

A Distributed Sensor Network to Monitor Soil Responses to Climate Change

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"Support for the NH EPSCoR Program is provided by the NSF Experimental Program to Stimulate Competitive Research (EPSCoR) program Research Infrastructure Improvement Award # EPS 1101245."

Project goals

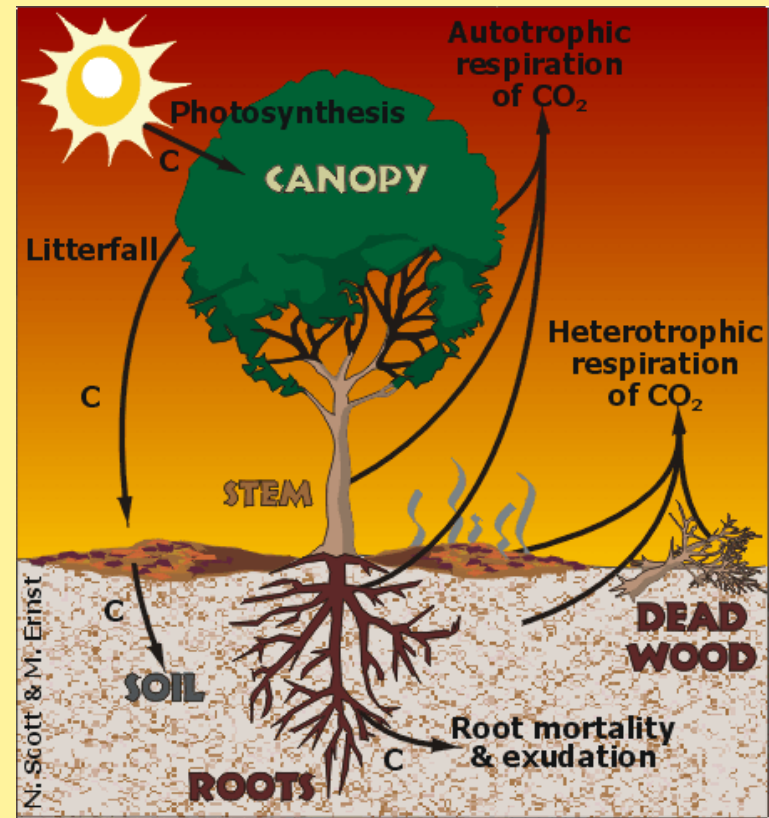
Establish a state-wide network of terrestrial and aquatic sensors to:



- To examine how soil properties and processes change spatially and temporally as climate in the region changes
- Link soil processes to water chemistry parameters
- Provide input to ecosystem models used to predict how ecosystems in the region will respond to climate and land-use change.

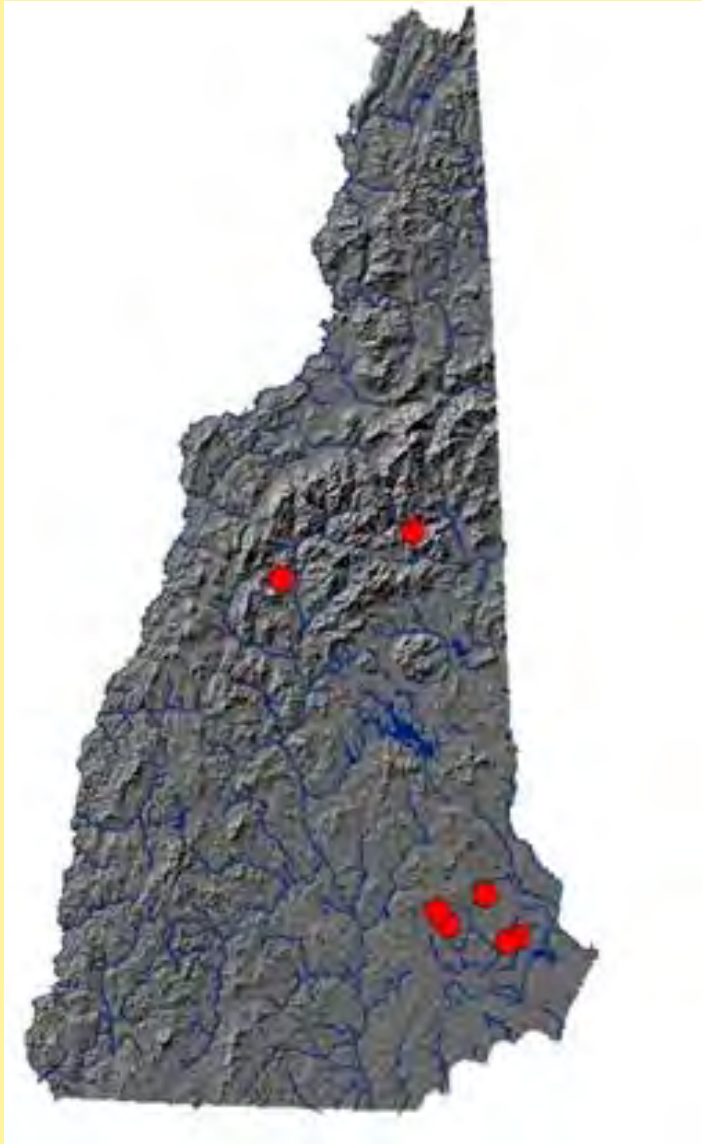
Climate Change impacts:

- Temperature
 - Soil moisture content
- ↓
- Microbial activity & soil solution chemistry
- ↓
- Cycling of nutrients
- ↓
- Drainage & runoff
- ↓
- Aquatic systems



