HARVARD FOREST
HARVARD UNIVERSITY
Established 1907 Long Term Ecological Research Site since 1988

Harvard LTER Schoolyard Program

Teacher Developed Lessons and Documents that integrate Harvard Forest Schoolyard Ecology Themes into curriculum.

- Lesson Title: Introducing our newest project, "Our Changing Forests"; Notes from a Schoolyard Teacher
- Teacher/Author: Melanie McCracken, Pamela Snow
- School: Groton-Dunstable High School
- Level: High School
- Date: March, 2014

Harvard Forest Schoolyard Ecology

Introducing our Newest Project:

Our Changing Forests

Pamela Snow, Harvard Forest
Melanie McCracken, Groton-Dunstable H.S.

HF-LTER Schoolyard Ecology

Real Science - Real Scientists - Real Issues

- **Research Projects**. Over 3,500 Students currently participating in authentic, field-based research projects.
- **Professional Development Workshops** and Online Resources. Teacher are given direct access to the expertise of Harvard Forest ecologists.
- **Schoolyard LTER Database**. Submit, Download and graph data online.

Existing Schoolyard Projects
2004-2014

- Buds, Leaves & Global Warming

  John O'Keefe, Project Ecologist
- Woolly Bully: The Invasive Pest, the Hemlock Woolly Adelgid

  David Orwig, Project Ecologist
- Water in the Landscape: Vernal Pools

  Betsy Colburn, Project Ecologist

Our Changing Forests

Protocol Development Team

- David Foster

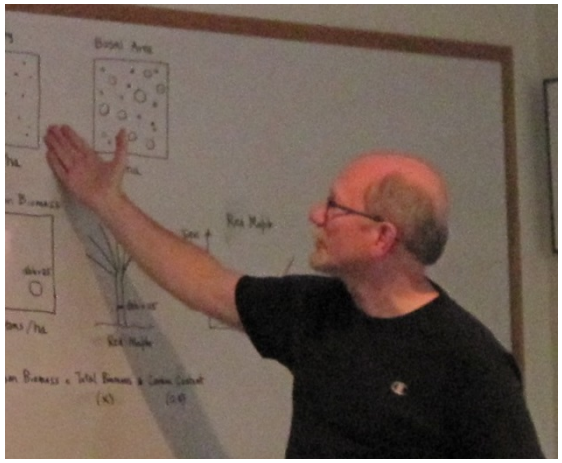
Director, Harvard Forest

- David Orwig

  Forest Ecologist

Edward Faison

Highstead Ecologist



Emery Boose

Information Manager

- Clarisse Hart, Director

  Education and Outreach

- Jennifer Albertine

  Project Coach

- Pamela Snow Schoolyard

  Ecology Coordinator

Teachers

Briana Brown
Brookline H.S.

Bill VanValkenburg
Gardner H.S.

Nick Kostich
Oakmont H.S.

Wayne Kerminski
Mohawk H.S.

Sharon McDonald
Athol H.S.
and
Melanie McCracken
Groton-Dunstable H.S.

August 2013: Summer training workshop at Harvard Forest

Dr. Albertine came out to GDRHS in late August to help set up the initial plot. First we measured out the 10 X 10 meter area and then we marked the corners with pvc pipe.

10 meter by 10 meter plot close to the school for easy access.

location of study area

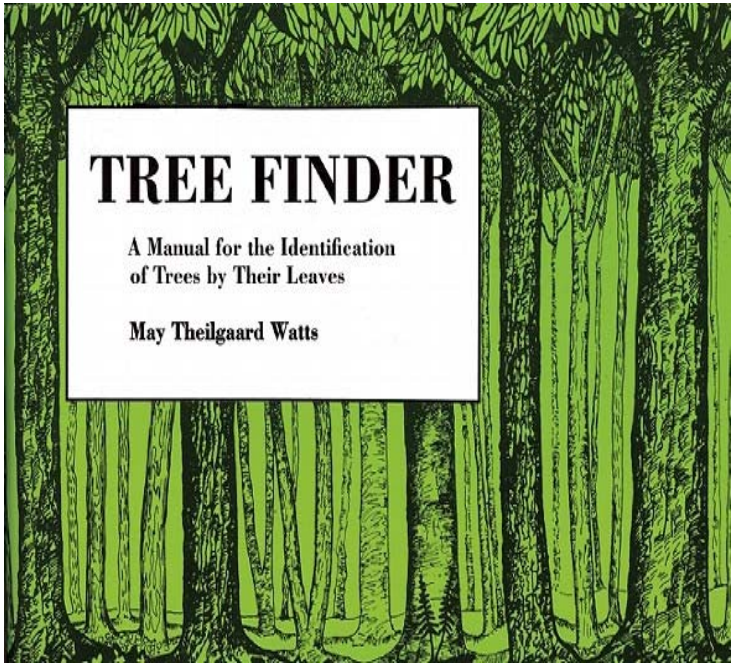
Next she and I identified some of the major species in the plot- red maple, scrub oak, hemlock and white pine

All the trees greater than 2.5 cm were diameter tagged with a metal marker. Then it was time to bring out the kids.

