Background

The pulsed, synchronous mass-production of seeds in tree species is a phenomenon called “masting,” which is an important event that occurs in forested ecosystems (Koenig and Knops 2006). Northern red oak (Quercus rubra) mast events, in northern hardwood forests, can provide abundant critical food sources for animals preparing for overwinter. Wildlife such as rats (Peromyscus spp.), squirrels (Sciurus spp.), black bear (Ursus americanus), ruffed grouse (Bonasa umbellus), and white-tailed deer (Odocoileus virginianus) can increase their survivability and fecundity during mast years (Koenig and Knops 2005, Lastley et al. 2006, Gillen and Helgren 2010). The ecology of mast events within an ecosystem is important to study as they have cascading effects (Dekel et al. 1996, Gillen and Helgren 2010). Lobo and Millar (2013) during years when seed yield is below normal, the decline in food production can result in reduced granivore populations, but also increases the chances of germination during the next masting event (Schmurr et al. 2002). Increased germination results from a lag in functional response time among granivores, an effective predator satiation technique (Schmurr et al. 2002). Oaks are greatly valued by many species, including humans. They are selectively harvested for high quality timber. The dependence of wildlife for food and habitat, and the human desire for quality timber attracts to the need to study oak, acorn production, and the effects on wildlife.

Objectives

- Gather baseline data on acorn yield at Cobblestone Hill of the Flatrock forest and examine if there was a relationship with tree size (i.e., DBH, canopy area).
- Estimate timing of peak acorn maturation at Cobblestone Hill.
- Understand relationship between small mammal presence and the timing of peak acorn maturation.

Materials and Methods

Focal Trees:
- Red oaks were randomly selected in plots along a N-S transect.
- Diameter at breast height (DBH) and the crown or canopy area were measured for each tree.

Seed Traps:
- 10 x 1m² seed traps were located midway between the trunk of selected trees and their canopy drip line.
- Seed traps were checked weekly and acorns were brought back to the lab.

Ground Plots:
- Ground plots were located adjacent to seed traps under the canopy of focal trees.
- Metrics were collected on species, gender, and tail and body length.

Acorn Viability:
- All acorns from seed traps were placed in a bucket of water for a float test to distinguish unsound (float) from sound (sink) acorns.
- Acorns were then opened to further assess damage classification (i.e., insects, wildlife, or fungi).

Small Mammal Trapping:
- Two large and two small Sherman live traps were associated with each focal tree (n = 42).
- Traps were baited, set, and checked twice weekly, weather permitting.
- Metrics were collected on species, gender, and tail and body length.

Results

- Cobblestone Hill: which is part of Flatrock forest, located in Altona, New York.
- Forest classification: northern hardwood forest.
- Common zygodont species: red oak, American beech, sugar maple, and striped maple (Acer pensylvanicum), among others.
- Local forest composition: cobblestone, downed woody debris, small mammal runways.

Abundance of Acorns/m²

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Sound Acorns</th>
<th>Number of Unsound Acorns</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-Sep</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>1-Sep</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>2-Sep</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>3-Sep</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>4-Sep</td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td>5-Sep</td>
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<td>30</td>
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<tr>
<td>6-Sep</td>
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<tr>
<td>7-Sep</td>
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<td>40</td>
</tr>
<tr>
<td>8-Sep</td>
<td>110</td>
<td>45</td>
</tr>
<tr>
<td>9-Sep</td>
<td>120</td>
<td>50</td>
</tr>
</tbody>
</table>

Abundance of sound acorns (seed traps) and small mammals (Peromyscus spp. combined) at ten northern red oaks sampled at Cobblestone Hill during each visit for fall 2013.

Conclusions

- Peak acorn maturation (greatest abundance sound acorns) → week of October 5th, 2013 season.
- There was positive, yet insignificant, correlation between diameter at breast height (DBH) and acorn yield.
- There was a significant negative correlation between crown area and acorn yield.
- Larger canopies allocate more energy towards leaves than acorn production.
- The timing of peak sound acorn yield was synchronous with the peak trap yield of small mammals.
- Peromyscus spp. are common granivores, thus their increased trappability should correlate with acorn pulses (Lobo and Millar 2013, Schmurr et al. 2001).
- As the number of sound acorns recorded in ground plots declined over time in respect to the seed traps, we can assume seed predation by granivores occurred.
- We cannot conclude that predation was only due to small mammals because white-tailed deer (Odocoileus virginianus), and birds such as blue jays (Cyanocitta cristata) are all known to eat acorns and are present in this forest ecosystem.

Limitations

- Baseline data collected in this 1st year cannot make inter-year comparisons in timing.
- Small sample size of trees (N = 10).
- We did not ear tag small mammals → lack of relative abundance to assess population trends.
- Lack of molecular identification among Peromyscus spp. (white-footed and deer mouse) → conservative biodiversity estimates.
- Only trapped during nocturnal period → overestimating diurnal seed predator activities.

Future Directions

- Assess timing of peak acorn maturation under future climate regimes.
- Compare timing among peak acorn maturation among other masting trees (e.g., American beech and hickories).
- Better define what a “masting event” in this region is as compared to other regions.

Literature Cited