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Sensor Network sites



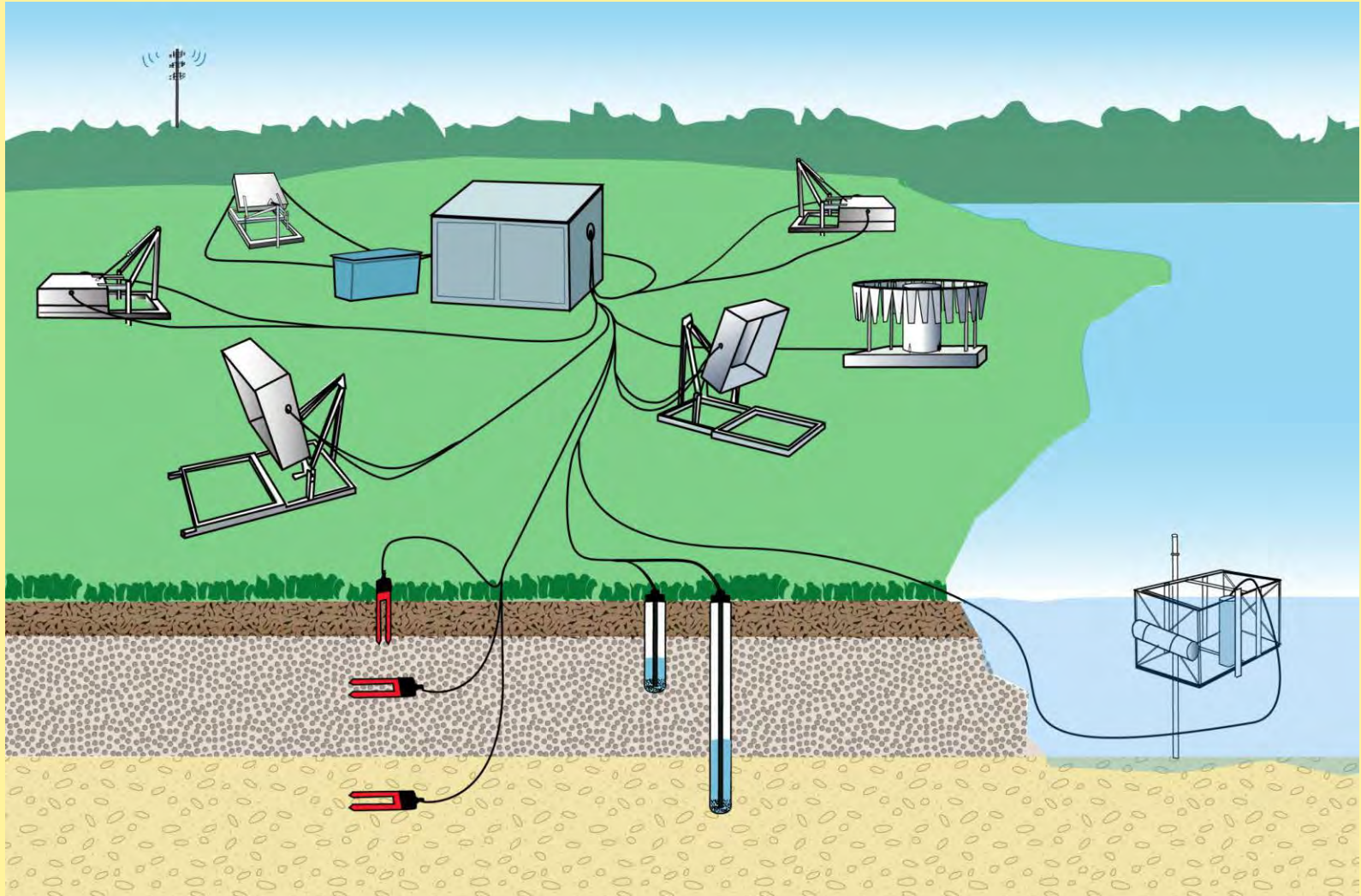
Locations:

- White mountains (2)
- Mid-transitional forests (1-2)
- Seacoast (4)

Land use types:

- Forested sites
- Agricultural sites
- Wetland site

Soil sensor system diagram



Artwork by: Janice Farmer



Soil Sensor Network Objectives:

1. Monitor soil carbon (C) & nitrogen (N) pools and fluxes with changing climate in the state of New Hampshire.
 - High temporal resolution
 - Extensive spatial scales



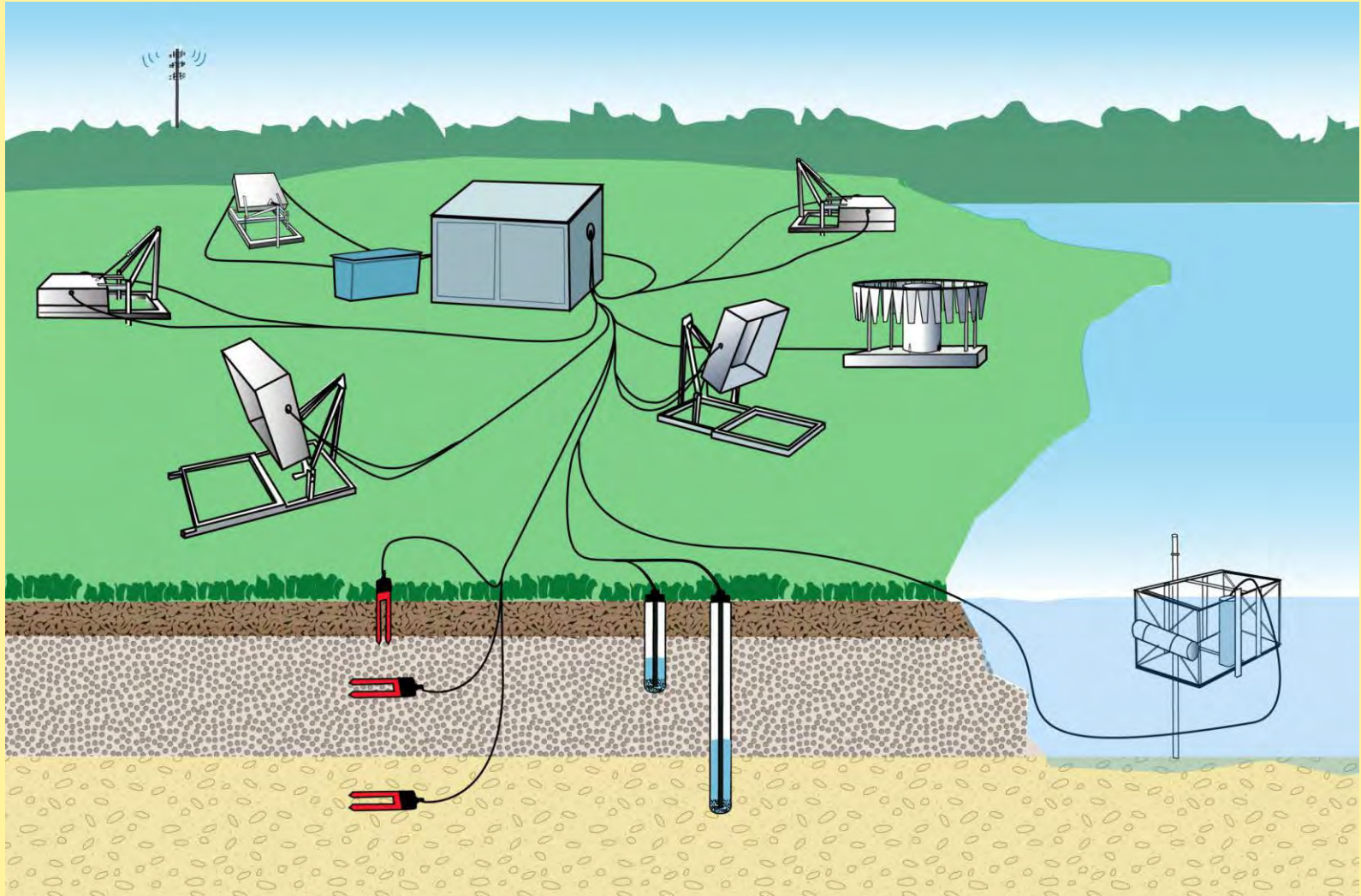
Soil Sensor Network Objectives:

2. Make data available to the public in near real time for scientific purposes and as an outreach tool for different stakeholder groups.

