POCKET FOREST MONITORING AND CITIZEN SCIENCE DATA COLLECTION PROTOCOL

PURPOSE
(WHY ARE WE MONITORING THE POCKET FOREST AND COLLECTING SCIENTIFIC INFORMATION?)
The purpose of monitoring the Pocket Forest is twofold.

1. **Pocket Forest Health Monitoring**: The first is to ensure that the planted forest continues to thrive over the next few years. If some of the plantings are failing to thrive, we want to catch the problem early and take measures to change direction or if practical, correct the situation. Common problems include:
   - Temporary microclimate issues during establishment (overly dry or droughty conditions)
   - Invasive species crowd natives and climate-adapted non-invasive species out
   - Damage from herbivores
   - Insect or pest infection
   - Damage from humans
   - Storm damage

2. **Citizen Science Data Collection:** The second is for citizen scientists to collect vegetative, soil, hydrologic, and wildlife data that can be analyzed over time to learn about our Pocket Forest.
   a. How is it developing?
   b. How quickly are plantings growing?
   c. How quickly are soil horizons developing?
   d. How resilient is it (or not) to dry or droughty conditions?
   e. How resilient is it (or not) to storm damage?
   f. Are there particular threats (pests, invasive species, herbivores, people) that are most problematic at this particular location?
   g. How quickly is soil carbon accumulating?

WHEN ARE WE DOING THE MONITORING?
Full Pocket Forest Health Monitoring and Citizen Science Data Collection should be done twice per year, once in early June, and once on or around September 15th. However, not all data will need to be collected at each visit. The instructions below provide information regarding what data to collect and when. In addition to these data collection efforts, a monthly maintenance check should be conducted. Some limited data can be collected as part of the monthly maintenance checks.

Monthly Maintenance Check
Using the **Pocket Forest Maintenance Guide**, a maintenance team should check the pocket forest monthly for the first three to five years, but full data collection would not be needed each month. The monthly maintenance team would check to see that:
   - no major damage has occurred (no major die-offs, no major pest outbreaks, etc.)
   - the perimeter fence is fully intact
   - watering is being done if it is needed

- the water barrels are full and the drip lines are functional

The monthly maintenance team could do optional observations (keeping notes in a team notebook), such as:
- Record temperature
- Are hydrologic conditions normal, dry/droughty, or excessively wet?
- Any major storms recently?
- What month/week do the leaves come out?
- What month/week do the leaves drop off?
- What wildlife and bird life are observed?
- Collect a soil moisture reading

HOW DO WE DO THE MONITORING AND CITIZEN SCIENCE DATA COLLECTION?

This monitoring protocol is designed to be accessible to middle and high school students and adults. The monitoring instructions and citizen science data sheets provided should be used collaboratively with the **Pocket Forest Maintenance Guide**. The observations made during monitoring will help inform the maintenance activities that are needed. The pocket forest health monitoring should take a team of one or two people an hour or less to accomplish. The citizen science monitoring/data collection should be able to be accomplished by a team of four people (two pairs) in about an hour or so. Each pair will include an observer and a scribe. The observer will take the measurements and samples and do the counting and will call out the information to the scribe who will write the information down on the data sheet. One pair will collect the vegetation and wildlife data, and the other pair will collect the soils data. Whichever team finishes first will collect the general information.

MATERIALS NEEDED

Data sheets
Notebook
Camera
Pens/pencils
Sharpie markers
Neon flagging tape to flag invasive species
Tape measure at least 30 feet long
1-square meter PVC monitoring frame
DBH tape
Digital calipers
Soil moisture sensor
Soil pH meter
Soil temperature probe
Light meter
Drain spade-style shovel for collection of soil samples for soil testing
Trowel
Quart-sized ziplock bags
Gardening gloves if you want them

Tree, Shrub, and Herbaceous Plant Guidebooks or apps
Invasive Species Guides

Species identification Apps and Links such as:
iNaturalist
Merlin (for bird identification)
IPANE – Invasive Plant Atlas of New England (https://www.invasive.org/weedcd/html/ipane.htm)

DEFINITIONS
Diameter at breast height/DBH: Diameter of woody vegetation at 4.5 feet above ground surface.

Below is a list of information to be collected by citizen monitors/citizen scientists. The intent is for data collection to take no more than 1 hour for the team as a whole, as discussed above.

