



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) James D. Arias	Project Number S0801
Project Title Let's Get Ready to Rumble! A Comparative Study of Three Ground Materials' Stability/Safety During an Earthquake Scenario	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experimental procedure demonstrates how 3 common ground materials [sand, soil, and cement] will behave during a simulated earthquake on a fault line. By using a shake table, it is possible to mimic the movements and vibrations of an earthquake. Using this shake table and models of buildings; this project will simulate how a building would react during an earthquake on each ground material.</p> <p>Methods/Materials The main parts of the project included: a shake table, two miniature building models (small A and large B), and ground materials. Important experiment materials included: rope, staples, staple gun, rulers, hot glue, a hot glue gun, wood, racket balls, bungee cord, a scroll saw, a nail gun, nails, a concrete slab, sand, dirt, stones, and a drill. First, the ground material was placed in the shake table. A model was placed over the middle of the space between the quadrants. The legs of the building model dug into the ground material. The starting point of the model was recorded by a ruler that marked on the wooden border. For transverse fault line tests, the quadrants were pulled vertically or back-and-forth 30 times for 4 tests. For the convergent/divergent fault line tests, the quadrants were pulled horizontally apart and back together 30 times for 4 trials. The cement trials were tested 3 times each. The model was measured for movement and was inspected for damage. The greater the damage or movement, the less safe the ground material was deemed.</p> <p>Results The movement model A had on sand averaged 1.47cm; model B moved on sand an average of 2.04cm. On soil, model A moved an average 1.27cm; model B had 1.89cm of average movement. During cement trials, model A had an average movement of .03cm. Model B had no movement at all during the same trials. The trials with cement yielded the most damage of all tests; the transverse tests for model A weakened the right legs the first two trials and pulled both left legs off.</p> <p>Conclusions/Discussion The soil group had the least movement and damage; therefore, it was deemed the safest. But there is no direct way of knowing which material would be safest during an earthquake; the world's geological diversity and the new earthquake prevention systems will affect the safety of the ground material. Needless to say, because of the constant movement of the Earth's crust, testing needs to be carried on to help prevent such devastations witnessed by the world this past year.</p>	
Summary Statement This project observes the behavior of three different ground materials under two building types during a simulated earthquake to judge which tested ground material is safest.	
Help Received Father helped construct earthquake simulator table	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Frances W. Atkins	Project Number S0802
Project Title Living Roofs	
Objectives/Goals Abstract One important factor that leads to the degradation of our environment can be traced to building construction and operation. We are responsible for engineering improved building designs, which can help compensate for compromised environmental stewardship. A "living roof" that uses healthy, live vegetation is a technological advance utilized in building designs. This project tested how a living roof affects the amplitude and rate of temperature change inside a classroom model by studying the effects of heat transfer interacting with the characteristics of a living roof. Based on research, I predicted that temperatures would increase at a higher rate in a classroom model with a conventional roof compared to a classroom model using a living roof design. By taking the average temperature of five trials for both the living roof and the conventional roof, the results affirmed my hypothesis to be partially correct. The rate of temperature change in the living roof model was significantly less, actually decreasing the temperature by 1.13 °F versus an increase of 6.66°F for the conventional model. This experiment suggests that the living roof absorbed energy from a heat lamp rather than re-radiating it into the building below. The decrease in temperature may be a result of evaporation from moisture within the living roof biomass. A smaller amplitude and lesser rate of temperature change means that a fraction of energy normally used by mechanical systems would be required to cool the building using a living roof design.	
Summary Statement This project tests how a living roof alters the amplitude and rate of temperature increase within a modeled classroom. A decrease in the rate of temperature change would required less energy to cool buildings down.	
