Tree Phenology Monitoring on Mount Mansfield: Vegetative and Flower Bud Development and Leaf Expansion, 1992-2003

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This monitoring was originally targeting sugar maple bud development to determine how the timing and emergence of leaves at different levels in the canopy related to pear thrips emergence from over-wintering in the soil, and subsequent feeding in the buds. During the initial monitoring, we recognized differences in the timing of leaf emergence in the upper and lower canopy as compared to understory regeneration. The sugar maple monitoring techniques proved success for the original objective, but other applications were evident. So method development expanded to other hardwood species and the objectives expanded to include using bud monitoring as a tool to evaluate tree vulnerability to current-year forest stress events, (e.g. spring frost, pear thrips feeding, etc.), and for use as an indicator of the effects of climate change on the timing of key tree processes.

Objectives

1. To evaluate the timing of sugar maple bud development in relation to pear thrips emergence on an annual basis.
2. To determine the relationship between the timing of bud development in the upper canopy, lower canopy and on regeneration.
3. To modify the sugar maple developmental stages for use with yellow birch, American beech, red maple and white ash.
4. To establish baseline data on the timing of vegetative and flowering development stages at two elevations and 3 hardwood tree species at Mount Mansfield.
5. To establish the relationship between the timing of bud development for 5 hardwood species: sugar maple, yellow birch, American beech, white ash and red maple.
6. To monitor the timing of bud development as an indicator of climate change.

Methods

Monitoring was conducted at the Proctor Maple Research Center (PMRC) and above the Underhill State Park (USP), Underhill, Vermont, at the base of Mount Mansfield. The PMRC site is located at a 1400 foot elevation, in a sugar maple forest used for maple syrup production and maple research. Large sugar maple trees dominated the portion of the stand used for this study. Tree species monitored at PMRC included: sugar maple, yellow birch, American beech, white ash and red maple. The USP site is located at a 2200 foot elevation in a mixed northern hardwood forest. Tree species monitored at USP included: sugar maple, yellow birch, and American beech. Criteria for tree selection was based on likelihood to persist for many years, so we selected dominant/codominant trees greater than 10 inches in diameter with healthy crowns and few bole defects.

Bud development monitoring using method developed by Parker and Skinner (ref.).

Sugar maple trees at 1400 feet were monitored consistently from 1992-2003. Bud development was recorded twice weekly from early April through mid-June using visual ratings as seen through a high powered spotting scope. Five mature trees and 5 saplings were used. Bud stages were recorded from the upper canopy, lower canopy and regeneration from 1992 -, from dormancy through full leaf expansion. For short-term studies, additional species were monitored (yellow birch, American beech, red maple and white ash), and 3 species were monitored at two elevations (1400 and 2200'). Descriptions of sugar maple bud stages were modified for the other hardwood species to allow between year comparisons of bud and leaf development.