INFORMATION TO INCLUDE ON MONITORING DATA SHEETS AND INSTRUCTIONS

GENERAL INFORMATION
Location: Ayer Devens Pocket Forest
Date
Name of Investigators
Temperature
Weather Today (sunny, rainy, cloudy, etc.)
Rain in the Past Week: Yes/No   If Yes, How much? See **Pocket Forest Maintenance Guide** for link to National Weather Service website and instructions on how to navigate the website.
Is Ayer in a Drought? Yes/No   If Yes, what Level?
Check Massachusetts Executive Office of Energy & Environmental Affairs Drought Status website:
https://www.mass.gov/info-details/drought-status
Have there been any recent (in the past month) severe storms, blizzards, hurricanes or tornados?

POCKET FOREST HEALTH MONITORING
It will be important to monitor the health of all the plantings and the integrity of the Pocket Forest site.
1. **Review POCKET FOREST MAINTENANCE GUIDE Prior to Visiting the Site**: Review the Pocket Forest Maintenance Guide to become familiar with how and when to complete various tasks, the equipment onsite, and maintenance methodologies.
2. **Plant Health Inspection**: This entails inspecting all of the plantings to see if any are damaged, dying or dead and taking remedial actions as needed and in accordance with the above-mentioned Pocket Forest Maintenance Guide.
3. **Perimeter Integrity Inspection**: Inspect the entire perimeter fencing and repair any gaps or broken sections. Check the bottom of the fence to ensure that no animals can get under it. See the above-mentioned Pocket Forest Maintenance Guide for details.

4. **Assess Watering Needs**: Per the above-mentioned Pocket Forest Maintenance Guide, determine whether or not watering is needed. Check to see if the rain barrels are full and request refills if needed. Check integrity of drip lines per the Pocket Forest Maintenance Guide.

CITIZEN SCIENTIST DATA COLLECTION

VEGETATION MONITORING

At the permanent data plots, collect the information listed below. Take photographs of each of the vegetative layers observed in the data plots.

For estimating percent cover, use the following Cover Range table, and record the midpoint values on your data sheet.

Cover Ranges	
Range	**Midpoint**
1-5 %	3.0 %
6-15 %	10.5 %
15-25 %	20.5 %
26-50 %	38.0 %
51-75 %	63.0 %
76-95 %	85.5 %
96-100 %	98.0 %

Herbaceous Layer
List herbaceous species and woody species less than 3.3 feet (1 meter) tall and their percent cover within a 1 square meter plot centered on the data plot center stake. Depending on the size of the site and time available, team can do more than one herbaceous data plot.

Shrub/Sapling Layer
List woody plant species less than 3 inches (7.62 cm) diameter at breast height (DBH) and greater than or equal to 3.3 feet (1 meter) and their percent cover within a 6-foot radius of the data plot center stake. Measure and record the DBH and height of each sapling in the data plot. You can use the digital calipers or the DBH tape (whichever is easier) to measure the DBH. If the sapling is shorter than 4.5 feet high (the DBH height), record the diameter at its widest point and record the height of that widest point. Record the percent cover (using mid-points) for each shrub species.

Tree Layer
List woody plant species 3 inches or more in DBH regardless of height and their percent cover within a 15-foot radius of the data plot center stake. Measure and record the DBH and height of each tree in the data plot. You can use the digital calipers or the DBH tape (whichever is easier) to measure the DBH. If the tree is shorter than 4.5 feet high (the DBH height), record the diameter at it's widest point and record the height of that widest point. Record whether your tree is located at the edge or the middle of the Pocket Forest. Trees located within 6.6 feet (2 meters) of the edge of the Pocket Forest are considered to be edge trees.

Woody Vines

List woody vines greater than 3.3 (1 meter) in height or length and their percent cover within a 15-foot radius of the data plot center stake.

Invasive and Weed Species

The data sheet will have a column to identify whether or not a species is native or non-invasive climate-adapted, or is an invasive or weed species that needs to be removed. Invasive and weed species can be removed by monitors after the monitoring tasks have been completed, or if there is not enough time, the monitor can note the location and mark the plants with flagging for removal at a later point (the sooner the better).

SOILS

Prior to visiting the site to do the soil sampling, read the soil lab testing protocols. Here is the link to the Cornell Lab soil testing protocols: https://bpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/7/9922/files/2021/11/01_CASH_SH_Series_Sampling_Protocols.pdf

Record pH, using the **pH meter.** Using the pH meter, collect two readings, one at 10 centimeters, one at 30 centimeters. Take a reading at each of the plot centers.

Record soil moisture using a **soil moisture meter/probe.** Push probe into ground all the way, typically 30 centimeters or as specified by the model you are using. Link to digital soil tester/meter/probe supplier: https://www.amazinggarden.net/products/4-in-1-digital-soil-tester?variant=39386463895735 Take a reading at each of the plot centers.

