Hydrology and Phenology Studies at Mass Audubon’s Drumlin Farm Wildlife Sanctuary

The Development of the Ecological Monitoring Program at Drumlin Farm

Sally Farrow and Erin Pitkin
Mass Audubon’s Drumlin Farm Wildlife Sanctuary
Natural History Conference March 24, 2016
Harvard Forest Workshop March 31, 2016
Sue Beede
Topics

1. Why study hydrology and phenology.
2. Update of the hydrology and phenology program at Drumlin Farm
3. Questions and Challenges
4. Science and Engineering practices
5. Climate Change, the water cycle and the importance of wetland biodiversity
6. The Development of protocols for people of all abilities
Yellow Spotted Salamander and Wood Frog ODPVP March 2016

Yellow spotted salamander  Wood frog eggs
Blue Spotted Salamander and Fairy Shrimp Drumlín Farm

Blue spotted salamander Ed Center Lawn

Fairy shrimp ODPVP
Harvard Forest Long Term Ecological Research Project
Drumlin’s Ponding Ponds

Ice Pond

Poultry Pond
More Drumlin Ponds

Bathtub Pond

Preschool Pond
Drumlin’s Vernal Pools

Old Deer Pen Vernal Pool

Boyce “Pond” (a true vernal pool)
Drumlin’s Vernal Pools

Shopping Cart Vernal Pool
Old Deer Pen Vernal Pool Depth - 2012

- (3/14) trees bare & buds closed
- (3/30) buds closed/red maple in flower
- (5/15) full leaf out
- (11/21) trees bare
Old Deer Pen Vernal Pool Water Depth 2008-

Drumlin Farm Mass Audubon

Harvard Forest Schoolyard LTER / Vernal Pool Project
Old Deer Pen Vernal Pool

The Old Deer Pen (Vernal Pool 1)

Air Temp in Celsius from September 2008-December 2015

Air Temp (°C)

Air Temp Trend Line
Preschool Pond Depth 2011-2015
Sugar Maple at Drumlin Farm

Bud Burst

Fall Leaf Drop
Bud Burst Sugar Maple Drumlin Farm Spring 2015
Bud Burst and Leaf Drop Sugar Maple Drumlin Farm

Bud Burst

Leaf Drop

Drumlin Farm Mass Audubon

Harvard Forest Schoolyard LTER / Spring Phenology Project

Drumlin Farm Mass Audubon

Harvard Forest Schoolyard LTER / Fall Phenology Project
Black Birch Drumlin Farm

Bud burst  2015

Fall Leaf Drop
Bud Burst and Leaf Drop
Black Birch Drumlin Farm

Spring Bud Burst
Fall Leaf Drop
Growing Season for a Sugar Maple and Black Birch at Drumlin Farm 2011-2015
Collection of pond data at Drumlin Farm

Students observe, measure and record:

• air and water temperatures
• weather and leaf cover
• pond depth using marked poles
• name & number of macroinvertebrates
Circle appropriate responses below.

**Cloud cover:**
Sunny / Partly sunny / Cloudy / Scattered showers / Raining

**Tree Canopy:**
Open (no trees near pond) / Partial coverage (some trees near pond) / Completely covered (trees overhang completely)

**Leaf Cover:**
Closed buds / Open buds / Open flowers / Partial leaf out / Full Leaves open

**Bottom Substrate** (can circle more than one):
Sand or gravel / Whole leaves / Decayed leaf bits / Mud / Silt

**Notes / Questions**
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

**Pond Profile**

![Pond Profile Diagram]
<table>
<thead>
<tr>
<th>Organism</th>
<th>Comments</th>
<th>Organism</th>
<th>Comments</th>
<th>Organism</th>
<th>Comments</th>
<th>Organism</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leech – up to 2&quot;</td>
<td></td>
<td>Dragonfly nymph – up to 2&quot;</td>
<td></td>
<td>Caddisfly larva – 0.5-1.5&quot;</td>
<td></td>
<td>Polliwog</td>
<td></td>
</tr>
<tr>
<td>Snails – 0.5-1&quot;</td>
<td></td>
<td>Damselfly nymph – up to 1.5&quot;</td>
<td></td>
<td>Predaceous diving beetle</td>
<td></td>
<td>Salamander – 3-8&quot;</td>
<td></td>
</tr>
<tr>
<td>Daphnia – 0.1&quot;</td>
<td></td>
<td>Water boatman – &lt;1&quot;</td>
<td></td>
<td>Mosquito larva – 0.5&quot;</td>
<td></td>
<td>Salamander polliwog</td>
<td></td>
</tr>
<tr>
<td>Copepod – 0.1&quot;</td>
<td></td>
<td>Backswimmer – &lt;1&quot;</td>
<td></td>
<td>Bloodworm – &lt;0.5&quot;</td>
<td></td>
<td>Turtle – varies; 3-20&quot;</td>
<td></td>
</tr>
<tr>
<td>Water pill bug – Isopod up to 1&quot;</td>
<td></td>
<td>Water strider – 1&quot;</td>
<td></td>
<td>Phantom midge – 0.5&quot;</td>
<td></td>
<td>Algae</td>
<td></td>
</tr>
<tr>
<td>Scud – Amphipod 0.5&quot;</td>
<td></td>
<td>Water scorpion – 3&quot;</td>
<td></td>
<td>Frog – varies; 1-8&quot;</td>
<td></td>
<td>Duckweed</td>
<td></td>
</tr>
</tbody>
</table>