Help Received Father helped with math calculations and by proofreading my report; Jack Smith helped with the collection of moss.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Wardah A. Bari	Project Number S0803
Project Title Bioremediation of Petroleum Hydrocarbon Contaminated Soils	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this project is to discover the nature of Bioremediation. Bioremediation is any process that uses microorganisms or their enzymes to return the environment altered by contaminants to its original condition. I wanted to see if natural attenuation or an enhanced treatment of the soil would be more effective in eliminating the contaminants.</p> <p>Methods/Materials I isolated three biocells: the first was a control with only natural soil, the second had soil with contaminants and was allowed to naturally degrade, and the third also had contaminants, but was given an enhanced treatment with the addition of nutrients, water, and oxygen. I measured the rate weekly at which the contaminants were consumed, by the microbes, in each cell.</p> <p>Results CELL 1, a blank cell, contained only soil. It had no contaminants, so therefore no treatment was necessary. There was no abnormal coloration or smell coming from CELL 1 because it was just like ordinary dirt with no additives. The TPH level was 100 mg/kg, which is considered to be non hazardous. CELL 2 contained just as many contaminants as CELL 3; however, it did not receive any treatment. I wanted to see if it would naturally attenuate without any additional help of tilling or moisturizing. The TPH level started at 1900 mg/kg and at the end of fifteen weeks, it lowered to 1086 mg/kg#a reduction of 57%#a result of natural bioremediation. At the end, there was still a lot of contaminant left. In CELL 3, the TPH level was 1750 mg/kg, which was a bit lower than the level in CELL 2; however, the rate at which bacteria consumed the contaminants was much faster. In just 15 weeks, the TPH went from 1750 mg/kg to 173 mg/kg #a reduction of 91%#a much greater difference than found in CELL 2.</p> <p>Conclusions/Discussion The aeration and addition of moisture to the treatment of the bioremediation process was found to be very effective and successful: in CELL 3, the TPH decreased by 1577 mg/kg in just fifteen weeks, about three months, compared to CELL 2#s, where the TPH level was only reduced by 814 mg/kg. This will be an economical and faster process to treat POL spills. My results reinforced the idea that bioremediation is a very effective way to safely remove toxic contaminants from soil.</p>	
Summary Statement My project is about testing the effectiveness of the process of bioremediation in the environment.	
Help Received My father acquired the Hanby Test Kit used in the method. Walgreens Pharmacy printed out my title banner. Several environmental engineers answered my questions regarding soil and contaminants.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Joshua S. Belford	Project Number S0804
Project Title The Effect of the Depth of a Focus on the Magnitude of an Earthquake	
Objectives/Goals The purpose of this project was to find out at what depth of a focus of an earthquake would it have the greatest magnitude and area of affect (or destruction).	
Abstract Methods/Materials First had to build the Oscillating Earthquake Device (OED), but that is long and complicated and requires soldering. Testing Get Planting pot fill with 5 cm of soil, place the OED at the center of the pot, cover over with 45 cm of soil. Place iPod over focus and run the iSeismometer application, turn on the OED in 5 second bursts (each 5 second burst is 1 trial) Place iPod 10 cm away repeat the last step then repeat it again at 20 cm away from epicenter. Dig out the OED and rebury at 20 cm repeat the last 2 steps, do the same for the depths of 35 cm and 50 cm. The actual process is much more complicated, but I just wanted to give an overview. Short simple list Oscillating Earthquake Device -Comprised of a motor with an off center weight attached -attached to batteries and on/off switch Planting pot (53 cm height by 60 cm rim diameter by 40 base diameter) Soil to fill the pot Pen and paper Meter stick iPod Touch with application iSeismometer. (optional plastic bag to cover iPod from dirt)	
Results 50 cm (depth) strongest at the 0 cm away from epicenter 35 cm (depth) strongest at the 10 cm and 20 cm away from epicenter 20 cm (depth) weakest at the 0 cm, 10 cm, and 20 cm away from epicenter. (Actual results are more detailed and include magnitude measurements)	
Conclusions/Discussion The data supports the hypothesis partially in that 2 out of 3 times the 35 cm depth will have the highest magnitude and area of affect, it was not supported in that the 50 cm depth was the strongest magnitude, but not area of affect. This data therefore can be applied to the purpose in that if an earthquake with a deeper focus occurs, the earthquake will be more far spread, but it will have less strength, and if the focus os shallow, the earthquake will cause more damage, but only within a limited range of the epicenter. (This data can be applied to the Haitian and Chilean earthquakes, as the Chilean earthquake was more shallow and therefore though having a great magnitude, had less area of affect)	
Summary Statement The Effect of the Depth of a Focus on the Magnitude of an Earthquake.	
