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The Effects of Higher and Lower CO2 Levels in the Atmosphere on the Photosynthetic Rates and Stomatal Conductance of Malosma laurina in The Santa Monica Mountains

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The Effects of Higher and Lower CO_2 Levels in the Atmosphere on the Photosynthetic Rates and Stomatal Conductance of *Malosma laurina* in The Santa Monica Mountains

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Abstract

We hypothesize that higher CO_2 levels will lead to a change in photosynthetic performance in the *Malosma laurina* population of the Santa Monica Mountains. We used one *Malosma laurina* that is across the street from university's theme tower. We chose this specific plant because it was in the sun and it was in a well irrigated area. We selected a plant that is in non-shaded areas at 12:00 pm and then dark adapt them for 20 minutes. We selected an adult plant that was between four and six feet tall. We took the measurements from the upper leaves of the plant. We measured the photosynthetic rates of the plant, which will be exposed to the unaltered CO_2 levels of the natural environment in the Santa Monica Mountains. Then, we used the LICOR (Li- 6400) system to create create three separate environments that we will then impose on the same plant but using different leaves. These simulated environments will have CO_2 levels of 280ppm (past atmospheric level of CO_2 before the industrial revolution), 400ppm (current atmospheric level of CO_2), and 800ppm (expected atmospheric level of CO_2 by 2100).

Introduction

Malosma laurina plays a crucial role in the Santa Monica Mountains. Although not visible to the eye, roots of the *Malosma laurina* grow extremely deep in to the surface of the earth even though they are just a few feet tall. These monstrous roots are pivotal because they provide structure and stability to the mountainsides. The bigger and deeper they are the more support they provide. This is important to the human species because the roots of *Malosma laurina* can help prevent natural disasters such as landslides and rockslides, which can essentially save lives. This experiment is worthy of pursuit because global warming is becoming more of a main concern today and it contributes directly to rising CO_2 level in the atmosphere. We hypothesized that the change in the CO_2 levels would foster a change in the productivity of the plant. To test this we used the Li-6400 to simulate different environments that were identical except for the fact that they each had different levels of CO_2

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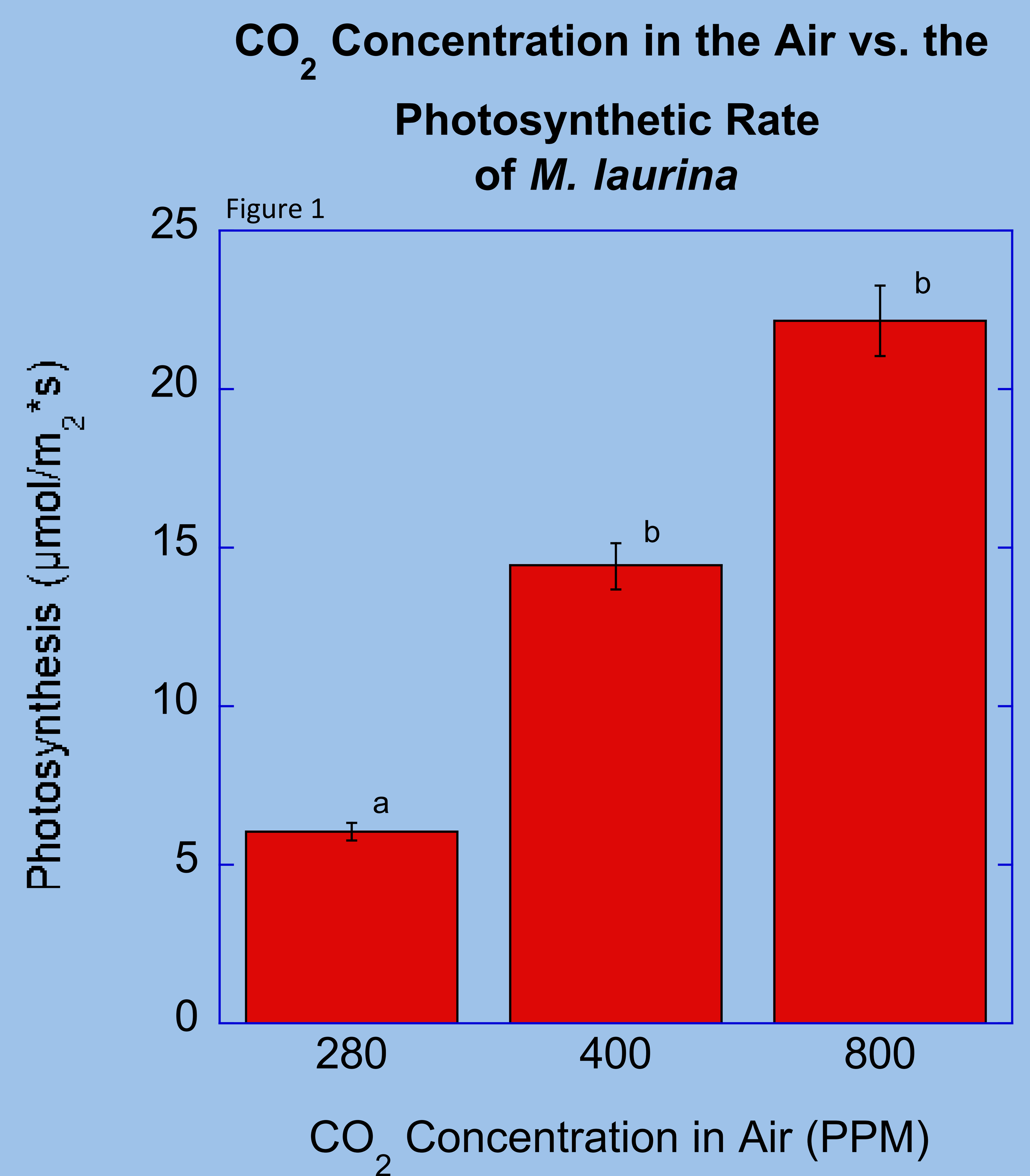


