COMPARISON OF A LOW-TECH VS. A HIGH-TECH METHOD TO EVALUATE SURFACE FIRE TEMPERATURES

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Prescribed surface fires were conducted in late March-early April 2001, at the Raccoon Ecological Management Area (two ~20 ha areas), and the Tar Hollow (~40 ha) and Zaleski (~40 ha) State Forests in thinned and unthinned mixed-oak forests of southeastern Ohio. Fires are being investigated as a silvicultural tool to aid in regenerating oaks, by removing understory saplings of fire-sensitive species (primarily maples). Previous research has shown that maximum fire temperature is a good variable in evaluating effects and achieving the desired level of topkill.

Tempil, Incorporated, manufactures a series of Tempilaq® temperature sensitive paints, each designed to melt and change color at specific temperatures. This provides a low-cost, "low-tech" method of measuring the maximum temperature achieved at selected locations within the prescribed fires. The visual interpretation of whether paint has melted introduces variability to the estimated maximum temperature.

Onset Computer Corporation produces a variety of miniature data loggers and thermocouples that can be programmed to record temperatures at regular time intervals. This "high-tech" instrumentation costs significantly more than the temperature sensitive paints, but records the time of fire arrival, temperature curve, and duration of heat dissipation.

The sites were instrumented with both low tech and high tech sensors to evaluate air temperatures attained during the fires at more than 400 points arranged on a 50-m grid. Tempilaq® paints that melted at 79°, 121°, 163°, 204°, 315°, and 427° C (175°, 250°, 325°, 400°, 600°, and 800° F) were applied to steel tags that were suspended at 25 cm above the forest floor in conjunction with the thermocouples and buried data recorders. Maximum temperatures recorded by the paints were adjusted to the midpoint between the highest melted paint and the next higher unmelted paint temperature.

A simple linear regression using the maximum temperatures from the paint tags as the independent variable resulted in an r^2 value of 0.84 and MSE of 116.9. There were no differences due to study areas or treatments. The maximum temperatures recorded by the paints sensitive to the highest temperatures were higher than those recorded by the thermocouples. This may be due to human error in interpretation or a true discrepancy. The temperature sensitive paints consistently, and accurately record the maximum temperatures produced by the prescribed fires used by forest managers. In addition to the maximum temperatures produced, the thermocouples and data loggers record residence time, which is needed to calculate fire intensity.

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