Enlisting Formal Educators as Partners in Conservation

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Entry Ticket

Write your name and institution/organization on 4 “sticky notes”. Place one sticky note on each chart to rate your experience with the following topics on a scale of 1-5 (1 = not much experience, 5 = lots of experience)

- Citizen Science
- Phenology
- Collaborating with other gardens, museums, or other informal institutions
- Working with local schools or teachers
The New York Botanical Garden
Brooklyn Botanic Garden
Urban Advantage: WHO we are and WHAT we do

Urban Advantage (UA) is a citywide science initiative that connects middle schools, teachers, students, and families with the excitement and process of scientific discovery and learning.

www.urbanadvantage.org
urban advantage
middle school science initiative

Partner Institutions

New York City Council
The New York Botanical Garden
American Museum of Natural History
Bronx Zoo
Brooklyn Botanic Garden
Wildlife Conservation Society
New York Aquarium
NYC Department of Education
New York Hall of Science
Queens Botanical Garden
Staten Island Zoo
We are a UA school!

urbanadvantage.nyc.org
For more information on Urban Advantage in NYC please visit www.urbanadvantagenyc.org:
Citizen Science

In North America, citizen science typically refers to research collaborations between scientists and volunteers, particularly (but not exclusively) to expand opportunities for scientific data collection and to provide access to scientific information for community members. Also known as public participation in scientific research (PPSR).

"Projects in which volunteers partner with scientists to answer real-world questions."

Source: Cornell Lab of Ornithology
Phenology

- “Pheno” is a combining form meaning “showing, or appearing, or seeming.”

- “ology” a branch of learning.
Plant Morphology

- Closely sketch and describe your plant part with a focus on its form and structure.
- What is its “story?” Where is this plant within its annual life cycle? What information can you gather from observation alone?
Phenology Challenge Part I

- Discuss what stage your plant specimen might represent within this plant’s annual life cycle.
- Draw how your assigned plant might look in each season.
Phenology Challenge

• Explore the NYBG Phenophase Guide. What more information could you add to your plant’s story?
• What tools would you need to inform people about the phenology of plants in your area?
What is Phenology?

- Observe an organism’s biology related to seasonal changes generally within a given year.
- Record features on a regular basis.
Plant Life Cycles

- What are events in a plant’s annual life cycle?
  - Leafing
  - Flowering
  - Fruiting
# Plant Phenophase Protocols

<table>
<thead>
<tr>
<th>Phenophase:</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breaking Leaf Buds</strong></td>
<td>A green leaf tip is visible at the end of the bud, but the first leaf from the bud has not yet unfolded to expose the leaf stalk (petiole).</td>
</tr>
<tr>
<td><strong>Leaves</strong></td>
<td>The entire length of the leaf has emerged from the breaking bud so that the leaf stalk (petiole) is visible at its point of attachment to the stem.</td>
</tr>
<tr>
<td><strong>Increasing Leaf Size</strong></td>
<td>A majority of leaves on the plant have not yet reached their full size and are still growing larger.</td>
</tr>
<tr>
<td><strong>Colored Leaves</strong></td>
<td>One or more leaves have turned to their late season colors.</td>
</tr>
<tr>
<td><strong>Falling Leaves</strong></td>
<td>One or more leaves are falling or have recently fallen from the plant.</td>
</tr>
<tr>
<td><strong>Open Flowers</strong></td>
<td>The reproductive parts (male stamens or female pistils) are visible between unfolded petals.</td>
</tr>
<tr>
<td><strong>Ripe Fruits</strong></td>
<td>One or more ripe fruits are visible on the plant.</td>
</tr>
<tr>
<td><strong>Recent Fruit or Seed Drop</strong></td>
<td>One or more mature fruits or seeds have dropped or been removed from the plant in the recent past.</td>
</tr>
</tbody>
</table>
Spring Phenology Protocols

Leaf Out (Bud Burst → Mature Leaf)  Flowering

Based upon National Phenology Network Protocols
Leaf Out:
Breaking Leaf Buds

One or more breaking leaf buds are visible on the plant. A leaf bud is considered "breaking" once a green leaf tip is visible at the end of the bud, but before the first leaf from the bud has unfolded to expose the leaf stalk (petiole) or leaf base.

How many buds are breaking?
Less than 3; 3 to 10; 11 to 100; 101 to 1,000; 1,001 to 10,000; More than 10,000
Leaf Out:
Leaves (Unfolded Leaves)

One or more live, unfolded leaves are visible on the plant. A leaf is considered "unfolded" once its entire length has emerged from the breaking bud so that the leaf stalk (petiole) or leaf base is visible at its point of attachment to the stem. Do not include fully dried or dead leaves.

What % of the canopy is full with leaves? Ignore dead branches in your estimate. Less than 5%; 5-24%; 25-49%; 50-74%; 75-94%; 95% or more.
Leaf Out: Increasing Leaf Size

A majority of leaves on the plant have not yet reached their full size and are still growing larger. Do not include new leaves that continue to emerge at the ends of elongating stems throughout the growing season.

What % of full size are most leaves?
Less than 25%; 25-49%; 50-74%; 75-94%; 95% or more.
Flowering:
Open Flowers

One or more open, fresh flowers are visible on the plant. Flowers are considered "open" when the reproductive parts (male stamens or female pistils) are visible between or within unfolded or open flower parts (petals, floral tubes or sepals). Do not include wilted or dried flowers.