Dr. Albertine came out for the second time to help introduce three classes of from 18 to 25 students, to the site.

Students worked in groups of 3. They each had clipboards, id books, and shared the dbh tape and dbh stick.

Identifying Trees



Includes native and commonly introduced trees of the U.S. and Canada east of the Rockies and north of Florida.

By May Theilgaard Watts.
Website for the "Finder Series" of Dichotomous Keys

I recommend this inexpensive pocket dichotomous key. Students find these keys easy to use.


SOFTBALL

Harvard Forest Schoolyard Ecology
Our Changing Forests

Field Site Description Sheet

School Name: Groton Dunstable Reg Date (month, day, year): Sept. 18, 2013
Teacher Name: Mrs. McCracken
Plot ID Plot 1
Time Start:_____ Time End_____

Plot Location: *County* Middlesex *State* MA *Coordinates*: Lat_____
Long_____
*Additional Directions to Plot:*_____

Topography/Physical Features:

1. ***Landscape position*** – Check one:
   ☐ ridge/hilltop ☐ hillside ☑ dry flat ☐ wet flat ☐ rolling upland
2. ***Aspect*** ____°
3. ***Slope*** – Check one:
   ☑ none ☐ slight ☐ moderate ☐ steep
4. ***Rock Cover in Plot*** – Check one:
   ☑ <1% ☐ 1-5% ☐ 6-25% ☐ 26-50% ☐ 51-75% ☐ >75%
5. ***Water in Plot*** – Check one or more:
   ☐ stream ☐ temporary stream ☐ flooded area ☐ vernal pool

Forest Canopy Characteristics:

1. ***Canopy Cover Estimate:*** Check one
   ☐ 10-25%, ☐ 26-50%, ☐ 51-75%, ☑ 76-100%

Evidence of Disturbance:

1. ***Forest Pests and Pathogens in Plot***: Check one or more:
   ☐ Hemlock Woolly Adelgid ☐ Gypsy Moth ☐ Ash Yellows
   ☐ Asian Long-horned Beetle ☐ Beech Bark Disease ☐ Emerald Ash Borer
   ☐ Hemlock Borer ☐ other_____
2. ***Human Activity in or Near Plot***: Check one or more
   ☐ cut stumps ☑ footpath ☐ stone wall ☐ other_____
   ☑ forest road ☐ building ☐ cellar hole
   ☐ barbed wire ☐ Open Field ☐ skid trail
3. ***Weather Events in or Near Plot***: Check one or more
   ☐ uprooted trees ☑ snapped trees ☐ large downed branches
   ☐ fire scars ☐ river flooding ☐ other_____
4. ***Downed Woody Debris Cover in Plot*** (pieces at least 10 cm in diameter): Check one:
   ☐ <1%, ☐ 1-5%, ☑ 6-25%, ☐ 26-50%, ☐ 51-75%, ☐ >75%
5. ***Wildlife Sign in Plot*** Check one or more
   ☐ deer pellets ☐ moose pellets ☐ deer/moose browsing
   ☐ moose bark-stripping ☐ deer antler rubs ☐ tree girdling [porcupine]
   ☐ beaver felled trees ☐ woodpecker holes ☐ bear claw marks on beech
   ☐ rabbit/porcupine browse ☐ other_____
6. ***Invasive Plant Species in Plot***: Check One or More: ☐ other
   ☐ Garlic Mustard ☐ Oriental Bittersweet ☐ Japanese Barberry
   ☐ Burning Bush ☐ Multiflora Rose ☐ Honeysuckle (shrub/Vine)
   ☐ Autumn Olive ☐ Buckthorn ☐ Japanese Stilt Grass