Help Received Dad helped solder wires together.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Rachel Bickert; Kelli Van Wandelen	Project Number S0805
Project Title Kelli and Rachel's Excellent Beach Adventure, The Sequel: Sand Storms and Sapiens	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals We determined the impact of the dredging on the beach east of Seabright Beach and the harbor, Twin Lakes Beach. In comparing the profiles of the two beaches, we will determine how longshore transport and dredging impact a beach.</p> <p>Methods/Materials The materials used are hand level, rod level and stadia rod. We go to both beaches and survey across from North to South until we reach the ocean, gathering height every two meters. We then cumulate the data and graph it.</p> <p>Results Our data shows that the harbor jetty blocks longshore sand transport past Seabright Beach, thus starving Twin Lakes Beach of sand. Furthermore, human dredging of sand from the harbor counteracts some of the sand starvation by adding sand to Twin Lakes Beach.</p> <p>Conclusions/Discussion Once dredging of the harbor started, however, Twin Lakes profile became steeper compared to Seabright. Upon initial inspection, dredging the harbor would seem to have a negative impact on the profile of Twin Lakes Beach; however, dredging appears to be essential in providing sand to nourish the beach. This prevents further erosion of the beach due to the trapping of sand and blocking of longshore transport by the upstream harbor jetty. Dredging of the Santa Cruz harbor is essential. If dredging were to stop, there would be negative impacts on many things. Twin Lakes Beach would become much narrower than its current 140 meters across. On the other hand, Seabright Beach would increase in width, because sand and sediment would build up in the harbor mouth (shoaling) and eventually around the jetty and into the harbor, increasing the size of the sandbar and Seabright Beach. The harbor would cease to exist because too much sand would be built up in the mouth and eventually throughout the harbor, stopping boat transportation. This would ultimately result in Twin Lakes Beach losing all sand and ceasing to exist. The houses on Twin Lakes Beach would lose their properly value of being beach-side homes, and would possibly be destroyed by reoccurring wave action. Also, the economy of Santa Cruz is highly dependent on the summer tourism. If these beaches were to be destroyed, fewer tourists would come to Santa Cruz, which would hurt the economy. As long as the harbor is in use, dredging is necessary to maintain it, the health of the beaches, and the city of Santa Cruz.</p>	
Summary Statement To compare the profile of two beaches and to determine both positive and negative effects of Santa Cruz Harbor Jetty and dredge on the beaches.	
Help Received Mentor Save Swartz and Project Supervisor Jane Orbuch	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Kelli Caruso; Garrett Dolphin	Project Number S0806
Project Title Point Source Plume Dispersion Due to a Rise in Elevation	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To observe and determine whether a higher or lower elevation release of pollutant would affect the pollutant levels within a city and also determine whether a "hot" would pollute a city more than a "cold" plume and whether the density of building organization had an effect on them.</p> <p>Methods/Materials Materials: 1. Legos; 2. A Lego Mat; 3. 2 Pencils; 4. Paper; 5. Camera; 7. Computer; 8. Dry Ice; 9. PVC Piping; 10. Screen; 11. Styrofoam beads; 12. Glue; 13. Wood; 14. Water; 15. Bowl; 16. PVC piping cutters; 17. Poppy seeds; 18. Stop watch; 19. Scale; 20. Tin foil; 21. Blow torch; 22. Ping pong balls; 23. Water hose for precautions.</p> <p>Results Our results were that a lower elevation release polluted the city more than a higher elevation release; that a cold plume polluted the more than a hot plume; and that lower density urban morphology gave the pollutant more room to circulate, hence giving a more polluted city.</p> <p>Conclusions/Discussion Pollutants released from a lower elevation facility will pollute nearby cities more intensely that a higher elevation release will and a lower flowing "cold" plume such as chlorine gas will generally circulate around in a city. Also, the higher density a city design is, the better its ability to disperse pollutants around and over the city rather than through it.</p>	
Summary Statement Our project is about exploring the dispersion of pollution throughout an urban city and how urban morphology affects the pollutant movement.	
