



**CALIFORNIA STATE SCIENCE FAIR  
2007 PROJECT SUMMARY**

<b>Name(s)</b> <b>Emma R. Dohner</b>	<b>Project Number</b> <b>J1607</b>
<b>Project Title</b> <b>Gopher Slumber Party</b>	
<b>Objectives/Goals</b> Objective: To study the feasibility of an environmentally friendly and humane method of getting rid of gophers: the use of nitrogen. My hypothesis is that by introducing nitrogen into a gopher run, I can lower the oxygen level in the run to a point incapable of sustaining the gopher (<6% oxygen), making this a feasible gopher removal technique.	
<b>Abstract</b> <b>Methods/Materials</b> Methods and Materials: To study the feasibility of using nitrogen to displace oxygen in a gopher run, I simulated gopher runs using different lengths and porosities of 3 in. PVC drainage pipe. I studied variables that I thought would be important (length, flowrate, and porosity) using a 2 level, 3 variable factorial design (8 experiments). I used a commercially available flowmeter to set the flow of nitrogen into the simulated run. I then timed how long it took the oxygen meter at the far end of the run to reach a reading of 6% (a point below which humans, and probably gophers, cannot survive).	
<b>Results</b> Results: My data shows that flowrate and length have an important effect on the time it takes to reach 6% oxygen. Higher flowrates lead to shorter times, while longer lengths lead to longer times. Surprisingly, porosity did not seem to have much of an effect. We were able to achieve 6% in all of our experiments except for one; the long length (80ft), low flowrate (2 scf/m), and high porosity run never got below 8% (this is due to diffusion of oxygen from the surrounding air through the pores, and back into the simulated run). Interestingly, I found that the use of nitrogen to displace oxygen remains effective even with runs that branch and change elevations.	
<b>Conclusions/Discussion</b> Conclusion: Lowering the oxygen level in a gopher run, by introducing nitrogen into it, is a feasible technique for getting the oxygen level below 6%, and presumably for getting rid of gophers. Since faster flowrates yield shorter times, I recommend pumping the nitrogen into the run at a flowrate of 4 scf/m (the maximum value of the flowmeter I used). At this flowrate, a standard 300 cu. ft. cylinder of nitrogen would last for slightly more than an hour. This method would be humane, because the gopher would simply go to sleep permanently, without feeling any pain. It is environmentally friendly, because it uses an inert gas found naturally in large quantities in the atmosphere (air is 78% nitrogen).	
<b>Summary Statement</b> In my project, I evaluated the feasibility of using nitrogen to displace oxygen, in a simulated gopher run, as a technique for removing gophers.	
<b>Help Received</b> Father helped set up the experiment and develop the factorial design. Mother advised me on my poster-board layout.	