



CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

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Project Title The Effect of Elevated Carbon Dioxide and Nitrogen Deposition on Herbivore Populations	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment was to observe the effects of elevated carbon dioxide (CO₂) and nitrogen (N) deposition has on herbivore populations, since these two treatments affect plant nutrient composition.</p> <p>Methods/Materials The study site was a grassland (the Jasper Ridge Biological Preserve at Stanford University), in which I used 32 plots, 8 replicate quarter-circle plots for the four treatments: control, elevated N, elevated CO₂, and both elevated N and CO₂. Elevated N was achieved by means of slow-release nitrogen tablets and liquid nitrate. Elevated CO₂ was achieved by means of CO₂-emitting tubes whose emission level were monitored by a computer. These treatments have been applied to the grassland for many years. Slugs traps were placed and collected. Specimens were counted, dried, and weighed.</p> <p>Results In general, the results reflected the N requirement of herbivores. After 16 weeks, I found that slugs had lower biomass and population under the elevated CO₂ treatments, while slugs under the elevated N treatment were biggest and most numerous.</p> <p>Conclusions/Discussion Because elevated CO₂ produces lower quality leaf tissue, elevated CO₂ harms herbivores, whether they exhibit compensatory consumption or not, a process in which a slug eats an excess of low-quality plant material to attain limiting nutrients. Herbivores incapable of the process cannot consume enough material to obtain the limiting nutrients they need. While other herbivores can, it takes time and energy to forage for more food and to efficiently process the nutrients in the food. This affects population and slug mass, implying changes in species composition in an inevitably high CO₂ world. Elevated N is beneficial to herbivores at least in the short term. Because elevated N foliage contains more nutrients, there were high slug mass and number values in all the N graphs until the 11th week, when perhaps the N deposition that was applied early in the season started to dissipate. Interestingly, all treatments are reflective of the environment. While CO₂ is ubiquitous, N deposition varies from region to region. (CO₂, CO₂ and N) In agricultural areas located near industry, N deposition is especially high. (N) Furthermore, the ability of plants to fix nitrogen into proteins and other organic substances impacts human welfare, since protein deficiency is the most common form of malnutrition in humans.</p>	
Summary Statement The objective was to discover what the effect of elevated carbon dioxide and nitrogen deposition has on herbivore populations, since these two treatments affect plant nutrient composition.	
Help Received Used lab equipment and study site at Stanford University under the supervision of Dr. Christopher Field, and graduate students Elsa Cleland and Halton Peters.	