FOREST CANOPY HEALTH: USE OF A STANDARD PHOTOGRAPHIC METHOD FOR LONG-TERM MONITORING AND EVALUATION

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ABSTRACT

In 1993, canopy photos were taken for the same forest health monitoring plots as in 1991 and 1992 at the July timing. All photos (Ektachrome slides) were compared to 1992 photos from the same points by the slide projection method to determine percent canopy cover. Canopy cover values for the two forest health monitoring sites at 1400 feet elevation decreased 2.7 and 7.2 percent, respectively, from 1992 values. This is attributed to light to moderate defoliation by pear thrips, *Taeniothrips*, inconsequence in 1994. Canopy cover at the non-defoliated 220-foot elevation site was similar to 1992 values.

INTRODUCTION

Forest canopy assessments related to tree health have historically been obtained by visual evaluations done by field personnel trained in how to evaluate such things as dieback, defoliation, and crown transparency. Such procedures lack permanent documentary records, such as photographs, from which future investigators can make comparisons, or check procedures. In 1991 and 1992, a photographic method to quantify canopy cover was developed and published in a manual (Curtis and Kelley, 1993). Canopy assessments were continued in the same plots this year to continue the annual evaluations and maintain long-term documentation of canopy cover changes.

METHODS

Methods were the same as used in 1991 and 1992, except that the number of photo points was reduced from 141 to 73 and photography was timed for late July when canopy cover should be at or near optimum levels. An analysis of 1992 data showed that the number of points per subplot could be reduced from 9 to 5.6 with little change in variation.

Photography

Using a 35mm camera with a 17mm wide angle lens, Ektachrome slides (IS0200) were taken beneath tree crowns by orienting the camera vertically over 73 permanent points established within the following northern hardwood forest health monitoring sites in Underhill, Vermont:

1. North American Maple Project (NAMP 014), Proctor Maple Research Center (PMRC) in Underhill - 25 points.

2. Forest Health Monitoring (VMC1400) at PMRC - 24 points.

3. Forest Health Monitoring (VMC2200) at Underhill State Park - 24 points.

Photographs were taken at the corner stakes plus center stake of each NAMP subplot, and were at a different, but comparable, spacing in the FHM systems. Orange fiberglass rods were used for photo point stakes.

With certain modifications, field procedure was based on a method developed by the Institute for Ecosystems Studies (Fergione, 1985). No weather criterion was applied except to avoid rain and excessive breeze.

The camera, equipped with a right-angle view finder, was mounted on a tripod with the lens facing up and the base of the camera facing true east. This arrangement, with the long axis of the film parallel to the true north-south axis, minimized the period at midday during which the sun might appear in the image. The camera tripod was erected over the photo point such that a plumb bob, hung directly under lens center, would be within 2.5 cm of the base of the photo point stake. Camera height was 1 m from the base of the stake to the optical center of the lens (about 2 cm from the lens front). A meter stick was carried for this purpose. The camera was leveled with a plate-mounted bubble level that was placed on the lens. This adjustment is the most critical for repeated comparisons of images taken from the same point, as small variations in leveling tend to magnify error in portions of the image from the upper canopy. All foliage up to 1 m from the camera lens was removed in an arc containing the image. After set-up was complete, three exposures were taken: one at the camera meter's

setting, one a full stop over, and one a full stop under. The overexposures obtained tend to show better color and are useful in revealing leaf damage due to insects, diseases or other factors. Underexposures afford more sky/canopy contrast and are more suitable for image scoring. In cases in which the sun appeared in the picture, it was blocked out with a device consisting of a film canister cap mounted on a wire. While exposures were being made, it was positioned such that the disc, at a distance of 60-70 cm from the lens, blocked out the sun.

Complete notes were taken for each set of exposures, including photo point ID, time of day, an estimate of cloud cover to the nearest 10 percent, f-stop, shutter speed, and exposure number.

Image Analysis

In order to develop a scoring procedure for canopy cover on the slides, a manual/visual method was compared to a computer-image analysis in 1991. The term, canopy cover, is used here to refer to the percent of sky obscured by vegetation, including woody tree parts. The computer analysis system (Swathkit) was more efficient for processing large numbers of slides but with the reduced number of slides in 1993, the manual slide projection method was preferred.

