Study Plan for Greenhouse Light Experiment with Understory Plants from Southeast Alaska

Introduction

The presence and absence of understory plants in Southeast Alaska has been observed by Hanley et al. to be associated with the overstory canopy type. Hemlock stands tend to have low understory abundance while Alder stands tend to have high. Light measurements made during the summer of 2000 indicate that alder stand canopies absorb about 90 percent of the ambient sunlight while hemlock stands are in the range of about 99 percent.

This study is designed to determine the growth response of five typical understory plants in response to differing light intensities. We are aware that other factors such as fertility, pH, soil moisture, organic matter accumulation etc. found in hemlock and alder stands may also contribute to the abundance of understory plants. Due to limitations in greenhouse space and resources we are only focusing on light intensity in this study.

Objectives

1. Determine the growth response of five typical understory plants from Southeast Alaska.
2. Test if the shapes of growth response curves are different by comparison of regression line analysis.
3. Determine an optimal light regime to be utilized in a following factorial experiment of light and soil conditions.

Procedures

The five understory plant species used in this study are *Cornus candensis* (bunchberry), *Oplopanex horridum* (devil's club), *Rubus spectabillis* (salmonberry), *Tsuga heterophylla* (western hemlock), and *Vaccinium ovalifolium* (huckleberry). Plant materials will be nursery stock obtained largely from nurseries in British Columbia. Ideally we would use plant materials from the southeast Alaska, however the prospect of propagating or cloning these native plants seems to be logistically prohibitive at this point. We know of no native plant nurseries within southeast Alaska and therefore will obtain plants from native nurseries located as near Alaska as possible. Plants will be one-year olds from the nurseries in either one gallon of four-inch pots. All plants will be transplanted to one-gallon pots with a common potting soil.

A series of nine light treatments will be applied to the understory plants. Light treatments will be maintained within a greenhouse (located on the campus of Oregon State University, Corvallis, OR) by the use of natural light attenuated by the greenhouse glass, and shade cloth. Four reflective panels (122 cm X 91 cm) will delineate and segregate light treatments i.e. each light treatment will consist of a light cubicle with an area 1.5 m^2. The reflective panels will provide for the most consistent lighting within a treatment. Locations of light treatments are to be randomly assigned to available space within the greenhouse.

Temperatures within the greenhouse will be maintained as best as possible to 15˚C during daytime and 10˚C during nighttime to be comparable to SE Alaska summertime conditions. The timing of this study is from Jan. to June. Maintenance of these conditions beyond June will be difficult and thus, June will be the planned termination of the experiment.

The light levels for each treatment will be obtained by the use of shade cloth suspended above the light cubicles with the following eight treatments planned: 100, 50, 25, 12.5, 6.8, 3.4, 1.7, and 0.8 percent of greenhouse light.

Each treatement also will use artificial lighting (high-pressure sodium, 250 watts) to extend the daylength in Corvallis to match summertime day lengths at 58˚ N latitude. A ninth light treatment will consist of full greenhouse light supplemented with a 1000 watt high-pressure sodium light. The lighting for this treatment would be comparable to a clearcut with no cloudy days and 2 to 3 times the light intensity of the 100 percent treatment.

Replication within a light treatment will consist of five plants per species. Therefore each treatment will have 25 plants. The growing space area for each plant will be approximately 600 cm^2. Some species such as *Oplopanex horridum* (devil's club) may have to be harvested early if there growth begins to interfere with other plants.

The treatments as outlined here are what we plan, however we will use photosynthetically active radiation (PAR) sensors and data loggers to monitor lighting intensity and to determine what the actual light treatments are. Data loggers will record hourly means for each treatment during the course of experiment.

Growth or accumulation of biomass will be the response measurement made in this study. Aboveground biomass will be clipped at the end of this experiment. The biomass from each plant will be dried and weigh to determine growth.