Figure 1. The above graph represents the photosynthetic rate measured at varying carbon dioxide levels in the atmosphere. Matching letters indicate no significant difference by one way ANOVA at $P < 0.01$ followed by a Fisher's LSD test. repeated measures. Error bars show deviation from the mean.

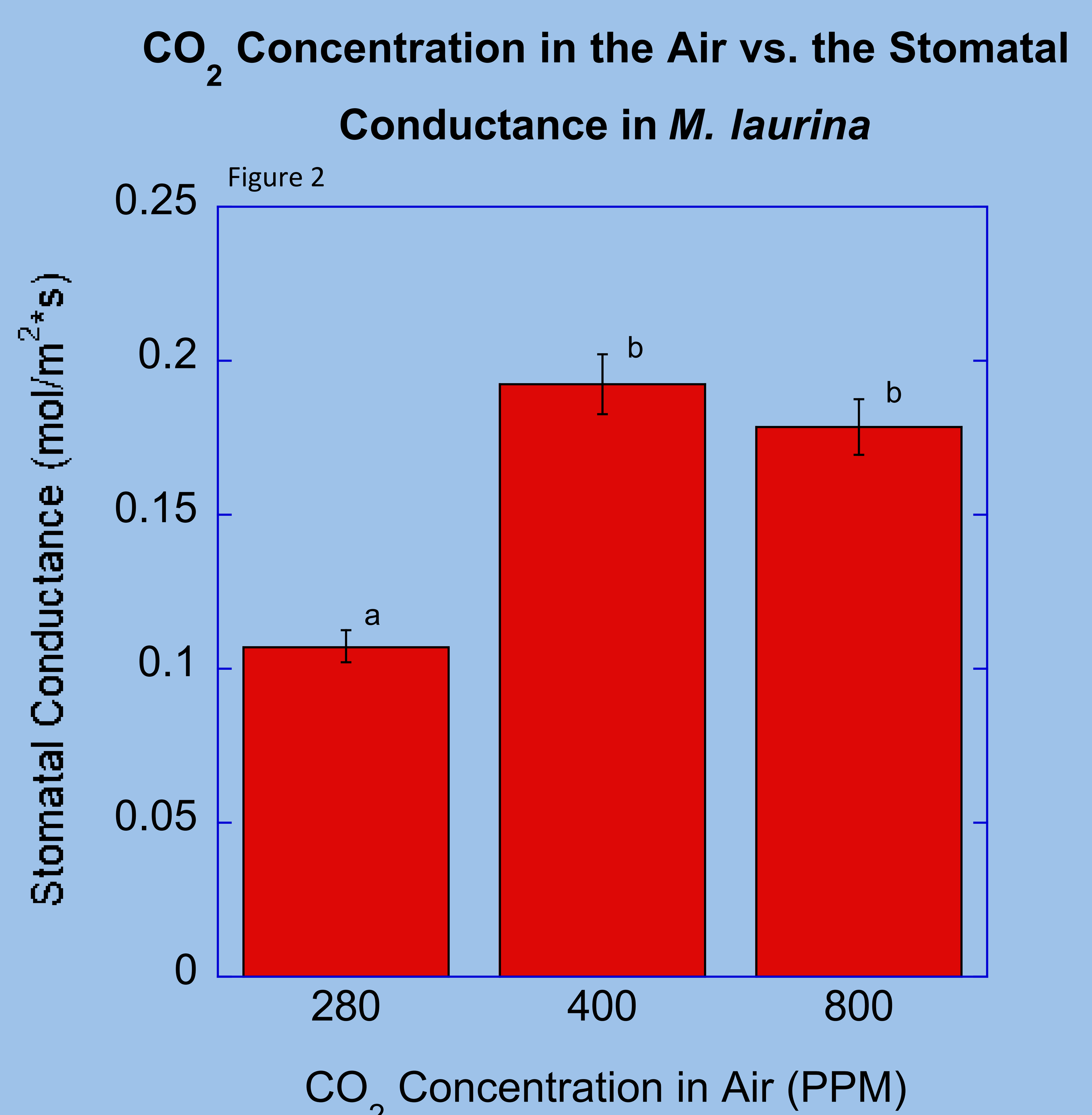
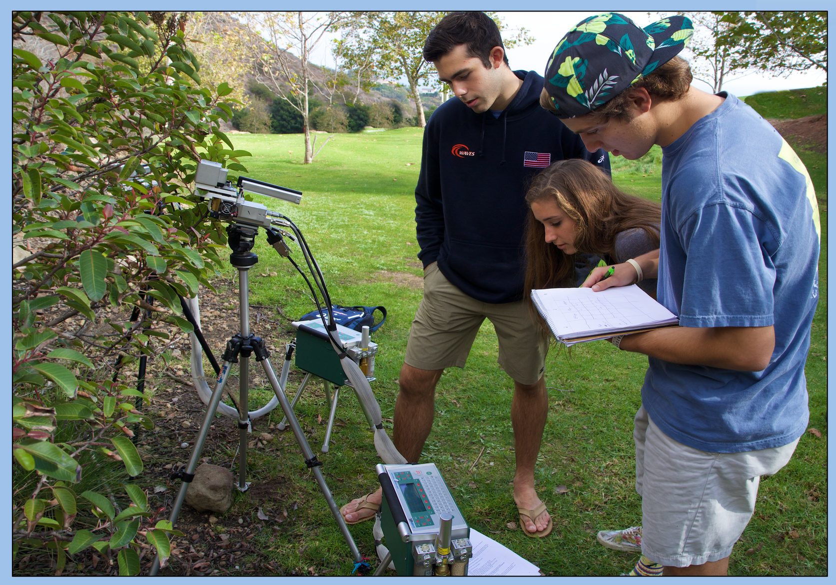