Each slide was projected onto a radial grid composed of 12 concentric circles intersecting with 12 lines radiating from the center. The number of grid intersections (out of 144) falling on visible sky were tallied and then converted to percent canopy cover. Both 1991 and 1992 slides of similar exposure were projected to make the comparisons. Usually the slide least exposed during bracketing at each photo point was selected for best contrast.

RESULTS

The two sites at Proctor Maple Research Center, at an elevation of 1400 feet, decreased in canopy cover compared to 1992 (Figure 1). This is attributed to light to moderate defoliation of sugar maple at this location by pear thrips. This occurred in May, 1993, resulting in smaller than normal leaves on many trees. The VMC 1400 site decreased an average of 7.2 percent in canopy cover while the NAMP 014 site decreased 2.7 percent in canopy cover. This drop in canopy cover was significant (<0.05) for the VMC site (90.9% to 84.4%) and when the VMC plots were combined with the NAMP plots. The decrease was not significant for the NAMP site alone (89.3% to 86.9%) because of an increase in canopy cover for plot 2. This plot has a lot of American beech in the understory which showed a noticeable increase in canopy foliage as viewed in the photographic slides. This increase may have resulted from increased sunlight due to defoliation of the overstory sugar maples.

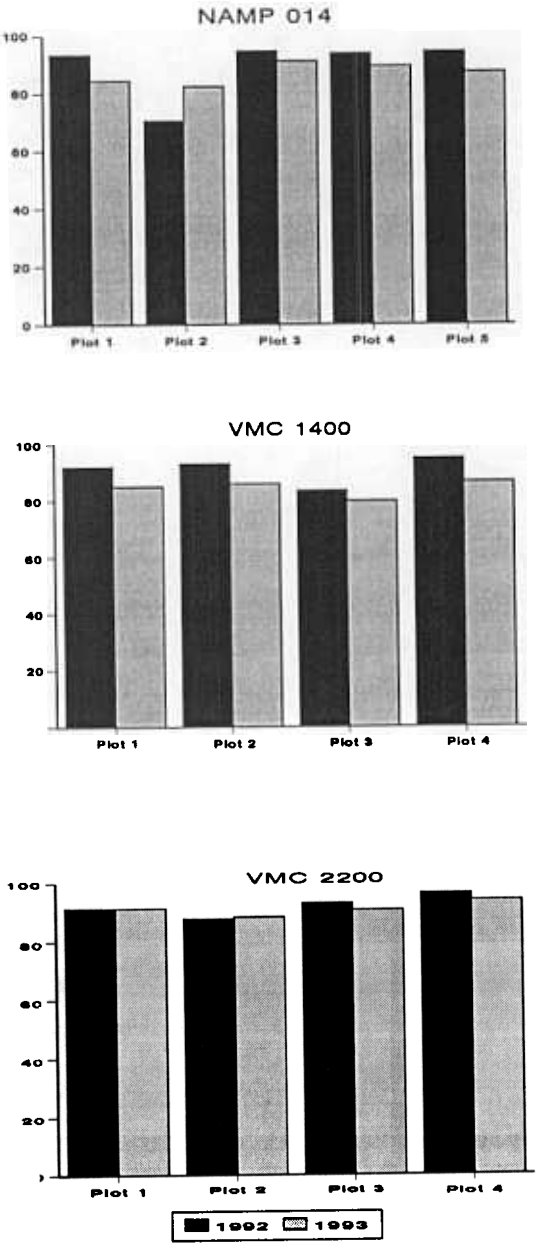

Figure 1. Crown Canopy Cover Changes from 1992 to 1993 in one Namp site and two FHM forest health monitoring sites.

In contrast, the VMC 2200 site at an elevation of 2200 feet had an average canopy cover that was very similar (no significant difference) to 1992 values (Figure 1). Percent canopy cover averaged 91.0 percent in 1993 compared to 92.0 percent in 1992. This site had no visible defoliation in 1993.

Sugar maple foliage transparency ratings (amount of light coming through the foliage) for these three sites done by ground observers in July also showed the greatest increase from 1992 (decrease in foliar density) for the VMC 1400 site.

FUTURE PLANS

The forest health monitoring photo points will continue to be photographed once annually in late July, to obtain archiveable images that can be compared with data since 1991.

CONTEXT

These Vermont monitoring cooperative plots are the only ones being evaluated by this method on an annual basis. The method was field tested in two additional NAMP plots, in Albany and Braintree, in 1993.

REFERENCES

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