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Stomatal Conductance of Malosma laurina in Frequently Burned and Non-frequently Burned Sites

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Abstract

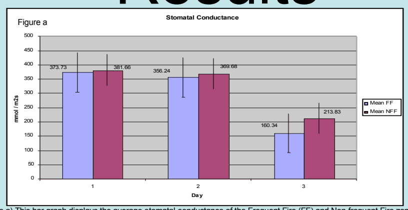
In the months following the Malibu fires, the fire zones have experienced and abundance of new growth. Among this new growth, there are differences that can be observed when comparing the top of the Malibu hill (frequent fire zone) to the base of the hill (non-frequent fire zone). As the chaparral resprouted we noticed the behavior of the *Malosma laurina* in both frequent and non-frequent fire zones and stomatal conductance, height, and water potential were tested for plants in the two varying zones, with plants in the non-frequent fire zone outperforming their counterparts.

Introduction

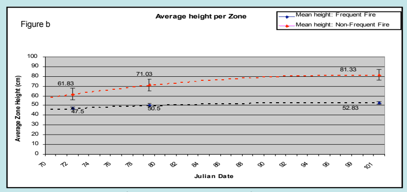
As fires become more frequent, the affected land is forced to adjust to accommodate the high frequency. In Malibu California, fires have occurred in rapid succession resulting in a diversified chaparral that serves as a perfect site to research plant response to frequent fire. In a zone that does "not conform in useful way to the traditional rules" we consequently hypothesized that the area that had not been exposed to frequent fire would be the site of plants with a higher stomatal conductance, greater height, and higher water potential (Zedle '83). We tested these parameters to determine whether or not frequent fire play a role in the development of plants within the two zones.

Height (cm)	Frequent	Non-Frequent Fire Zone
Mean	50.27	71.56
Average Growth Per Day	0.172	0.649
Stomatal cond	Frequent	Non-Frequent Fire Zone
Mean	296.65	321.78
Water Potential (-mPa)	Frequent	Non-Frequent Fire Zone
Mean	-20.4	-16.8

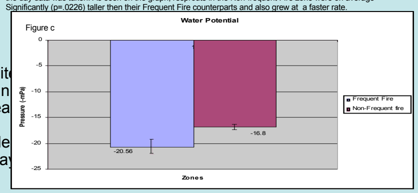
Results



(Figure a) This bar graph displays the average stomatal conductance of the Frequent Fire (FF) and Non-frequent Fire zone the data indicated that the Non-Frequent Fire zone had on average a higher stomatal conductance, however the Difference was not statistically significant.



(Figure b) The graph shown here in figure b displays the mean height of the resprouts at each site according to the day data was taken. As seen on the graph, resprouts in the Non-frequent Fire zone were on average Significantly (p=.0226) taller then their Frequent Fire counterparts and also grew at a faster rate.



(Figure c) This graph shows the average leaf water potential of the resprouts in the two fire zones. Plants in the Non-frequent fire zone had a significantly (p=.0469) lower water potential of -16.8 compared to -20.4 of Frequent Fire resprouts.

Data Set	P-Value
Stomatal Cond	0.789
Height	0.0226
Water pot	0.0465

Study Site

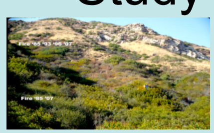


Figure e

Materials and Methods

Two locations were selected, one a zone where frequent fires had occurred and the other which has only experienced a fire recently. In Each zone six plants were tagged shortly after post-fire resprouting had occurred and their progress tracked. Data collected included height, which was measured using a meter stick, stomatal conductance, which was measured by taking the average stomatal conductance of 3 leaves per plant using a Steady State Porometer, and leaf water potential, measured using a pressure bomb. Using these data sets we attempted to gauge how well the resprouts were performing on average for each zone.

Discussion

Our data and the resulting analysis showed several things. First off, plants in the Non-Frequent Fire zone showed higher stomatal conductance (gs) then those plants in the Frequent Fire zone. However, this difference between them was not statistically significant (P=.789) when using a 95% confidence level. Therefore we can not conclusively say that there was a difference of *gs* in plants in the two zones. Analysis of the average plant height and growth rate in the two zones did turn up statistically significant data (P=.0226). Plants in the Frequent Fire zone were on average 21.12 cm smaller then their Non-Frequent fire counterparts, and their rate of growth was slower compared to the Non-Frequent Fire plants (see fig e). Along with the statistical data, simple observation showed that the two groups simply looked different. Plants in the Frequent Fire zone were shorter and had small leaves, while the plants in the Non-frequent Fire zone were much taller and had much broader leaves. Finally the water potential in the leaves was taken for both groups of plants. The Non-frequent Fire zone resprouts had a statistically significant (P=.0456) higher water potential on average (fig.c) then those resprouts in the Frequent Fire zone. This indicates to us that the resprouts in the frequent fire zone have perhaps depleted their reserves due to frequent resprouting occurrences while the plants in the Non-frequent fire zone, which have gone longer since their last resprouting, still had ample supplies.

Conclusion

In looking at our data it is observed that the resprouts in the Non-frequent Fire zone consistently outperformed their counterparts in the Frequent Fire zone in the measure parameters of growth rate, water potential, and stomatal conductance. This is perhaps due to the fact that plants in the Frequent Fire zone have had to resprout repeatedly, thereby either depleting their nutrient stores in their roots used to help resprout, or by being denied ample time between fires to re-accumulate stores of nutrients to resprout with. Plants in the Non-frequent Fire zone however have experienced less fires/resprout periods and thus most likely had larger stores available upon resprouting, allowing greater growth rate and larger water stores (as indicated by the greater water potential). Each of these items are also not mutually exclusive as each effects something else. For instance the larger leaf and plant size of the Non-frequent Fire plants is likely related to the higher water potential (Jarvis). A possible confounding factor however in this experiment was that the Non-frequent Fire zone lay downhill of the frequent fire zone. Therefore resprouts in this zone could have simply had more water available due to run-off from the hill.

The significance of this data is that as human populations in the area have increased so have the number of man-made fires. If our experiment is correct, this increased rate of fire is placing large amounts of stress on plant species who are adapted to lower natural fire rates. This increased stress due to man-made fires could thus lead to profound ecological problems if the fire rate increases to the point where species such as *Malosma laurina* can no longer survive or function healthily.

Literature Cited

P. G. Jarvis *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, Vol. 273, No. 927, A Discussion on Water Relations of Plants (Feb. 26, 1976), pp. 593-610

Paul H. Zedler, Clayton R. Gautier and Gregory S. McMaster *Ecological Society of America* Vol. 64, No. 4 *Vegetation in Response to Extreme Events: The effect of a short interva between fires in California Chaparral and Coastal Scrb*(Aug.1983),pp. 809-818

Jose M. Moreno and Walter C. Oechel *Ecological Society of America* Vol. 72, No. 6 Fire Intensity Effects on Germination of shrubs and herbs in Southern California Chaparral (Dec., 1991), pp. 1993-2004

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