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Post-fire Recovery of *Juglans californica* in Sycamore Canyon: gas exchange performance of unburned mature and burned epicormic and basal resprouts

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Abstract

Sycamore Canyon experienced a fire during April of 2013. This allowed for the comparison of burned and unburned individuals in the area. Based on its resprouting types and abundance in the area, *Juglans californica* made for a good test species. A total of eighteen individuals were tagged and used with a LiCor6400XT to find fluorescence, Jmax, Vcmax, TPU, gm, photosynthesis, and conductance. Leaf samples were sent to California State University, Bakersfield for Nitrogen analysis to obtain PPNUE and percent nitrogen (with specific leaf area). These data were compared between burned mature, and burned basal and epicormic resprouts. ANOVA testing established that the only significant differences were seen amongst photosynthetic quenching, light adapted fluorescence, photosystem II quantum yield, and electron transport rate.

Introduction

The Santa Monica Mountains are located in one of five Mediterranean type climates in the world. These climates are characterized by mild, wet winters and warm, dry summers. Fire has always been understood as a part of the natural cycle, occurring about once every 20 years. However, recent environmental changes have led to many looking into the frequency of these fires and how strongly they affect the success of native plant life (Keeley, 1981). Of the three fire responses, resprouting, seeding, and a combination of the two, resprouting is the one of interest (Malanson, 1982). A fire had recently taken to Sycamore Canyon of the Santa Monica Mountains in April of 2013. This opened an opportunity for looking into the differences in performance of unburned and burned plants. In this case, the best test species in Sycamore Canyon is *Juglans californica* (common name Black Walnut). Sycamore Canyon contains a camping area that was partially untouched by the fire. A total of eighteen individuals were chosen that were divided into six mature unburned plants and twelve burned resprouts. Of the twelve resprouts, there were six that solely resprouted at the base (basal resprouts) and the other six also had epicormic resprouts.

Methods

**Fig. 1.** Fluorescence, Photosynthesis, and Conductance were measured using a LiCor6400-XT. Unburned mature plants and burned basal and epicormic resprouts were tested.

**Fig. 2.** Leaf samples were collected and sent to California State University, Bakersfield for Nitrogen content analysis. Pictured is collection of basal leaves.

**Fig. 3.** Comparison of light adapted fluorescence across mature and resprout plants. Letters denote differences among species by one-way ANOVA followed by a Fisher’s LSD test, P < 0.05, n = 6.

**Fig. 4.** Comparison of quantum yield or photosystem II efficiency across mature and resprout plants. Letters denote differences among species by one-way ANOVA followed by a Fisher’s LSD test, P < 0.05, n = 6.

**Fig. 5.** Comparison of photosynthetic quenching across mature and resprout plants. Letters denote differences among species by one-way ANOVA followed by a Fisher’s LSD test, P < 0.05, n = 6.

**Fig. 6.** Comparison of electron transport rate across mature and resprout plants. Letters denote differences among species by one-way ANOVA followed by a Fisher’s LSD test, P < 0.05, n = 6.

**Table 1.** Comparison of data from Sharkey curve. Presented as Mean ± SE. By way of one-way ANOVA no statistical differences were found across plant type in each category.

<table>
<thead>
<tr>
<th></th>
<th>Vcmax</th>
<th>Jmax</th>
<th>TPU</th>
<th>gm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature</td>
<td>63.8 ± 6.3</td>
<td>99.3 ± 4.9</td>
<td>7.5 ± 0.4</td>
<td>2.0 ± 0.8</td>
</tr>
<tr>
<td>Basal</td>
<td>58.7 ± 8.9</td>
<td>104.7 ± 12.2</td>
<td>7.8 ± 0.9</td>
<td>2.4 ± 0.9</td>
</tr>
<tr>
<td>Epicormic</td>
<td>70.3 ± 5.3</td>
<td>120.6 ± 5.1</td>
<td>9.1 ± 0.4</td>
<td>2.4 ± 0.6</td>
</tr>
</tbody>
</table>

Using the LiCor6400-XT, a myriad of data was recorded. The information of interest resulted in comparing fluorescence, Jmax, Vcmax, TPU, gm, PPNUE, percent nitrogen (with specific leaf area), photosynthesis, and conductance between mature, basal, and epicormic individuals. Each of the data were calculated and compared between the three individual types. The ANOVA statistical analysis was used. Above are the only results that contained any statistical significance. The rest had p values well above .05, which results in no statistical difference in the values. Hence, Jmax, Vcmax, TPU, gm, PPNUE, percent nitrogen (with specific leaf area), photosynthesis, and conductance were statistically the same among mature, basal, and epicormic individuals.

Results

**Conclusions**

- Quantum yield, photosynthetic quenching, and electron transport rate were significantly higher for basal resprouts than for both epicormic resprouts and mature plants. This may be because basal resprouts are not in direct sunlight. Direct light may cause photos Dameage and be worse for the plant than partial sunlight.
- Light adapted fluorescence was significantly less in mature plants than resprout plants. This may be due to leaf age, with mature plants having older leaves that may not be as photosynthetically productive.
- Jmax, Vcmax, TPU, gm, PPNUE, percent nitrogen (with specific leaf area), photosynthesis, and conductance did not show significance across the three types of leaves examined. However, Jmax, Vcmax, and TPU follow the same trends as PNP55, qP, and ETR.

**Literature cited**


**Acknowledgements**

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Study Site

Data were collected at Sycamore Canyon Campground in Malibu, California in October of 2013. This site was partially burned in April of 2013.