Establishing a low-cost sensor network to address local and regional research questions and support STEM education across the Northern Forest Region

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Overview of the Sensor Network

Our low-cost, energy-efficient sensor network monitors biophysical properties of forests across the region (Fig. 1). The data are informing novel research questions and supporting K-12 education.

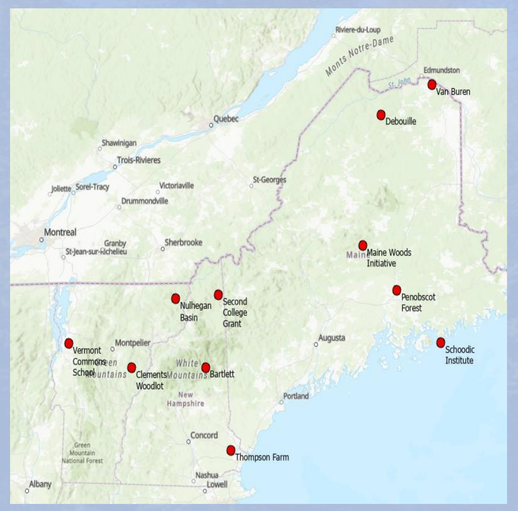
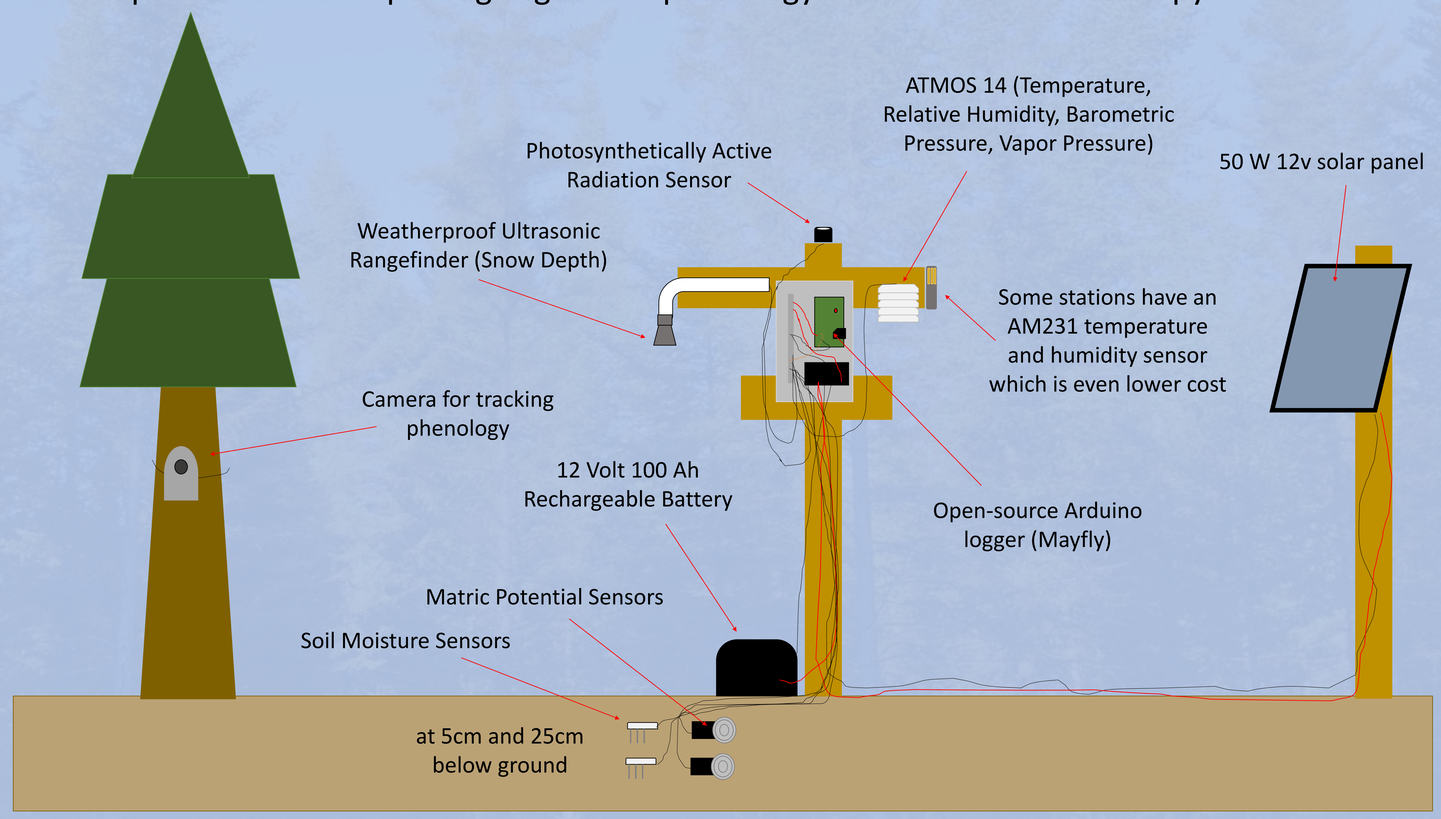


