrolichen species recorded and

virtually no change in graminoids and crustose lichens (Figure 3). Results for cover are displayed by site and plot in Figure 4.

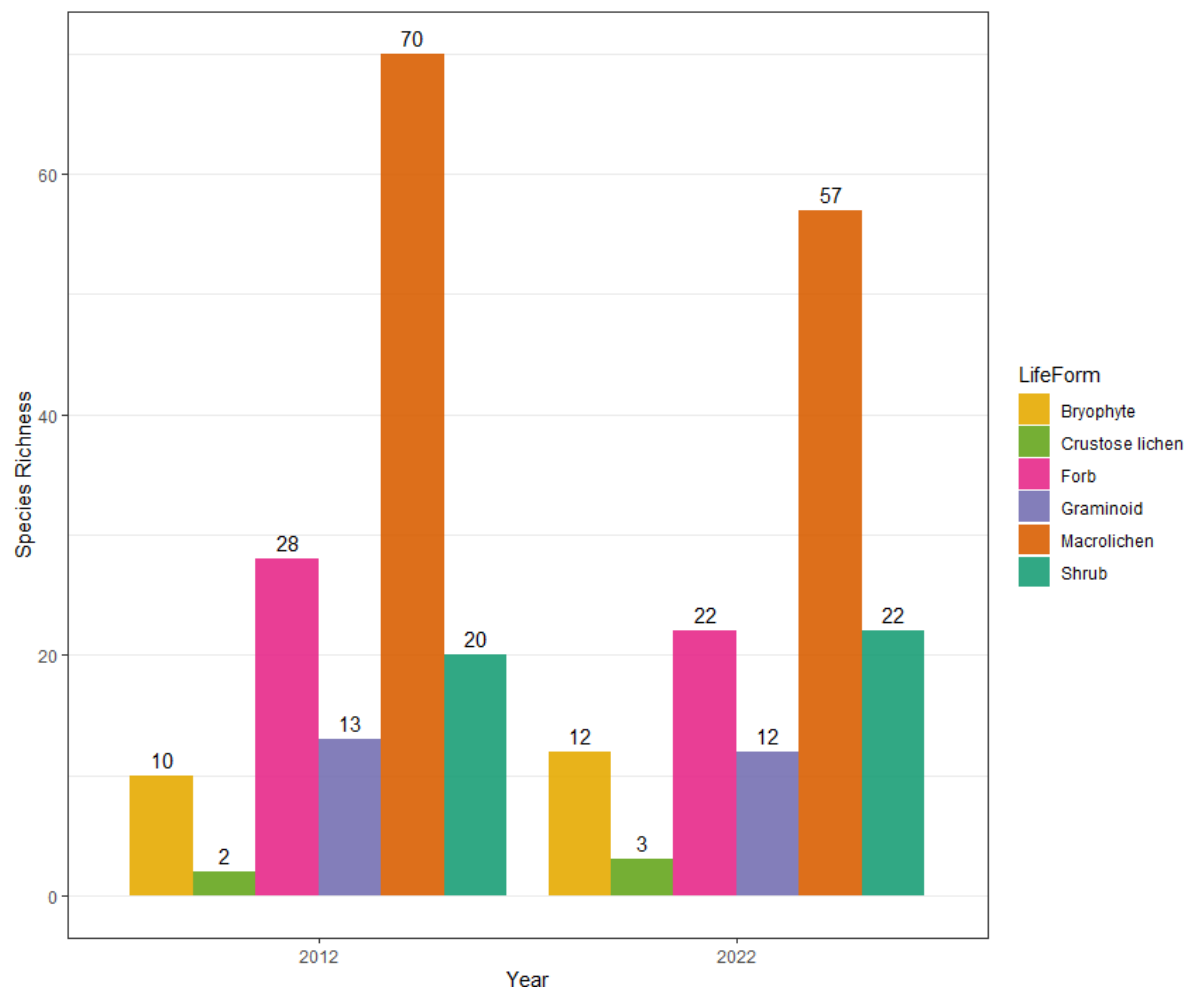


Figure 4. Total species richness by functional group for each sample year.

Change by cover is summarized in two figures. In Figure 5, change by functional group and exclosure status is displayed for each site. The sites are ordered by landcover class. We see small to substantial increases in shrub cover from 2012 to 2022 for most plots. We see substantial decreases in lichen cover for plots in the Alkaline & Nonalkaline Alpine, no change in the Lava Flow plots, and mixed effects in the Sedge-Dryas Meadow and Shrub-Tussock Tundra plots. One particular Shrub-Tussock plot, 9M, displayed an idiosyncratic change: an increase in cottongrass (*Eriophorum*) cover, primarily *Eriophorum vaginatum* (tussock cottongrass), and a decrease in all other prominent species (Figure 6).