**Note student left out information

Beaver sign in plot

Harvard Forest Schoolyard Ecology

Our Changing Forests

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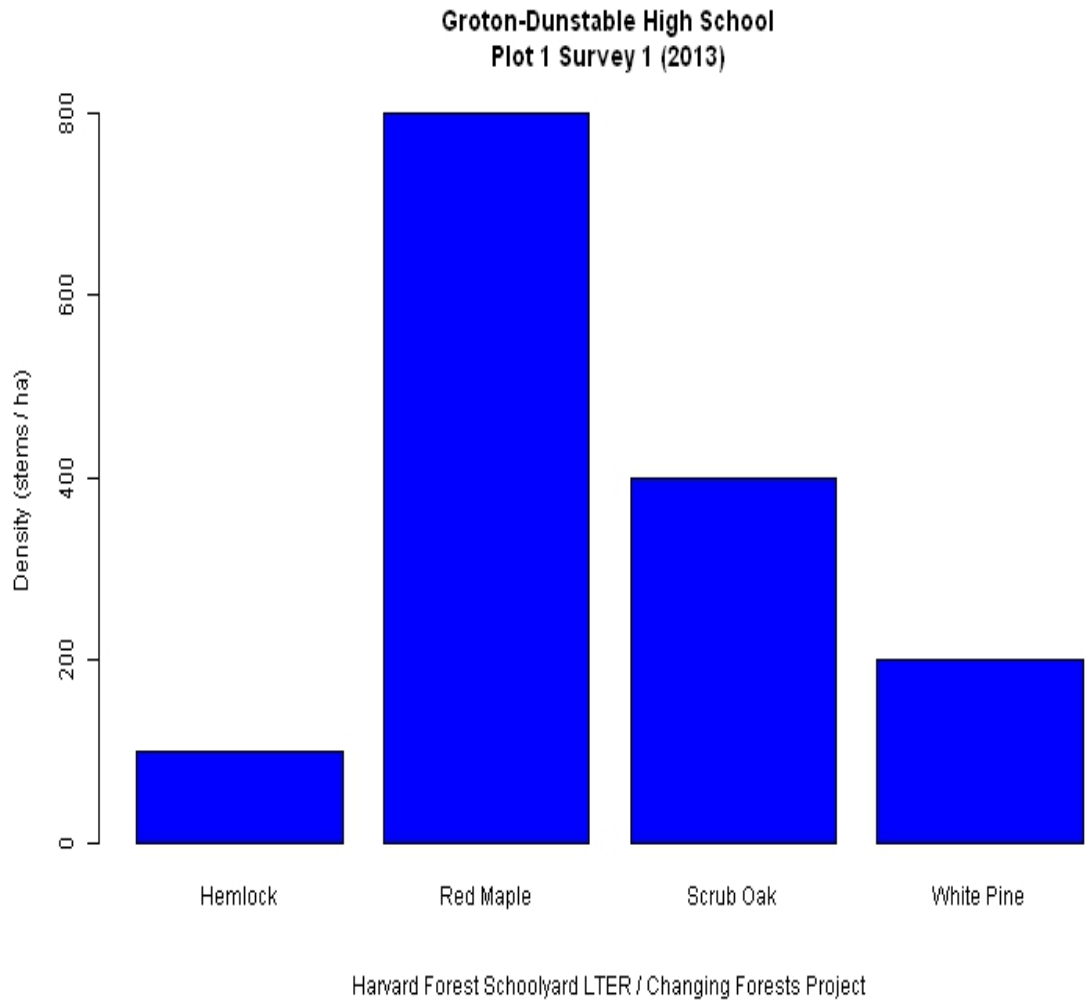
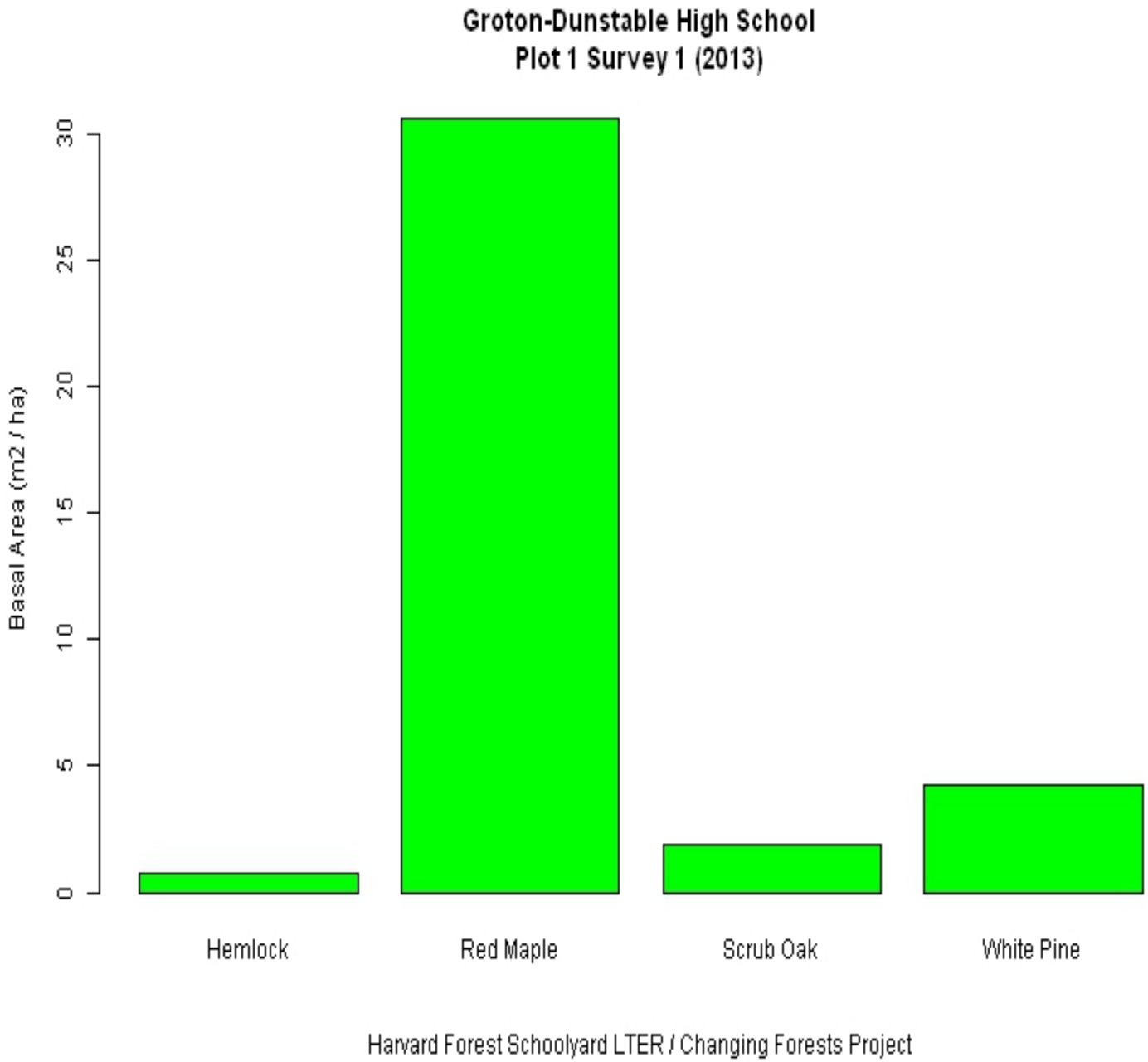
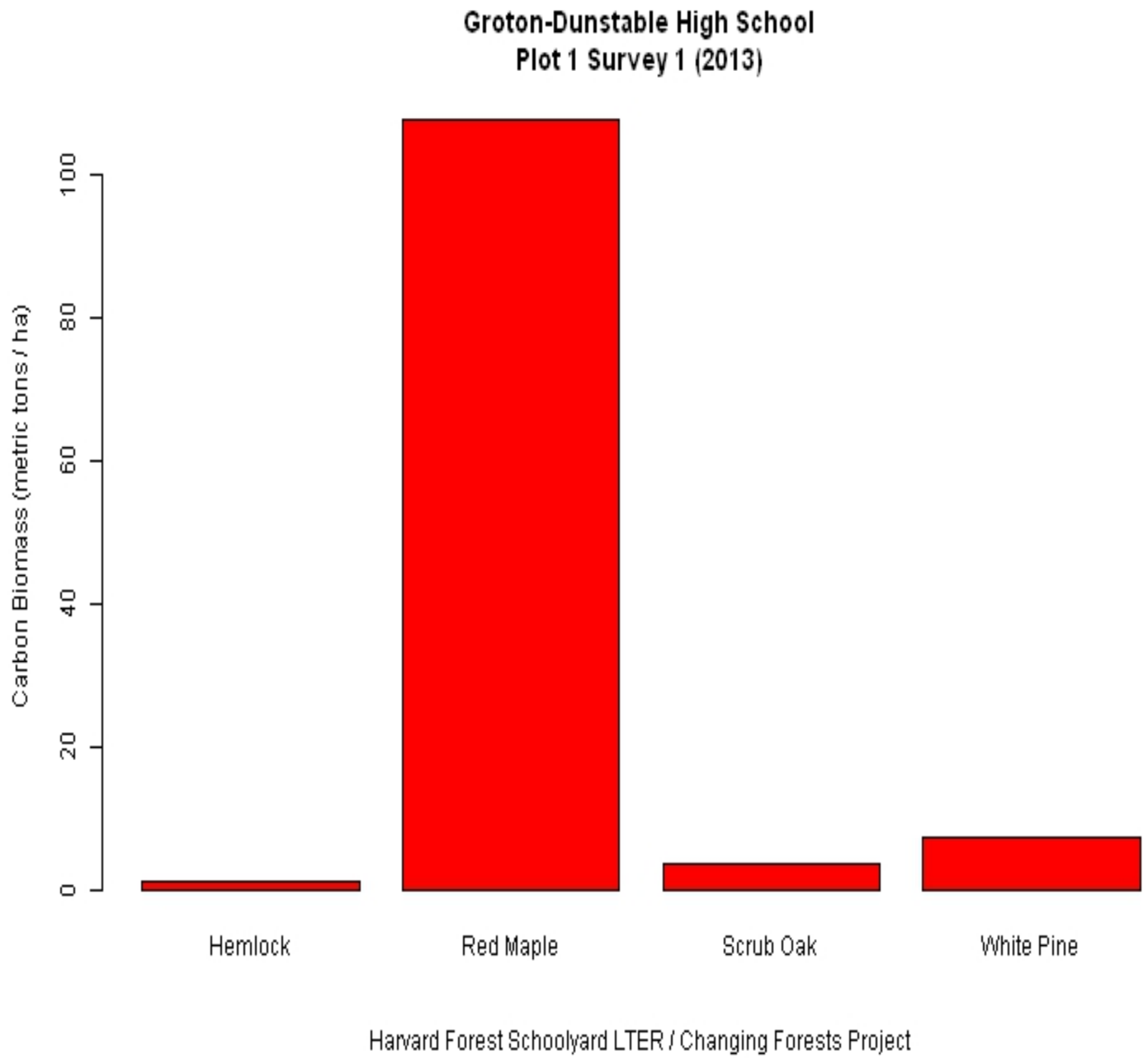
Tree Identification Number	Tree Species	Diameter at Breast Height (DBH) Record all stems ≥ 2.5cm DBH	Condition (living, dead)
89	scrub oak	6.2	living
88	red maple	57.8	living
96	red maple	8.9	living
90	red maple	4.5	living
99	scrub oak	10.7	living
100	scrub oak	3.5	living
94	White Pine	9.1	living
95	~~Eastern Hemlock~~ WP	21.5	living
92		24.2	dead
85	red maple	4.9	living
86	red maple	6.3	living
93	Eastern Hemlock		living
97	red maple	9.2 cm	living

