# CALIFORNIA STATE SCIENCE FAIR
# 2010 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**S2005**

**Project Title**
## Reducing Pollution through Green Roofs: A Photosynthetic Optimization Study

**Abstract**

**Objectives/Goals**
My project has the objective of optimizing the design of green roofs in Southern California by analyzing the storage of carbon by four native plants.

**Methods/Materials**
Five samples of the following four plant species, fragaria californica, galvezia speciosa, heteromeles argutifolia, and salvia clevelandii, were studied. I measured and recorded the photosynthetic and transpiration rate for the 20 plants using LI-COR equipment, located in the Lab of Professor Philippa Drennan, Chair of the Biology Department at LMU. Each experiment started with adjusting for changes in atmospheric pressure relative humidity and zeroing the equipment. Temperature was held constant as was the air flow. Both rates were measured at 10 illumination levels from 0 to 1800 uMoles m-2 s-1, "Units". Measurements started after a "stabilizing" period and the LI-COR took many measurements and displayed the average of those readings for each illumination level. I averaged and graphed the results from the 5 samples of each species.

**Results**
Galvezia had the highest Water Use Efficiency Ratio of 7 overall occurring between illumination levels of 400 and 600 Units. At 1200 to 1800 its Water Use Efficiency ratio dropped only to 6, compared to 4 for the other species. Fragaria had the highest photosynthetic rate at 8.9 CO2 Units and saturated at an illumination level of 900 Units. Salvia had the next highest photosynthetic rate of 7.8 (saturation occurring at 1500); galvezia 6.4 (400); and heteromeles a surprising 1.7 CO2 Units, saturating at 200. Heteromeles had the lowest transpiration rate at all illumination levels. Fragaria had the highest transpiration rate at all illumination levels.

**Conclusions/Discussion**
Galvezia is a superior choice for the vegetation of a green roof in southern California, since its Water Use Efficiency Ratio Maximum is 7 and is greater than 6 for illumination levels over 200 Units. Fragaria had the highest photosynthetic rate but this was offset by the largest transpiration rate. Salvia had the second highest photosynthetic rate but it had the second highest transpiration rate, too, so its Maximum Efficiency Ratio was 4.5. Heteromeles had the lowest photosynthetic rate and transpiration rate at all illumination levels.
Future research should include mapping photosynthetic and transpiration rates and saturation points for increases in CO2 concentration and temperature.

**Summary Statement**
Optimizing the choice of vegetation for a Green Roof located in Southern California

**Help Received**
Dr. P. Drennan gave me access to her lab at LMU and explained how to operate the LI-COR. Selected for the SC Academy of Sciences Junior Research Program.