Figure 5. Change in functional group cover from 2012 to 2022 for each site.

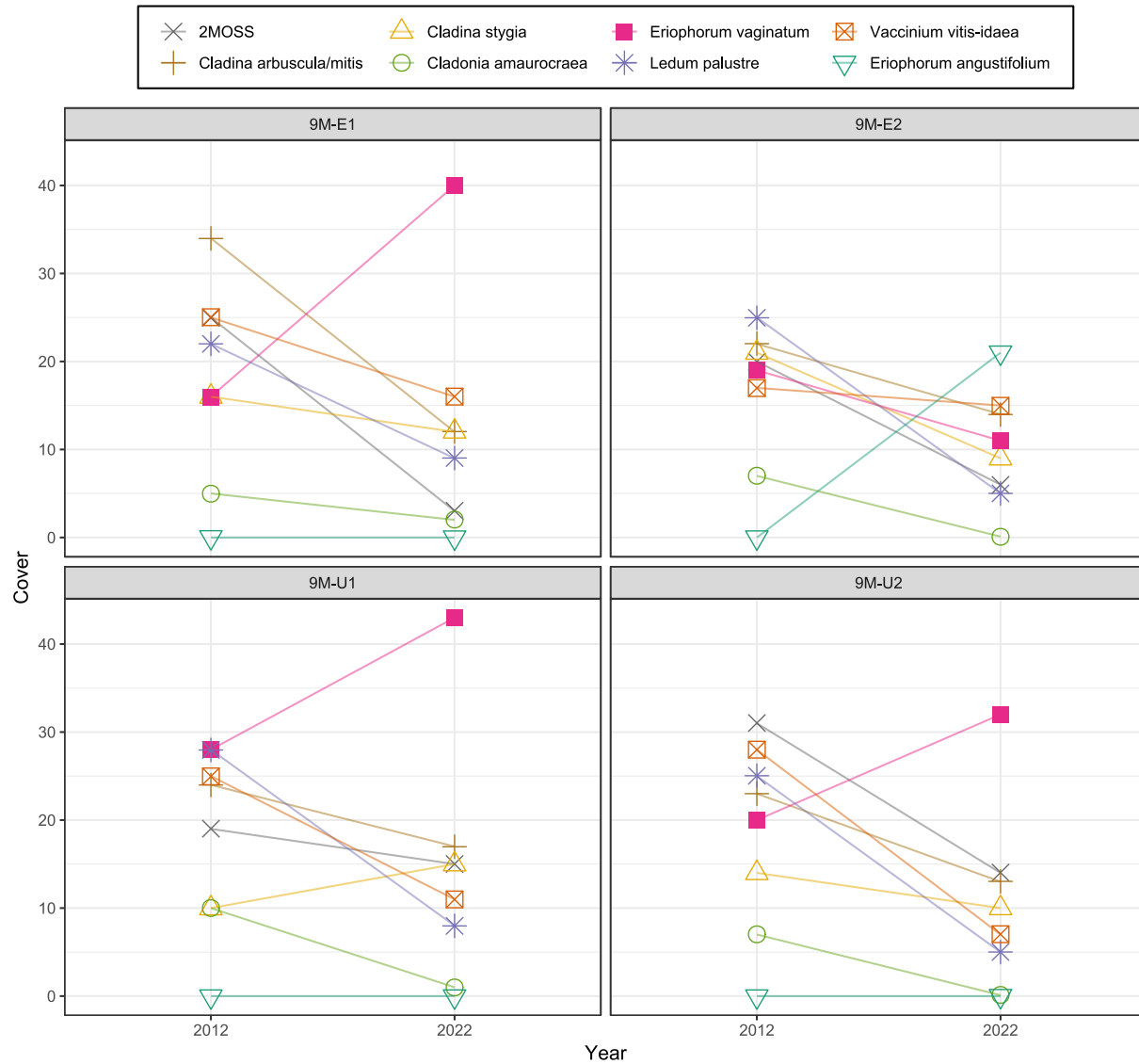


Figure 6. Change in species cover for 9M from 2012 to 2022 (includes all species above 10% cover).

Discussion

This report has been written to allow timely publication of the data collected in 2022, and begin change detection analyses. The major finding of this remeasurement was a large decrease in macrolichen cover between 2012 and 2022 in several plots. The preliminary hypothesis is zinc toxicity from the galvanized fencing is causing lichen cover declines. We are currently studying this phenomenon and it will form the basis of a separate report.

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