Figure 2. The above graph represents the stomatal conductance measured at varying carbon dioxide levels in the atmosphere. Matching letters indicate no significant difference by one way ANOVA at $P < 0.01$ followed by a Fisher's LSD test. repeated measures. Error bars show deviation from the mean.



Materials and Methods

We gathered all data from the Malibu Campus of Pepperdine University located in the Santa Monica Mountains. We used one *Malosma laurina* that we found across the street from university's theme tower. We chose this specific plant because it was in the sun and it was in a well irrigated area. We selected a plant that is in non-shaded areas at 12:00 pm (noon) and then dark adapt them for 20 minutes. We selected an adult plant that was between four and six feet tall. We took the measurements from the upper and middle level leaves of the plant. We measured the photosynthetic rates of the plant, which will be exposed to the unaltered CO_2 levels of the natural environment in the Santa Monica Mountains. Then, we used the LICOR (Li- 6400) system to create create three separate environments that we will then impose on the same plant but using different leaves. We turned the machine on and set the flow rate at 200 µmol/s. Then we turned on the mixer of the Licor and would set the amount released to either 280ppm, 400ppm, or 800ppm. We selected these CO_2 levels because 280ppm was the amount of carbon dioxide in the atmosphere before the industrial revolution , 400ppm is the current level of carbon dioxide in the atmosphere, and 800ppm is the predicted level of carbon dioxide in the atmosphere by the year 2100. We also set the the PQuantum light setting of the LICOR to 2000 $\mu mol/m^2s$. We set the temperature to 22 degrees Celsius. Then we began to record the photosynthetic productivity and stomatal conductance.

Discussion and Conclusion

Our original hypothesis stated that an increase in CO_2 levels would lead to a change in photosynthetic rates and stomatal conductance in the *Malosma laurina* population of the Santa Monica Mountain. Our results supported our hypothesis. What we did not ever hypothesize was exactly how it might effect the plant, whether it be negatively or positively. We took the mean of the photosynthetic rates measured from each leaf at each CO_2 level and compared them. Our results showed that as the CO_2 levels increased from 280 ppm to 400ppm and then to 800ppm the rate of photosynthetic activity did so as well. This showed us that there was a positive correlation between higher CO_2 levels and photosynthetic activity on the specific *Malosma laurina* plant that we tested. We found that the 400 ppm and 800 ppm are significantly different from 280 ppm, but not significantly different from each other. No previous literature was found regarding photosynthetic rates on the *Malosma laurina.* Once again we predicted that there would be a change in the stomatal conductance but did not know if it would be positively or negatively correlated. When comparing our mean values of stomatal conductance we noticed something out of pattern. When the plant was exposed to CO_2 levels 280 ppm vs 400 and 800 ppm, we observed that the stomatal conductance rates of the plant at 400 and 800 ppm have a higher mean value than at 280 ppm. We can conclude from this data that an increase in CO_2 concentration in the air leads to changes in the photosynthetic performance in the *Malosma laurina.*