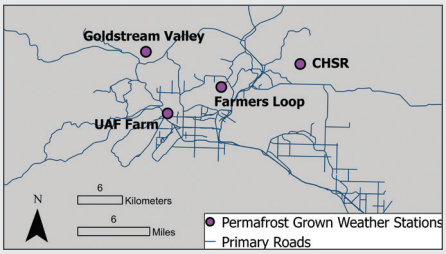
Permafrost Grown 2023 (Year 2) Project Highlights

Permafrost Grown is a five-year project funded by the National Science Foundation and based at the University of Alaska Fairbanks (UAF). The project is working with farmers in Alaska to understand how permafrost and agricultural activities interact, develop management strategies and create best practice guides for farmers cultivating on permafrost-affected soils. We are collecting a wide range of data to understand the physical, social, economic and policy impacts of permafrost on northern farms. Here we provide some project and result highlights from year 2.

Project Website and Weather Stations Launched



Permafrost Grown launched its project website (www.permafrostgrown.org) that contains an overview of the project, our methods, our project team, and near-real time weather data from our five automatic weather stations.

Four stations are in Fairbanks (locations pictured) and one is in Anaktuvuk Pass through a collaboration with Gardens in the Arctic (https://gardensinthearctic.com/). Please use the website and weather station to view the weather near you!

Permafrost Clues from Soil

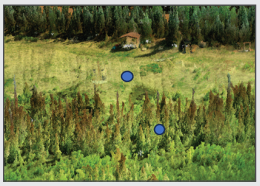
We can estimate the depth of the top of permafrost prior to thaw (likely due to land clearing) based on certain indicators such as soil color changes.

The hatched line indicates the estimated top of permafrost prior to thaw (57 cm) at the UAF Experiment Farm based on remnants of lenticular cryostructures.

Asparagus Trial

Our asparagus trial shows promise as a potential profitable crop in permafrost-affected soils that is also a perennial crop. Part of the patch includes an area that was previously abandoned due to land sinking from permafrost thaw. Our patch is performing better than patches of similar-aged asparagus planted in nonpermafrost areas.

Soil Temperature Differences



Monitoring of soil and air temperatures in undisturbed forest and in a cultivated but abandoned field (locations shown by blue circles in image) showed that for the month of July, air temperatures were similar (differing by ~1 °C), while soils in the undisturbed forest were on average ~8 °C cooler at 15 cm depth.

Drilling for Permafrost at Depth

We are using various drilling methods, including an electric drill with auger attachments and a large drill rig to find permafrost under the ground surface.

Electric drill with auger lets us look for permafrost in the upper 5 m of soil.

We are working with a drill rig to find and drill through the entire permafrost table. Our deepest borehole to date was 55 m.

Permafrost Grown Preliminary Data for 2023 Great Mulch Study

Mulches are commonly used to artificially warm cold soils, for weed suppression, moisture retention and to increase crop yields. We are measuring the thermal and moisture impacts of 11 different mulch types (see table below). We set up replicate plots with and without zucchini crops and had a soil only control. We are evaluating mulches in the context of warming near-surface ground temperatures and how they might enhance or limit permafrost thaw at depth. See below for our preliminary results.

Aerial drone image (Aug. 15, 2023) of the study set up; mulch types left to right are listed in order in the table below. We also measured crop yield, weed suppression and biodegradability of the mulches.

Check out our Great Mulch Study Interpretive sign and demo plots at the Georgeson Botanical Gardens in Fairbanks, AK.

Mean and max temperatures (°C) of the surface and mean temperature at 100 cm depth between June 15 and September 10, 2023. Mean air temperature during that time was 16.3 °C. Some mulches that are wave-selective (e.g., SRM Red and IRT Plastic) experienced periods of intense heat from direct sunlight with the highest soil warming impact occurring at or near June solstice. Red numbers indicate some of the warmest and blue the coolest measured mean and maximum temperatures.

Mulch Type	Surface Mean Temp. (°C) (with/without crop)	Surface Max Temp. (°C) (with/without crop)	100 cm Mean Temp. (°C) (with/without crop)
Compost*	16.9 / 17.7	21.5 / 24.7	12.8 / 13.0
Straw* (or hay)	16.3 / 16.2	23.2 / 22.2	12.5 / 12.4
Classic Black Plastic	17.5 / 20.0	29.7 / 39.0	12.9 / 12.9
Paper*	16.9 / 17.3	29.3 / 28.5	12.5 / 12.6
BioRadical Plastic*	17.6 / 20.5	28.5 / 49.6	12.8 / 12.9
InfraRed Transmitting (IRT) Green Plastic	18.3 / 20.1	32.0 / 38.2	13.2 / 13.4
Silver	16.8 / 18.0	24.4 / 29.9	12.9 / 13.2
IRT Olive Plastic	17.6 / 21.1	32.3 / 42.0	13.0 / 13.3
Bio 360 Plastic*	18.3 / 19.6	40.9 / 35.6	13.2 / 13.5
SRM Red (Selective Reflective)	18.8 / 21.6	42.6 / 52.7	13.2 / 13.3
White-on-Black Plastic	16.8 / 18.1	26.8 / 29.9	12.9 / 12.9

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