Students can use graphing tools on the Harvard website to compare basal area, stand density and carbon biomass after data has been submitted.




Groton-Dunstable High School
Plot 1 Survey 1 (2013)
Basal Area (m2 / ha)
0
5
10
15
20
25
30
Hemlock
Red Maple
Scrub Oak
White Pine
Harvard Forest Schoolyard LTER / Changing Forests Project


Groton-Dunstable High School
Plot 1 Survey 1 (2013)
Carbon Biomass (metric tons / ha)
0
20
40
60
80
100
Hemlock
Red Maple
Scrub Oak
White Pine
Harvard Forest Schoolyard LTER / Changing Forests Project

Alternatively students can use dbh to calculate basal area, and carbon biomass

Units: biomass = kilograms, dbh = centimeters

Biomass (metric tons) = biomass (kilograms)/1000

Carbon biomass = 0.5 * biomass

Default = red maple if biomass equation not available

Acer pensylvanicum (ST) biomass = (exp(7.227+1.6478*log(dbh/2.54)))/1000

Acer rubrum (RM) biomass = 0.1262*(dbh^2.3804)

Acer saccharum (SM) biomass = 0.1008*(dbh^2.5735)

Betula alleghaniensis (YB) biomass = 0.1684*(dbh^2.4150)

Betula lenta (BB) biomass = 0.0629*(dbh^2.6606)

Betula papyrifera (WB) biomass = 0.0612*(dbh^1.6287)

Betula populifolia (GB) biomass = 0.1564*(dbh^2.3146)

Betula spp. (RB) biomass = 0.0629*(dbh^2.6606)

Castanea dentate (CH) biomass = 2.204*(exp(0.95595+2.4264*log(dbh/2.54)))

Fagus grandifolia (BE) biomass = 0.1967*(dbh^2.3916)

Students learn:

How to look closely at an outdoor site

How to measure DBH and identify common tree species

What field ecology is like and one way to measure change in a forest

About stand density and basal area and how they relate to carbon biomass

How fun it is to go outside!