- Soil scientists
- Environmental modelers
- School lesson plans

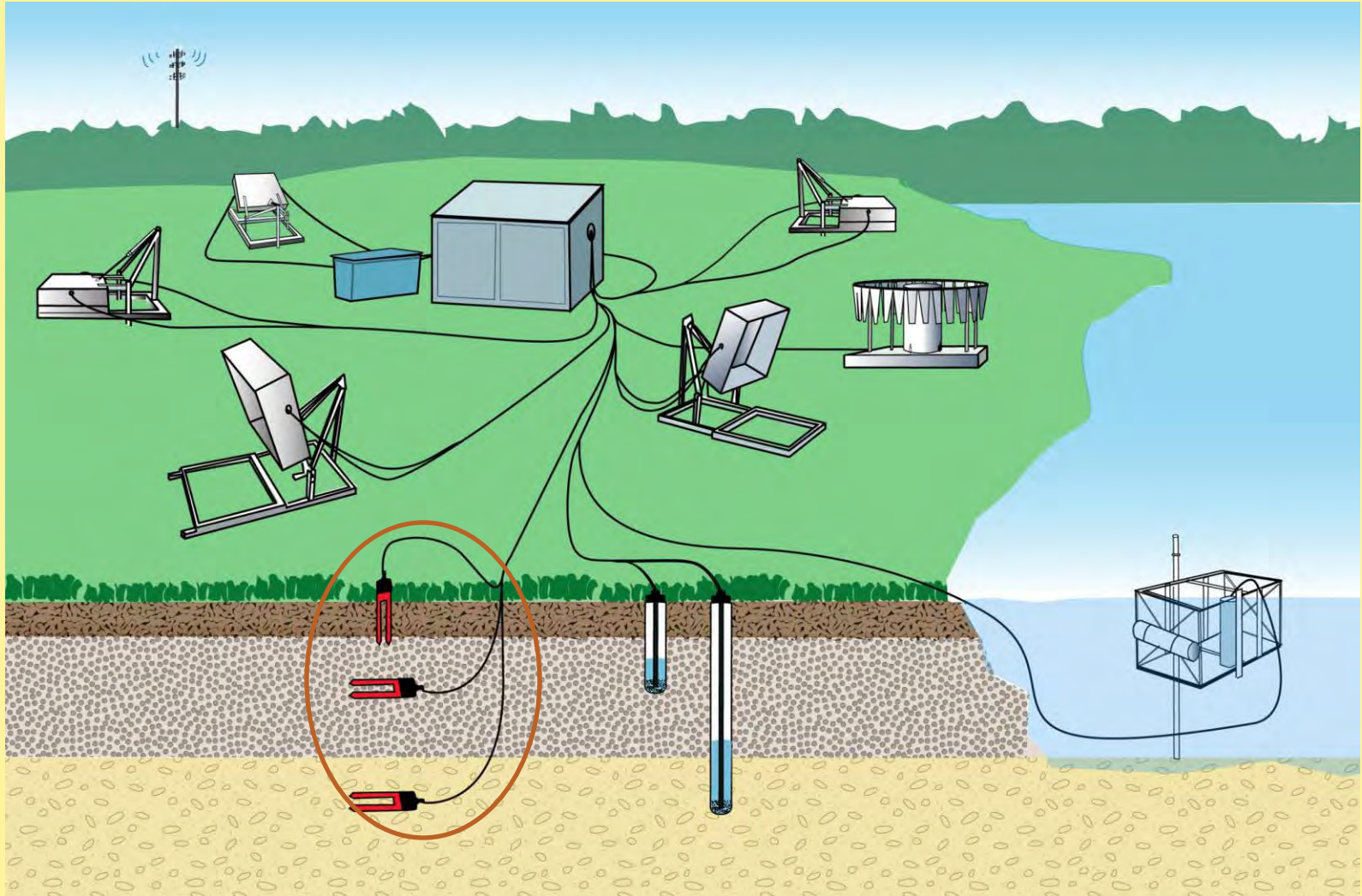


Soil sensor system diagram



Artwork by: Janice Farmer

Soil sensor system diagram



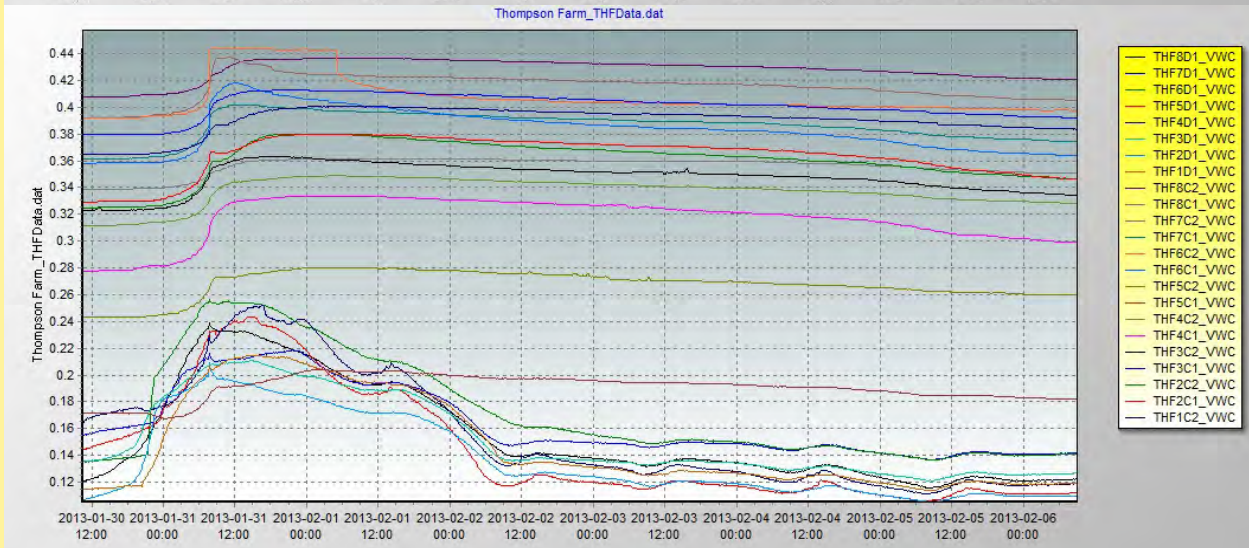
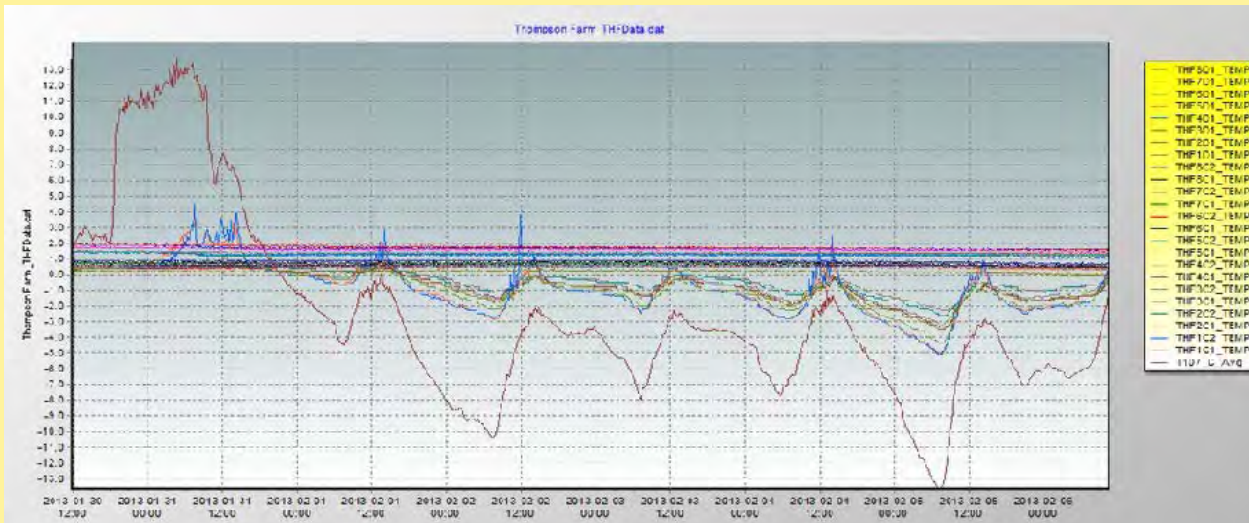
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Automated sensors

