



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Sophia Barwegen</b>	<b>Project Number</b>  <b>S0902</b>
<b>Project Title</b>  <b>The Effect of Light Pollution on Dark Sky Brightness and the Calvin Cycle of Wildflowers in Yosemite National Park</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> This research proposes that if plants from Yosemite National Park experience artificial light pollution, simulated by a 60 watt light bulb underneath a black apron, then those typically found at higher elevations will experience a larger change in CO<sub>2</sub> over a 9 minute period. Additionally, this research also proposes that, if a location in Yosemite is both higher in elevation and farther away from populated areas (ie. Yosemite Valley), then the night sky will experience more brightness.</p> <p><b>Methods</b> This project was a two-part study: one was a 27-day descriptive study addressing the night sky brightness at different elevations throughout Yosemite, and the second was a study reviewing the effects of light pollution on the Calvin Cycle on plants found in the 5 elevation zones of Yosemite. During the descriptive study, a measurement, magnitudes per square arcseconds, was taken on a Unihedron Sky Quality Meter in order to assess the brightness of the night sky at different elevations in relation to distance from a populated area within the park. The second study took 5 different species of plants (<i>Eschscholzia caespitosa</i>, <i>Helianthus annuus</i>, <i>Eschscholzia californica</i>, <i>Mimulus lewisii</i>, <i>Lupinus albifrons</i>), assessing their growth and CO<sub>2</sub> flux during the Calvin Cycle as they were placed under a black lab apron with a LED lamp underneath to simulate the Calvin Cycle with light pollution.</p> <p><b>Results</b> It was observed that areas typically above 3,048 meters, or below the Alpine High Sierras, had the lowest amount of sky brightness; also, sites located at least 24.1402 km from Yosemite Valley experienced the greatest dark sky ratings. For the second study, <i>Mimulus lewisii</i>, which is found from 2438.4-3169.92m, had the largest CO<sub>2</sub> change over the course of experimentation, a 9 minute period in comparison to the other wildflowers tested.</p> <p><b>Conclusions</b> Test sites in Yosemite's backcountry still had high levels of light pollution despite still being defined as protected wilderness areas with the only areas being truly dark were those in the highest elevation zone and at least 24.1402 km from Yosemite Valley. Further, noting that wildflowers' habitats will be a better factor in predicting how light pollution will affect them as <i>Mimulus lewisii</i> faced the greatest CO<sub>2</sub> change despite not being the highest in elevation. These results help quantify the impact of light pollution on plants Calvin Cycles in addition to its effect on dark night skies.</p>	
<b>Summary Statement</b>  I tested how artificial light pollution affects the brightness of the night sky in wilderness areas in Yosemite and the Calvin Cycle of wildflowers from the 5 elevation zones of Yosemite.	
<b>Help Received</b>  I gained support from my research class teacher, Dr. Koltermann, on how to analyze the results of my Calvin Cycle study on wildflowers.	