Characterization of Light in Forest Stands Following Silvicultural Treatments

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Introduction

- Light
  - Photosynthesis
  - Photosynthetically active radiation (PAR), wavelengths of 400-700 nm

Introduction

- Silviculture and light manipulation
  - Known: cutting increases light
  - However, differences in composition and vertical canopy structure may lead to different amounts of PAR with application of the <u>same</u> silvicultural practice.

Introduction

- Increasing number of ecophysiological studies are leading to quantification of PAR target levels for individual species

Introduction

- Managers need a way of relating specific PAR levels to more practical field measurements such as basal area
- The strength of relationships between PAR and variables such as basal area and canopy cover, may change across forest types and silvicultural treatments

Introduction

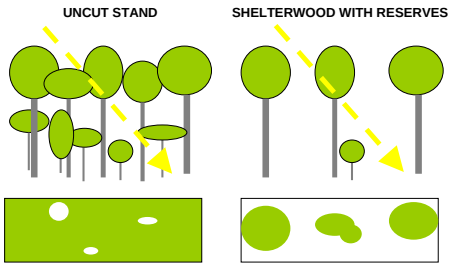
- PAR light measurement
  - Instantaneous (short term measurement)
  - Integrated (continuous measurements over long duration)

Introduction

- Temporal variability is the key
- How this variability changes over different forest types and stand structures is not well documented

Introduction

- Ecological impacts of forest management practices
  - Does active forest management simplify composition and structure, and lead to reduced heterogeneity in habitats?



- HIGH VERTICAL HETEROGENEITY
- LOW HORIZONTAL HETEROGENEITY

- REDUCED VERTICAL HETEROGENEITY
- INCREASED HORIZONTAL HETEROGENEITY
- TEMPORAL VS. SPATIAL HETEROGENEITY IN LIGHT?

Objectives

- To investigate the hypothesis that implementation of silvicultural practices results in reduced heterogeneity in understory PAR

Objectives

- To compare the degree of spatial and temporal heterogeneity in understory PAR across multiple silvicultural treatments and controls

Objectives

- To compare the strength of relationships between PAR and canopy cover, PAR and basal area, and canopy cover and basal area across multiple silvicultural treatments and controls

Study Site

- **Daniel Boone National Forest, KY**

Cold Hill Study Area, DBNF

Methods

Four silvicultural treatments and controls

Methods

- **Shelterwood with reserves (10-15 ft^2/ac residual basal area to create a two aged stand)**

Methods

- **Oak-shelterwood (60-75 ft^2/ac residual basal area, herbicide to reduce understory stand density)**

Methods

- Thinning to the B-level of the Gingrich Stocking Chart (tree vigor and crown class will be the basis for marking removals)

Methods

- Woodland-thinning (30-50 ft^2/ac residual basal area after cutting with prescribed fire for long term maintenance)

Methods

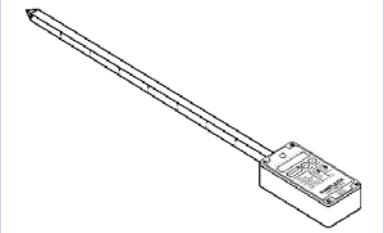
- Controls (no treatments)

Methods – Data Collection

- **Canopy cover: Digital Plant Canopy Imager** **(CID Inc., Camas, WA)**

Methods – Data Collection

- **Light (PAR): Accupar Ceptometer**
  (Decagon Devices, Pullman, WA)



Photosynthetically Active Radiation (PAR)

- **Ceptometer in open to calculate % Full PAR**
- **Values measured in umol $m^{-2}s^{-1}$**

Photosynthetically Active Radiation (PAR)

- PAR sampling mid-June, mid-July, and mid-August
- Measurements taken in 2 hour time spans: morning, noon,and afternoon
- Measurements centered around solar noon

Photosynthetically Active Radiation (PAR)

<u>Example</u>:

If solar noon = 1:30pm

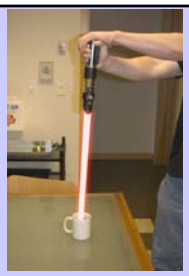
Morning = 9:30am-11:30am

Noon = 12:30pm-2:30pm

Afternoon = 3:30pm-5:30pm

***1 hour rest period between each time period**

Unlabeled uses for Accupar Ceptometer



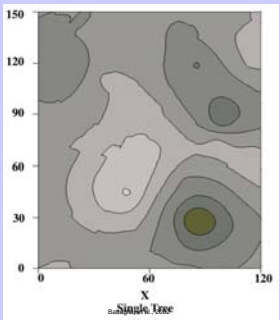
Potential Analysis Techniques

- **Computation and comparison of variances across time periods and treatments**

Potential Analysis Techniques

- **Kriging is synonymous with "optimal prediction" (Journel, A. and C.J. Huijbregts, 1981). It is a method of interpolation, enabling predictions of unknown values from data observed at known locations.**

Kriged ground-level gap light index (GLI) spatial patterns in longleaf pine following silvicultural treatments. (Battaglia et al., 2002)



Potential Analysis Techniques

- Investigation of the strength of relationships between PAR, basal area, canopy cover, etc. through regression analysis

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Please recycle.

Enjoy the summer.