- Soil temperature
 - Water content
 - Electrical conductivity
-
- Soil surface
 - 15 cm
 - 30 cm

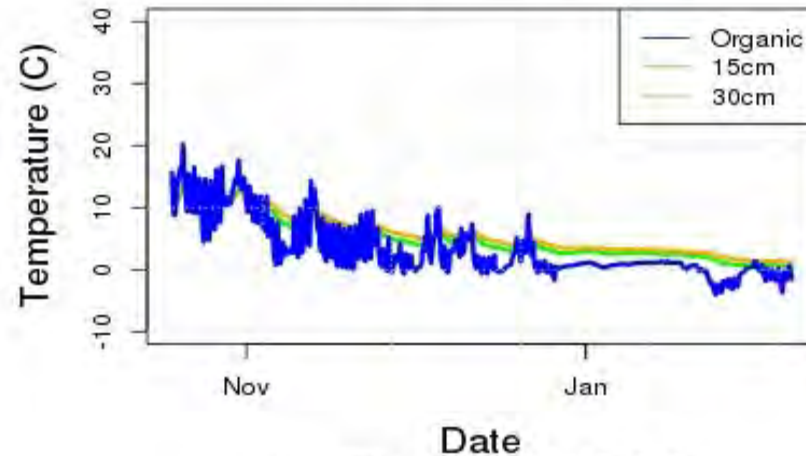


Raw data output



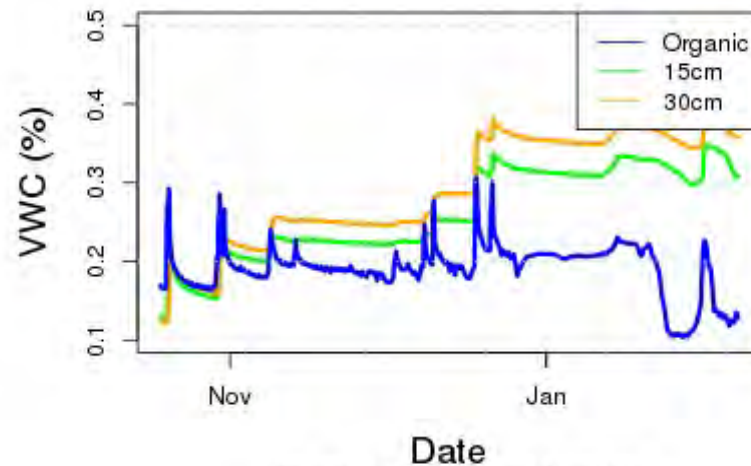
Online data

Thompson Farm: Temperature



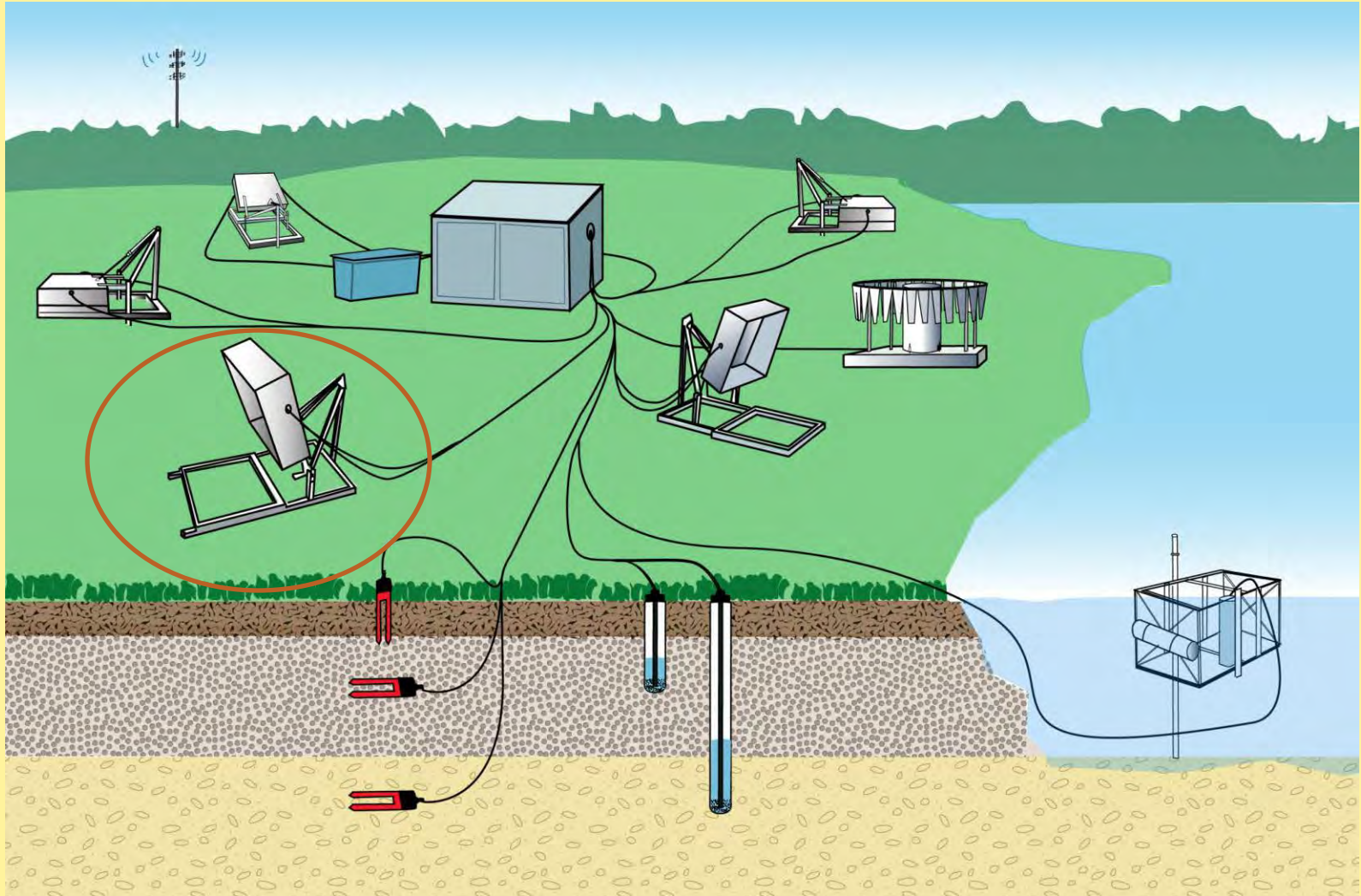
Last updated 2013-02-06 23:40:00

Thompson Farm: VWC



Last updated 2013-02-06 23:40:00

