INFLUENCE OF ALTERNATIVE SILVICULTURAL TREATMENTS ON SPATIAL VARIABILITY IN LIGHT IN CENTRAL HARDWOOD STANDS ON THE CUMBERLAND PLATEAU

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INTRODUCTION

Effective oak silvicultural treatments allow light to reach the forest floor with sufficient intensity and duration to enable establishment, growth, and development of preferred species. Although it is intuitive that increases in light will accompany various levels of canopy removal, specific amounts and the distribution of light resulting from different silvicultural treatments have not been precisely determined. Our objectives were to document the amounts and distribution of photosynthetically active radiation (PAR) in stands receiving alternative silvicultural treatments.

METHODS AND STUDY SITES

Each treatment and controls were replicated three times in three comparable upland oak forest type units (upland sites typical of the Cumberland Plateau) on the London Ranger District of the Daniel Boone National Forest (latitude 370°05' N, longitude 840°05' W) in Kentucky. Two silvicultural treatments—(1) shelterwood with reserves ([10-15 ft^2/ac] 2.3 – 3.4 m^2/ha residual basal area to create a two-aged stand; and (2) thinning to the B-level of the Gingrich Stocking Chart (marking based on tree vigor and crown class)—and untreated controls were replicated thrice. Canopy cover was measured once at each of 20 permanent sample points located in each treatment unit with a digital plant canopy imager (CID Inc., Camas, WA).

PAR measurements (micromoles m^{-2} s^{-1}), were also acquired with an Accupar Ceptometer (Decagon Devices, Pullman, WA) at each of these 20 points. During each measurement period, a quantum sensor and data logger (Li-Cor Inc., Lincoln, NE) was set up in a nearby opening to collect reference or "above canopy" measurements for subsequent calculation of percent full PAR within the stands.

RESULTS

PAR measurements in untreated controls were typically 10 percent of ambient PAR (total available PAR in the open). Maximum PAR levels were observed in the shelterwood with reserves treatment, typically 80 percent of ambient PAR. Mean PAR measurements in the intermediate intensity overstory removal treatment, Gingrich B-level thinning, were 35 percent of ambient PAR. Understory PAR increased significantly with each increasing level of overstory removal, as expected. Variability in PAR did not follow the same pattern. Variability in PAR was maximized by intermediate levels of cutting in the Gingrich B-level thinning.

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DISCUSSION AND CONCLUSIONS

Interpretation of PAR levels in treated stands should take into account the potentially wide ranges in PAR from point to point. The precise spatial arrangement of residual stems will determine the amount and distribution of PAR throughout the day. These factors will interact with the PAR requirements of regenerating species, and could substantially influence future stand composition.

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