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A Remote Camera System to Observe the Growth and Quality Changes of a Developing Stand

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Abstract

Describes the use of a remote 35-mm data-recording camera to observe daily the growth and quality development of a 27-acre clearcut.

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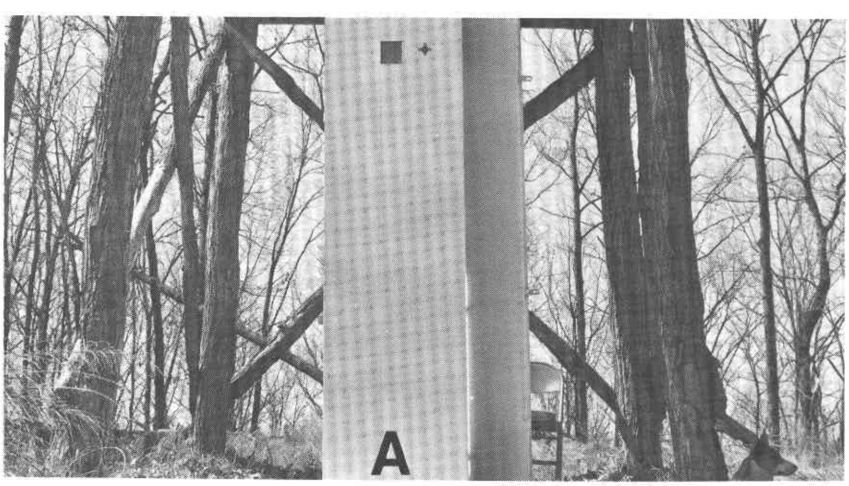
Introduction

Forest researchers continue to try to solve the problems of poor quality in our forest trees and stands. They need accurate quality and growth information to determine which silvicultural treatments will save the most time and money. To acquire detailed information on quality development, a remote camera system using time-lapse photography was designed. By observing the start of a forest stand and following the growth patterns of individual trees, we can see many factors that influence the tree's final form. Factors such as weather, animal damage, slope, aspect, density, and man affect development and quality of a tree.

This paper describes the camera system and how it is being used for total observation of a developing forest stand.

Methods

The remote camera system (Fig. 1) is located on a hillside above a recent 27-acre clearcut at the Vinton Furnace Experimental



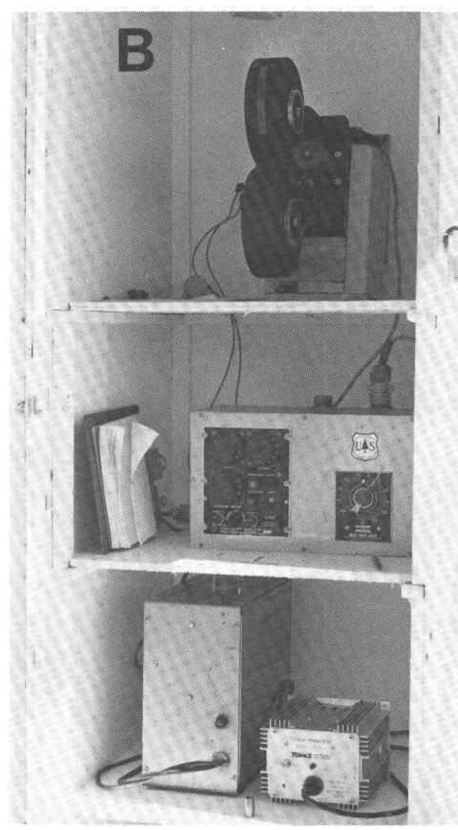


Figure 1.—(A) Camera box (front); (B) camera box (rear) showing components.

Forest in southern Ohio. The camera records the progression of growth during the initial stand development and also the quality change of particular stems which is taking place on the clearcut from now to "x" years in the future. It is part of an overall tree-quality study of individual quality characteristics and how they change over time. Eventually, forest researchers hope to have a visual record of the changes in tree species, various elements of weather, insect and wildlife damage, and gross changes in external tree characteristics, such as individual changes in live and dead limbs, limb size, epicormic branching, external defect, bole form, and overgrowth development.

Milacre plots were established on the clearcut and culturally treated; thus, many changes in growth patterns and species composition will be observed in the early development of the new forest. These changes will be the main target for the camera system at the outset.

Why Use a Camera System?

The automatic camera system is economical and reliable. Usually it is not feasible to take pictures daily at a remote location because of the time element and cost involved. But, the camera system is designed to be automatically triggered on a daily basis to record a series of at least seven photographs per day for satisfactory time-lapse effect. The present installation requires scheduled service of an 8-day clock and battery. To make the system completely automatic, future plans require installation of a silicon solar panel (photovoltaic cells) which will provide sun-to-electricity direct charging of the camera battery and provide power to an electric clock.