Soil sensor system diagram



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Soil respiration

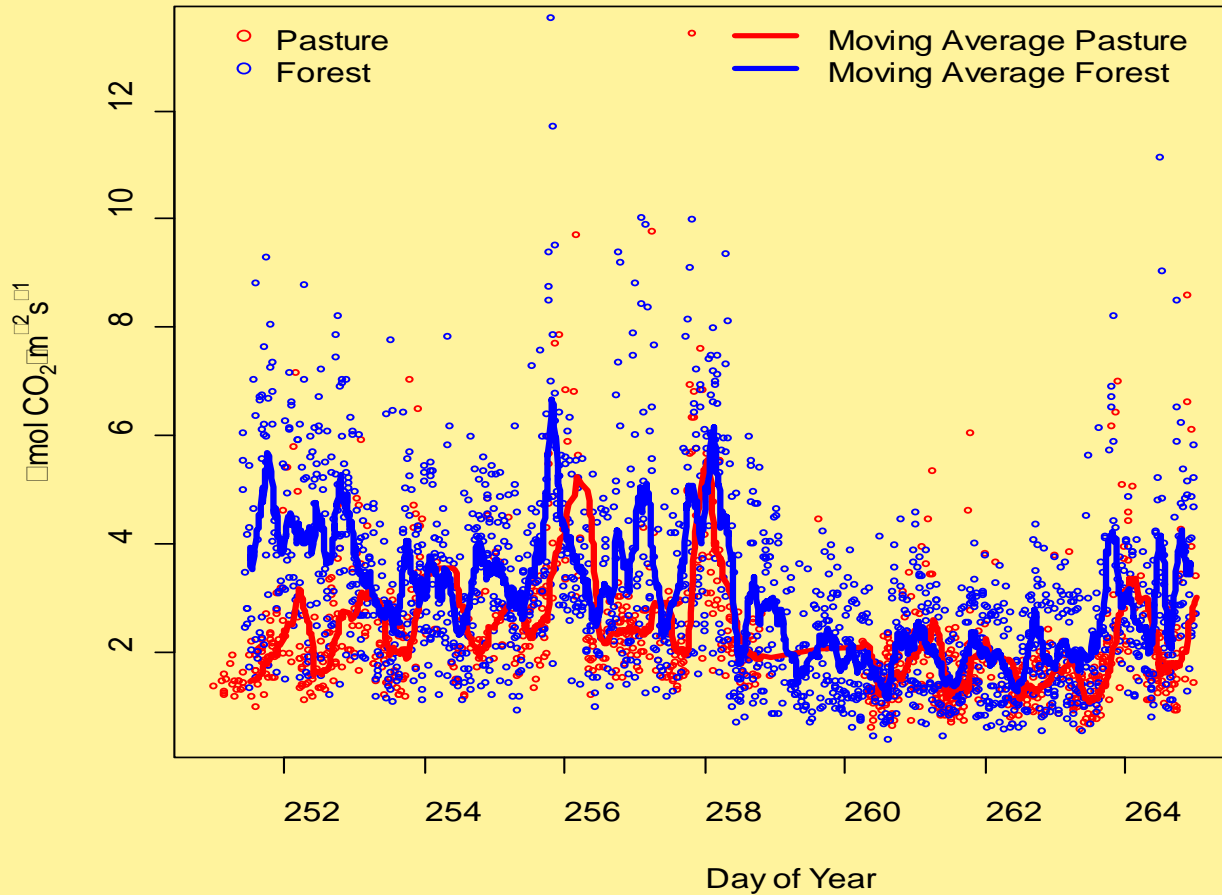
- Monitored using automatic sampling chambers
- Quantify the CO_2 flux from the soil to the atmosphere
- Creates a “mini” atmosphere inside the chamber where CO_2 builds up
- Sample is then pumped to an infrared gas analyzer to determine the change over time