Help Received Marko Princevac helped us understand the practical application for our project and allowed us to use his plume dispersion simulator; Vance Usui helped us develop and further our project and idea; Patrice Dolphin for providing art supplies and paper; Rick Caruso gave us building materials.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Evelyn Chang	Project Number S0807
Project Title The Development of an Eco-Friendly Calcium in situ Precipitation System for the Mitigation of Liquefaction Prone Soils	
Abstract Objectives/Goals The purpose of this research is to develop a new approach of soil modification that takes advantage of intrinsic soil characteristics and the abundance of eco-friendly materials to transform the loose and porous soil mass into a denser and less permeable state capable of resisting liquefaction during earthquakes. Three processes: Microbially-Induced Calcium Precipitation (MICP), Calcium In-Situ Precipitation System (CIPS), and the proposed Eco-Friendly Calcium In-Situ Precipitation System (ECIPS), are experimented and compared. Methods/Materials While MICP and CIPS rely on controlled environment, specially selected bacteria (from bat guano) and/or particular commercial ingredients (such as liquid calcium fertilizer), the proposed ECIPS method causes calcium precipitation to occur within soil mass through permeation with a solution made of egg shells, vinegar, urea and baking soda. Soil samples were subjected to repeated tests consisting of gradation, direct shear, and unconfined compression. Results During the direct shear and compressibility tests, it was observed that all samples from all three processes showed an increase in hardness and soil strength. It should be noted that sandy soil is typically considered to possess zero or negligible unconfined compression strength due to lack of cohesion, or inter-particle bonding. However, after the permeation process, cementation within the soil mass enabled the treated sandy soil mass to stand alone in cylindrical form, and thus, is capable of being subjected to unconfined compressibility tests. Conclusions/Discussion The results indicate: 1) the delicate bacteria selection and the highly controlled environment of MICP process is too difficult to be duplicated, with the effect of bacteria undistinguishable; 2) the CIPS process could increase soil strength and reduce soil permeability substantially, but the materials used may not be eco-friendly; and 3) the proposed ECIPS process was able to improve the cohesion and the compressive strength of the tested soils substantially, thus rendering the treated soils liquefaction-proof. The ECIPS process also proves to be eco-friendly, organic-based, waste recycle-capable, minimally intrusive, cost effective and easily executable.	
Summary Statement My research develops a new and eco-friendly process of using wasted eggshells and organic vinegar to strengthen the soil against liquefaction.	
Help Received Used lab equipment at Associated Soils Engineering, Inc. under the supervision of my father, the Senior Project Engineer, and Mr. Don Zike, the lab manager. Science teachers, Ms. Shannon Bunch and Mr. David Knight, answered questions and edited my lab notebook.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Berj Chorlian; Shaunt Kevork	Project Number S0808
Project Title Gravimetric Analysis: Removing Lead from Soil	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Contaminated soil can present harm to an ecosystem. Pollutants, such as lead, can accumulate in the soil due to the mixing of chips of lead based paint. Additionally, the exhaust from automobiles running on leaded gasoline deposits lead onto the soil, leading to relatively high and potentially toxic levels. Once lead accumulates in the soil, it can be transported via the surfaces of leafy plants, and can cause harm through biological magnification. Additionally, lead can leech into groundwater and contaminate vital resources. The effects of lead pollution reach wildlife as well as humans and have harmful effects. Through a process of gravimetric analysis, we hypothesized that lead could be removed from soil in a manner efficient enough to be expanded upon and used widely as a viable technique of lead removal.</p> <p>Methods/Materials The method was to introduce sodium chloride to soil laced with lead (II) nitrate and separate the resulting white precipitate via centrifugation. The separated white precipitate, in the form of lead (II) chloride, was weighed.</p> <p>Results The results were compared to the original amounts of lead in the soil, determining how efficient the method was. The white precipitate was proven to be lead (II) chloride after adding sodium chromate and watching the mixture turn yellow. Ultimately, it was shown that using gravimetric analysis and ion precipitation, lead ions were removed from the soil.</p> <p>Conclusions/Discussion The results showed that gravimetric analysis was, in fact, a viable technique to remove lead from soil. With a combination of chemical reactions and centrifugation, it was possible to rid soil of toxic chemicals, specifically lead.</p>	
Summary Statement Using gravimetric analysis and ion precipitation to remove lead from soil.	