Growth progression, shown as a time-lapse movie, should answer many questions about juvenile tree behavior. For example, in winter trees are dormant, but because of ice and snow accumulations, many young seedlings and saplings may take on a different stem form as a result of bending and breakage. Also, removal of terminal buds browsed by wildlife results in changes in tree form. Even daily weather data can be interpreted, because the photo will record the weather if light conditions are acceptable. Data on light intensities can be recorded because the Cds (Cadmium selenide) photoconductor cell has a known wavelength spectral response.

Camera

The camera (Sonderman 1973) is an Auto-max G3, data-recording, 35-mm half-frame camera.[1] It uses a Mitchell magazine with a capacity of 500 feet of film, Nikon bayonet lens mount, and a Vivitar 17-mm wide-angle F3.5 lens with an 84° angle of view. The drive motors in the camera are powered by a single, deep cycle 12VDC marine battery, which runs an inverter and intervalometer as part of the system. Power to the components is regulated by an 8-day clock, which is set to permit power at predetermined times. Light requirements are determined by a single Cds photo-conductive cell mounted beside the camera lens. A time-delay relay incorporated in the system permits only one photo period per 24 hours. We use Kodak Ektachrome EF 5241 color film in 400-foot rolls with an ASA of 160. It is high-speed color reversal film on acetate base, suitable for direct projection. The shutter speed is 1/125 of a second with an aperture of F/16. One loading of the magazine allows 914 photo days of seven frames per day. The system is housed in a 2-foot by 2-foot by 8-foot high rectangular wooden box bolted to a 4-foot by 4-foot concrete slab. A 4-inch glass square provides camera view and weather protection for the wide-angle lens. The camera is orientated to the northeast at an azimuth of approximately 27°, which provides excellent side shadow images (Neelands 1979) in the late morning photo periods. Shadow effect is beneficial for height determination and defect definition.

Application

Each season the exposed color film will be removed from the magazine and processed. It will then be edited and spliced onto processed film of previous seasons to form a continuous 35-mm time-lapse color motion picture. As trees grow and develop in front of the camera lens, adjustments will be made to the camera and lens to concentrate on specific individual trees within camera range for detailed surveillance of individual defects.

In the 16 months since the establishment of the clearcut, there has been a dramatic change in the regeneration. The initial photograph of the clearcut (Fig. 2) is free of most vegetation, except for scattered debris. In contrast, the second in the series of clearcut photos (Fig. 3) shows the entire area completely covered with new growth. A sampling of the milacre plots verifies that the major important tree species are black gum, aspen, yellow poplar, white ash, and red maple, all in seedling form. Species identification from photographs is not possible because of seedling size. However, after four or five growing seasons we should be able to identify individual species from the photographs. The camera system is still in the trial stage, and expectations of what will actually be seen are speculative. Hopefully, each year's growth photographed in color will shed new light on many aspects of development that would otherwise not have been detected before.

[1] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

Figure 2.—Photograph taken May 1979 (clearcut-winter 1978).

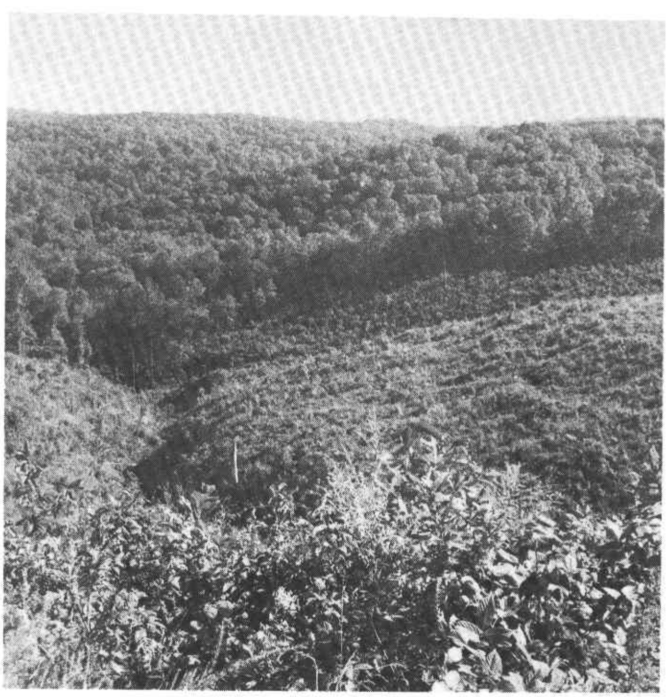


Figure 3.—Photograph taken September 1980 (clearcut-winter 1978).

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