What percentage of all fresh flowers (buds plus unopened plus open) on the plant are open? For species in which individual flowers are clustered in flower heads, spikes or catkins (inflorescences), estimate the percentage of all individual flowers that are open. Less than 5%; 5-24%; 25-49%; 50-74%; 75-94%; 95%<.
Fall Phenology Protocols

Leaf Color Change
Leaf Drop
Fruit Ripening

Based upon National Phenology Network Protocols
Leaf Color Change

The leaves have changed to their late season color(s), and there is virtually no green left in the leaves.

- >50% of tree?
- >95% of tree?

If drought seems to be the cause of leaf color change for a plant, please make a comment about it for that plant.
Leaf Fall

For the whole plant, the leaves have fallen off and are brown/dead

- >50% of tree?
- >95% of tree?

If drought seems to be the cause of leaf fall for a plant, please make a comment about it for that plant.
Fruit Ripening

The fruit has become ripe in three spots on tree (e.g. color change, splitting, both, etc.)
What Materials do I Need?

- Data sheet
- Pencil
- Clipboard
- Phenology guide
- Binoculars
- Tree ID (optional)
What to Look for and Record

- **Yes (Y)** – if the phenophase *is* occurring
- **No (N)** – if the phenophase *is not* occurring
- **Uncertain (?)** – if you are *not certain* whether the phenophase is occurring
- Do not record anything if you *did not check* for this phenophase
Phenology Data Collection
For each plant species, record the **phenophase** you observe on the data collection sheet you will use in the field.
Locate the species on your collection sheet and match the **accession number** on the label with the accession number on the data sheet.
Colored leaves
One or more leaves (including any that have recently fallen from the plant) have turned to their late-season colors. Do not include fully dried or dead leaves that remain on the plant.

What percentage of the canopy is full with colored leaves?
Less than 5%; 5-24%; 25-49%; 50-74%; 75-94%; 95% or more
What do you observe?
Record the **phenophase** on your data collection sheet

### Citizen Science: Native Flora Garden Phenology

<table>
<thead>
<tr>
<th>Native Flora Garden</th>
<th>20X000 Red Oak</th>
<th>20X002 Red Oak</th>
<th>20X006 Red Oak</th>
<th>20X007A Sycamore</th>
<th>20X007 A Sycamore</th>
<th>20X008 Sugar Maple</th>
<th>20X124A Sugar Maple</th>
<th>20X124 B Sugar Maple</th>
<th>20X125 B Sugar Maple</th>
<th>20X126B Cherry Birch</th>
<th>20X127B Cherry Birch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observer(s):</td>
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<td>Check when data entered online</td>
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</table>

**Note:** Fill in the corresponding columns for each species based on your observations.
Your data sheet should look like this:

<table>
<thead>
<tr>
<th>Column</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaking Leaf Buds (Emerging leaves)</td>
<td>y n ?</td>
</tr>
<tr>
<td>Leaves (Unfolded Leaves)</td>
<td>y n 95%</td>
</tr>
<tr>
<td>Increasing Leaf Size</td>
<td>y n 95%</td>
</tr>
<tr>
<td>Colored Leaves</td>
<td>y n 95%</td>
</tr>
<tr>
<td>Falling Leaves</td>
<td>y n</td>
</tr>
<tr>
<td>Open flowers</td>
<td>y n ?</td>
</tr>
<tr>
<td>Ripe fruits</td>
<td>y n ?</td>
</tr>
<tr>
<td>Recent fruit or Seed Drop</td>
<td>y n ?</td>
</tr>
<tr>
<td>Check when data entered online</td>
<td></td>
</tr>
</tbody>
</table>

Be sure to...

- Match the accession number when available
- Circle: y n ?
- Optional: Record intensity data (ex: >95%)
Sugar Maple

*Acer saccharum*

Maple Family: Aceraceae

N.S. to S.D., south to Ga. and Mo.

20010131*B*
RED MAPLE
ACER RUBRUM
MAPLE FAMILY: ACERACEAE
E. NORTH AMERICA
AMERICAN BEECH
FAGUS GRANDIFOLIA
BEECH FAMILY: FAGACEAE
E. NORTH AMERICA

X10210
RED OAK
QUERCUS RUBRA
BEECH FAMILY: FAGACEAE
N.E. NORTH AMERICA
X10083
Phenology at
The New York Botanical Garden

- To study the impacts of climate change on the Native Forest, The New York Botanical Garden engages volunteers in collecting important scientific data on different species of trees, shrubs, and herbs.
Where are these plants?
Phenology programs for youth at The New York Botanical Garden
Phenology at Brooklyn Botanic Garden

BBG Species:

- American Beech – *Fagus grandifolia*
- American Witch-hazel – *Hamamelis virginiana*
- Black Gum (Tupelo) – *Nyssa sylvatica*
- Flowering Dogwood – *Cornus florida*
- Red Maple – *Acer rubrum*
- Red Oak – *Quercus rubra*
- Spicebush – *Lindera benzoin*
- Sugar Maple – *Acer saccharum*
- Sweet Birch (Cherry Birch) – *Betula lenta*
- Sweet Gum – *Liquidambar styraciflua*
- Tulip tree – *Liriodendron tulipifera*
Phenology at Brooklyn Botanic Garden
Data Collection Materials
Phenology at Brooklyn Botanic Garden

Next Steps...

✓ Continue to refine materials
✓ Incorporate phenology lessons and activities in other Teacher Education workshops
✓ Introduce program to colleagues throughout the Education Department so that they can involve youth in data collection
Time for Reflection