Data key: 1-4 = few, 5-15 = some, >15 = many

Comment suggestions: unusual numbers – high or low; size; where found in the pond; unusual color or structure; life stage, etc
Biodiversity of Drumlin Farm Ponds

Macroinvertebrate Biodiversity in Ice and Poultry Ponds - 2012

Biodiversity in the Drumlin Farm Ice and Poultry Ponds 2015
CCHS Pathways Students at Deer Pen Pond
CCHS Pathways Students checking for Bud Burst 2015
CCHS Pathways Students monitoring Boyce Pond

CCHS Students

Boyce Pond
Boyce Pond Water Depth 2009-2015

Drumlin Farm Mass Audubon

Depth (cm)

Date

Harvard Forest Schoolyard LTER / Vernal Pool Project
Ice Pond Water Depth
2011-2015

Drumlin Farm Mass Audubon

Depth (cm)

Date

05-Jan 05-Mar 05-Apr 05-Jun 05-Aug 05-Oct 05-Nov

Harvard Forest Schoolyard LTER / Vernal Pool Project
Leaders in Environmental Access For All
at Drumlin Farm Wildlife Sanctuary

Mass Audubon
Vocational Internships and Eco-Monitoring Overview

**Project Manager**
- Equipment Management
- Daily Task Oversight

**Hydrologist**
- Water Temperature
- Pole Depth

**Phenologist**
- Bud Count
- Tree Canopy Assessment

**Meteorologist**
- Air Temperature
- Weather Assessment
# ECO-MONITORING VISUAL GUIDES

## Equipment Check In/Out Sheet

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Check Out</th>
<th>Check In</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clip Boards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Sheets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Thermometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Thermometer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binoculars</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Daily Task Check List

<table>
<thead>
<tr>
<th>Daily Tasks</th>
<th>Check Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Temperature</td>
<td></td>
</tr>
<tr>
<td>Air Temperature</td>
<td></td>
</tr>
<tr>
<td>Pole Depth</td>
<td></td>
</tr>
<tr>
<td>Weather</td>
<td></td>
</tr>
<tr>
<td>Tree Canopy</td>
<td></td>
</tr>
<tr>
<td>Leaf Cover</td>
<td></td>
</tr>
<tr>
<td>Bud Count</td>
<td></td>
</tr>
</tbody>
</table>
ECO-MONITORING VISUAL GUIDES

FIELD NOTES

Daily Field Notes

Date: ___________________________  Pond: ___________________________

Initials: _______________________

Please Check All that Apply

CLOUD COVER/WEATHER:

- Sunny
- Partly Cloudy
- Cloudy
- Rain
- Snow

TREE CANOPY OVER POND:

- Open (no trees)
- Partial Coverage (some trees)
- Completely Covered (trees overhanging)

LEAF COVER:

- Closed Buds
- Open Buds
- Open Flowers
- Partial Leaf Out
- Full Leaves Out

COMPiled DATA SHEET

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Air Temp (°C)</th>
<th>Water Temp (°C)</th>
<th>Pole Depth (cm)</th>
<th>Cloud Cover</th>
<th>Tree Canopy</th>
<th>Leaf Cover</th>
<th># of Leaves</th>
<th># of Buds</th>
</tr>
</thead>
</table>

- Sunny
- Partly Cloudy
- Cloudy
- Rain
- Snow

- Open (no trees)
- Partial Coverage (some trees)
- Completely Covered (trees overhanging)

- Closed Buds
- Open Buds
- Open Flowers
- Partial Leaf Out
- Full Leaves Out
Simplifying Data

Air and Water Temp Ice Pond 2011-2016

Date

Celcius

Air Temp (c)

Water Temp (c)
The End