Figure 1. Distribution of sensor network. Sites host different numbers of stations: Vermont Commons School (1), Nulhegan Basin (3), Clements woodlot (9), Second College Grant (2), Bartlett (1), Thompson Farm (1), Van Buren (1), Debouille (1), Maine Woods Initiative (2), Penobsccot Forest (2), Schoodic Institute (1).

Sensor Suite Layout

The sensor suite features instruments for measuring air temperature, relative humidity, photosynthetically active radiation, soil temperature, soil moisture, and snow depth, as well as a time-lapse camera for capturing vegetation phenology beneath the forest canopy.



Building the Network

Alix Contosta (UNH) demonstrating sensor wiring to Vermont Commons School students while building a station on school woodlands in Charlotte, VT.

Karin Rand (UVM) explaining the application of sensor networks in Corinth, VT for examining impacts of the emerald ash borer on Northern Forests as part of workshop and field tour for foresters and other natural resource managers.

Teachers from VT, NH, and ME assembling the solar panel for sensor station during INSPIRES teacher workshop at the Schoodic Institute, ME.

Preliminary Data

Sensors currently record hourly or half-hourly. Data is then downloaded from the SD card onsite. Initial data collection shows differences across a subset of sites (Fig 2).

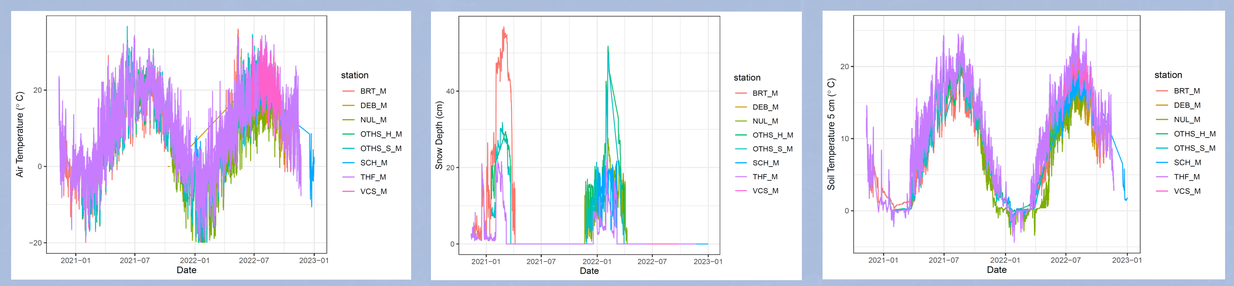


Figure 2. Preliminary data from a subset of sites showing time series of air temperature, snow depth, and soil temperature at 5cm below ground from late winter 2019 to late fall 2022

Future Goals

- Continue to grow the network
- Add new sensors for soil respiration and dendrometry
- Clean and analyze incoming data
- Support teachers in using large datasets in STEM curriculum