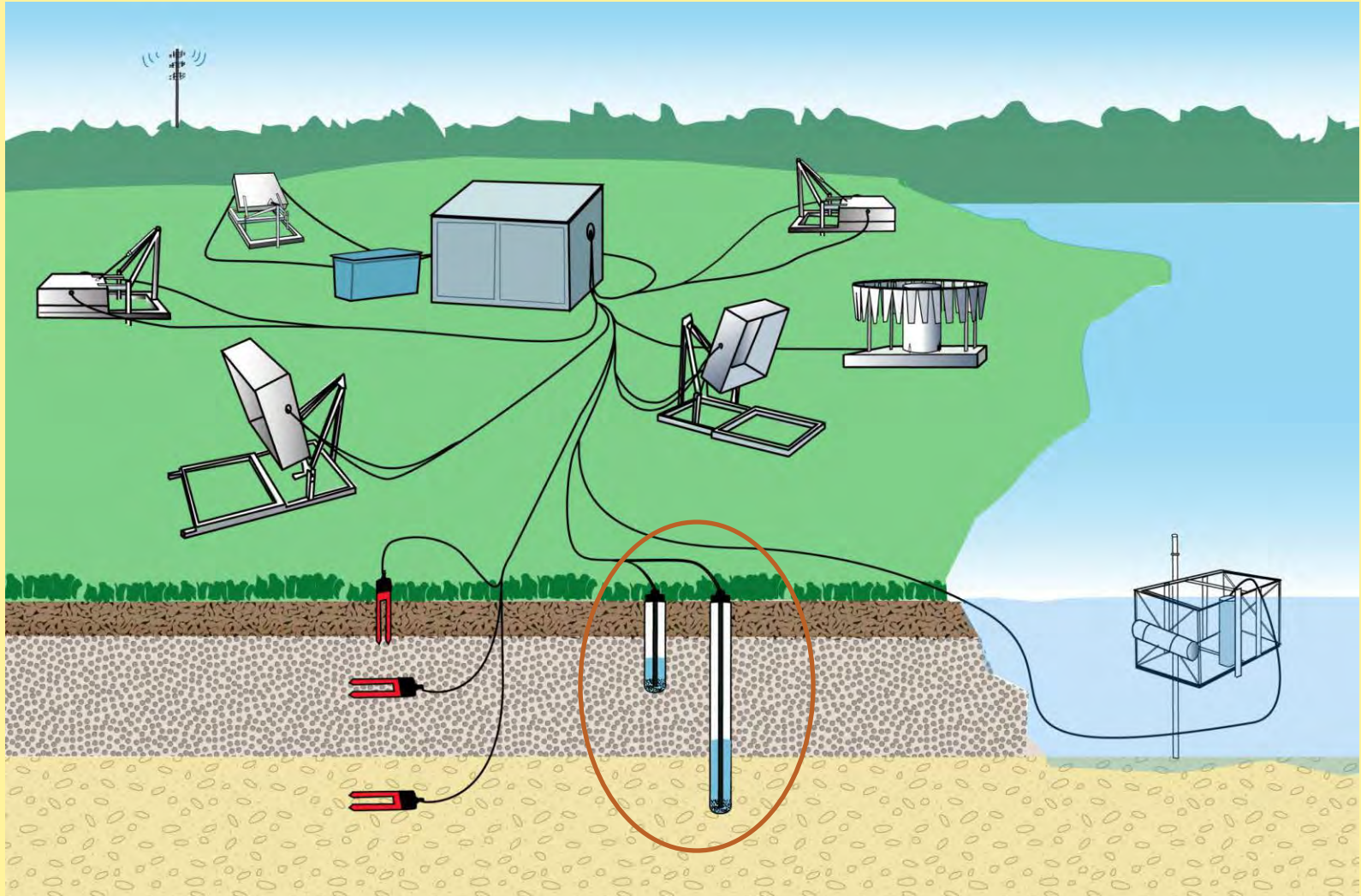
Chamber & Sensor Installation



CO₂ Flux data



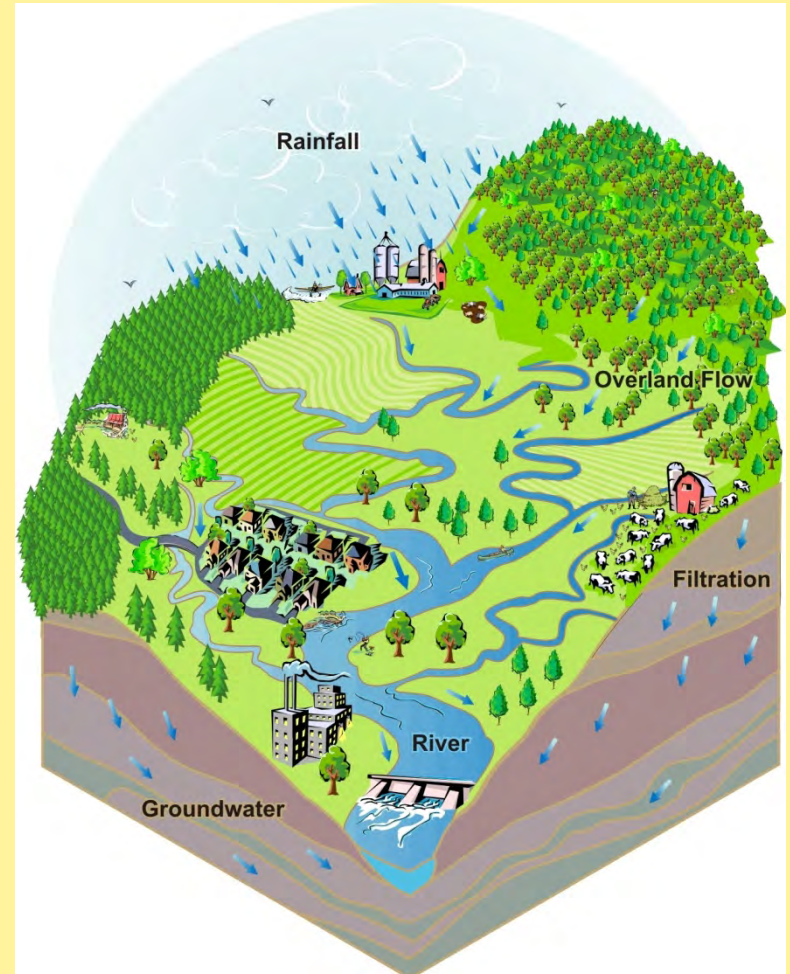
Soil sensor system diagram



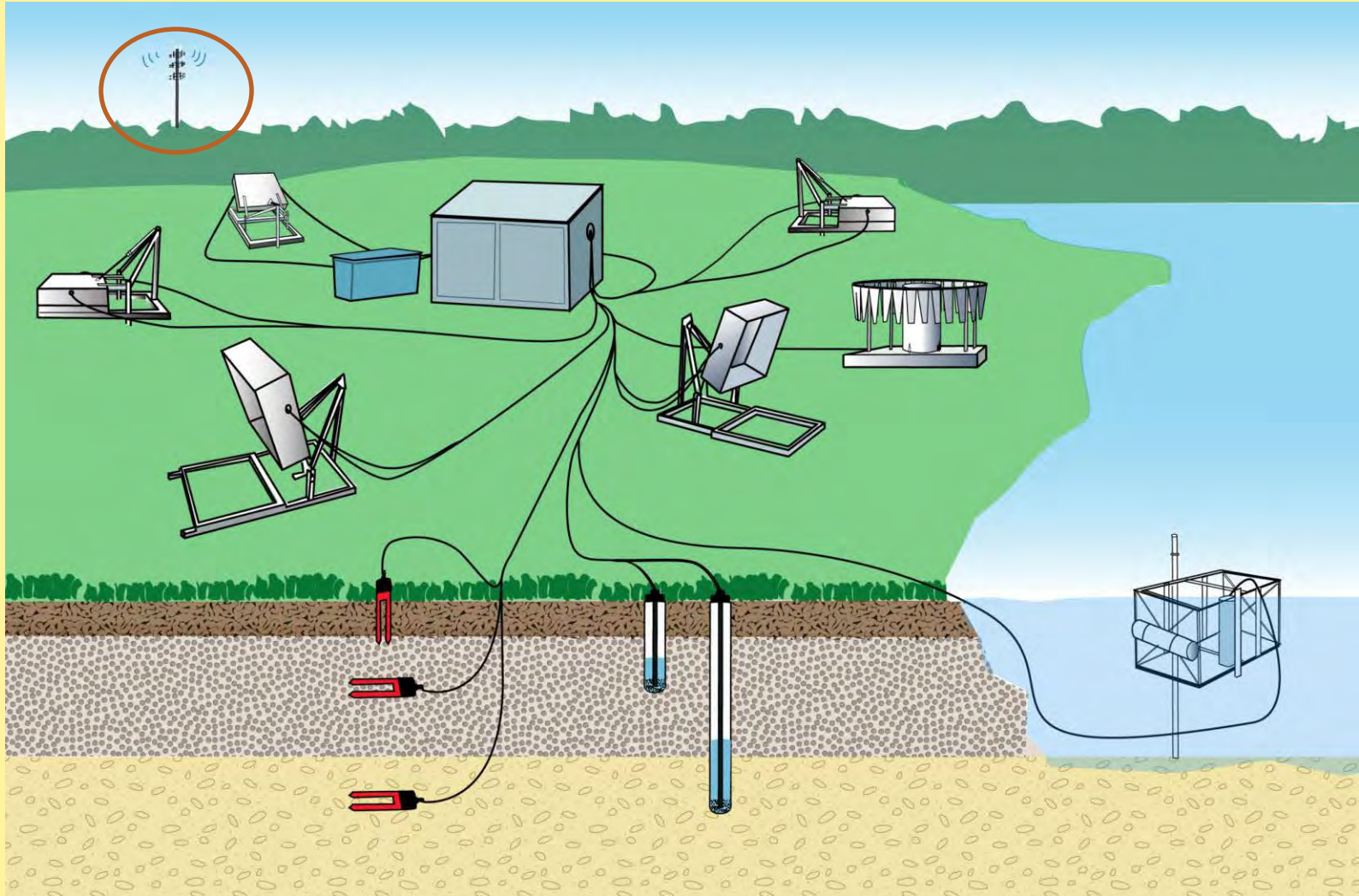
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Linking Terrestrial and Aquatic Processes

- Soil dissolved organic matter will be quantified by lysimeters