Record **soil temperature** and **take a light meter reading**. Take a reading at each of the plot centers.

Collect 5 soil samples at five locations in the Pocket Forest once during the first spring after planting (I.e. spring of 2024) and once every other year after that. Follow the soil sampling protocols provided by the soil lab that you select and send to the soil lab. Collect the 5 soil samples in a "W" or "M" pattern covering the Pocket Forest area, with samples taken at each of the five points on the letter, as shown on the Cornell Soil Lab sampling protocol link above and in the image below from Cornell Soil Lab Fact Sheet Number 16-01:
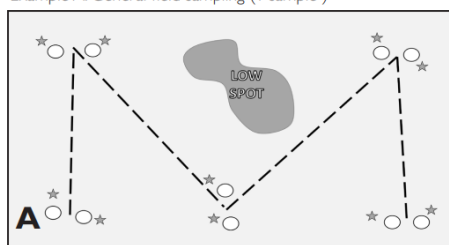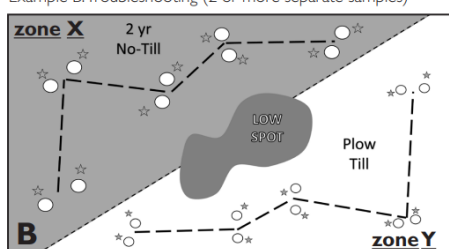
The Cornell Soil Health Laboratory https://soilhealthlab.cals.cornell.edu/testing-services/soil-health-analysis-packages/ is recommended because they will do Soil Organic Matter tests, whereas other labs (Including UMass Amherst Soil Lab) may not offer this test.

Collect soil samples for analysis of:
- Nutrients
- Soil Organic Matter (SOM) (& Soil Organic Carbon (SOC) if available)
- Bulk Density

You can choose the Cornell Basic Soil Health Analysis Package, which costs $90 per sample. The sample size should be four cups of well-mixed soil, gathered according to the Cornell soil sampling instructions (see link at top of this section).

Link to Cornell Lab video on bulk density sampling:

https://www.youtube.com/watch?v=omnrmrA-XMQ

Observe development of soil horizons over time:

Once every other year in the spring, measure depth of O (organic) and A (mixed organics and mineral) soil horizons by digging a small soil pit (just enough to do your measurements) and measuring the depth of these two horizons from top of the horizon to the bottom of the horizon. Dig three soil pits on a transect, one on the slope, one in the center of the data plot in the center of the Pocket Forest, and one closer to East Main Street. Take photographs of the soil pits that you have dug.

WILDLIFE
- Record visual and auditory observations and signs of wildlife including birds.
  o Nests, tunnels, holes, droppings, food caches, etc.
- Use the Merlin App to identify birds visually or by song.

INVERTEBATES
- Set out tiles, during monitoring, lift tiles up and document the ground dwellers
- Look for munch marks on leaves
- Observe insects in plots

POCKET FOREST MONITORING DATA SHEETS

Investigators:	Date:
Location:	Temperature:
Weather Today (sunny, rainy, cloudy, etc.):	
Rain in Past Week: If Yes, how much:	
Are Drought Conditions Present? If Yes, what Level? Check Massachusetts Executive Office of Energy & Environmental Affairs Drought Status website: https://www.mass.gov/info-details/drought-status	
Any recent severe storms, blizzards, hurricanes, tornados?	
Any other abnormal conditions?	

WILDLIFE OBSERVATIONS

SPECIES	NOTES (where observed, what was observed, how many, etc.)

Location: Investigators: Date:
VEGETATION MONITORING

HERBACEOUS LAYER		
Species	Percent Cover (use midpoint value)	Invasive or Weed Species?
SHRUB/SAPLING LAYER		
Species	Percent Cover (use midpoint value)	Invasive or Weed Species?
TREE LAYER		
Species	Percent Cover (use midpoint value)	Invasive or Weed Species?
VINES		
Species	Percent Cover (use midpoint value)	Invasive or Weed Species?

SOILS MONITORING

Location:

pH at 10 cm:

pH at 30 cm:

Soil Temperature:

Soil Moisture:

Light Meter Reading:

SOIL PIT LOG

Soil Horizon	Depth	Notes

INVERTEBRATE OBSERVATIONS

TYPE/SPECIES	NOTES (where observed, what was observed, how many, etc.)

FOREST LAYOUT DIAGRAM (draw below)

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