- Compare and contrast soil water chemistry to that measured by nearby stream sensors



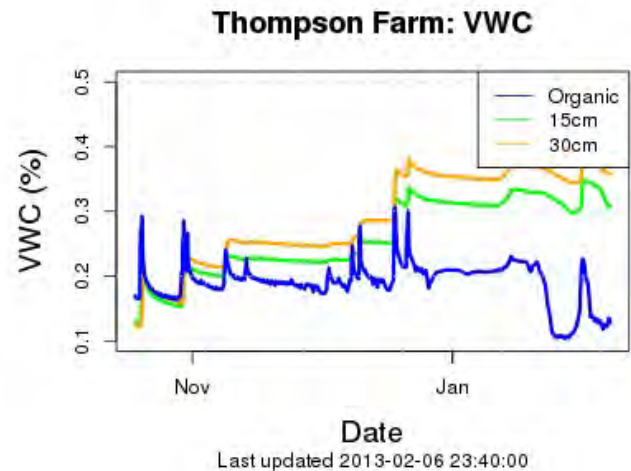
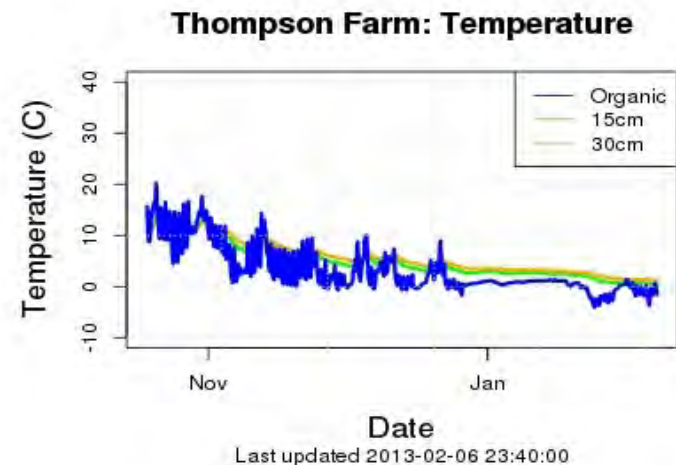
Soil sensor system diagram



Artwork by: Janice Farmer

Telemetry

- Data is sent from a cell phone modem back to UNH
- Stored on server
- Quality control
- Data analysis
- Pushed to the web for visualization every hour

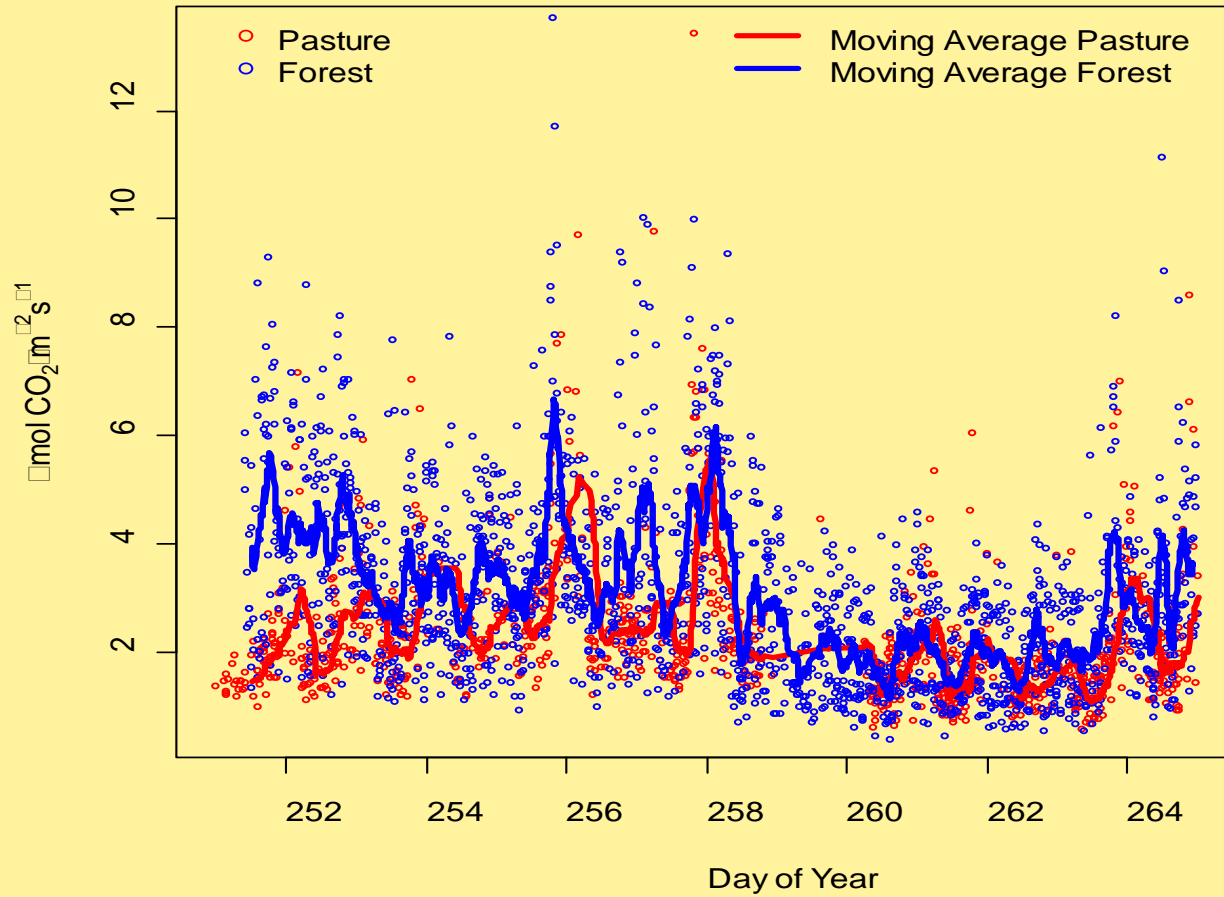


In situ sensors

- Advance current data collection
- Snapshots
- High resolution continuous streams
- Temporal variations
- Data interpretation
- Saves time, money
- Sampling in winter



CO₂ Flux data



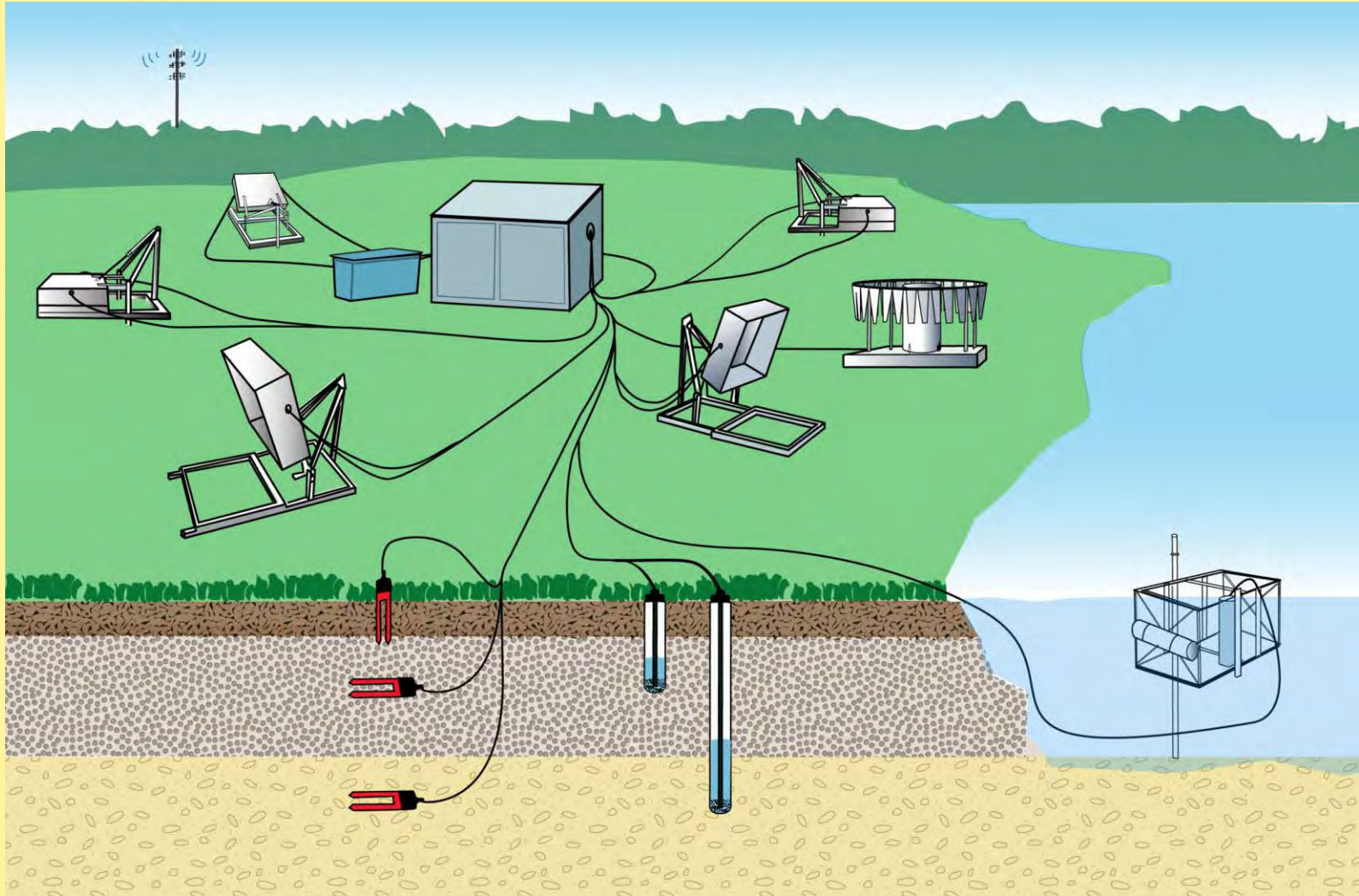
Total Soil organic Carbon and Nitrogen



- Assessed by collecting soils from network sites
- Soils are sampled to a depth of 50 centimeters (cm) and analyzed for moisture, bulk density, pH, texture, and total C & N concentrations.

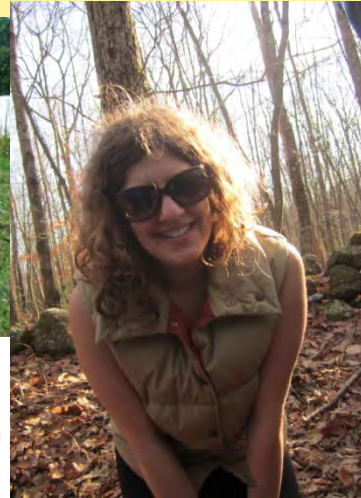


Soil sensor system diagram



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Questions?



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