Help Received Used lab equipment at Ferrahian High School under the supervision of Dr. S. Relle.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Brennan T. Coulter	Project Number S0809
Project Title The Potential for Tree Based Oils As a Substitute for Diesel Fuel	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This research investigates the potential for tree based oils as a substitute for diesel fuel. Firstly for an oil to be a viable substitute for diesel, it must provide comparative performance in terms of miles per gallon, demonstrate a positive net energy gain, reduce carbon emissions and have economics on a cost per mile basis equal to or better than diesel fuel. Secondly the oil must also be scalable in order to have an impact. Finally as oils from trees such tend to be much heavier oils their viscosity and ability to flow in the fuel system of a car, are major concerns so viscosity must be tested along with other basic physical properties that are of concern in a fuel; density, cloud point, and ability to blend with diesel.</p> <p>Results From the assessment of viscosity, cloud point, melting point, density, and blendability with diesel; palm, castor, and jojoba oils were eliminated as candidates leaving avocado, a blend of avocado and diesel, and a blend of coconut and diesel as possible fuels. The testing for performance showed a baseline performance of Diesel of 27.0 mpg, followed closely by Jojoba at 25.5 mpg, Castor at 24.7 mpg, and Avocado at 24.3 mpg(all within the expected ranges). The blended fuels (85% diesel) were also tested with results landing between diesel and the pure tree oil. The avocado oil emerged as having the best overall properties as a fuel with the best blending characteristics. The other tree oils were eliminated for a variety of reasons.</p> <p>Conclusions/Discussion Avocado oil is viable only if it can be sourced at a cost delivering a cost per miles equal to or better than diesel and can be scaled to produce 6 billion gallons. Based on an economic model for the production of avocados, a delivered cost of \$1.74/gal to Houston was estimated which is below the threshold \$1.82/gal to be equivalent to diesel. Tax credits of \$1.00/gal for the oil make the economics more favorable. To produce 6.0 billion gallons of avocado oil, it was determined that 14.2 million acres would need to be planted. A United Nations study shows that countries in Central America and the Caribbean have a total of 73.6 million acres of unplanted crop land that is viable for this purpose. Avocado oil has been found to meet all the criteria to qualify as a viable substitute for diesel fuel and may provide the US consumer a savings of \$0.05 per gallon; a first for an environmentally friendly bio-fuel.</p>	
Summary Statement The Potential for #Tree Based# Oils as a Substitute for Diesel Fuel	
Help Received English teacher helped critiqu report; Parent mentor helped with economics	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Madeline A. Cushing	Project Number S0810
Project Title The Effects of Water on a House's Foundation on Three Different Soil Bases	
Abstract Objectives/Goals The objective is to determine which of the three soil bases, sand, silt, and clay, lends itself the greatest stability with vast water intrusion and lack of proper drainage. Methods/Materials Three plexi-glass boxes of the same size and volume were purchased. The same volume of sand, silt, and clay was added to the three different boxes, each box with a different type of soil. Each soil is compacted with a three pound weight until dense as possible. A ceramic tile and constructed house was added to each compacted soil within the boxes. Each box goes through the simulation of a heavy rain of 1.89 L water added and the volume, mass, tilt, fischering/cracking or air pocketing, grade/slope, and pooling are measured after 20, 40, and 60 minutes. Another 1.89 L of water is added and the same measurements are recorded again after 20, 40, and 60 minutes. Results No soil is optimal without proper drainage, but the box with the sand soil base lent itself the greatest stability with the vast water intrusion and lack of proper drainage. The sand soil base caused the least amount of movement and supported the structure of the foundation the best out of the three soils. The sand soil base absorbed water without eroding, collapsing, or air pocketing. In addition, the sand soil base remained the most level of the three soils preventing tilt or grade of the foundation. Conclusions/Discussion In my hypothesis I believed that the clay soil bases lended the most stability because of its dense structure and limited air spaces causing the least amount of erosion and collapsing of the soil. But in actuality, after experimenting, the clay eroded the most and expanded and collapsed after the addition of water. But the clay was not the worst of the three soils. Silt, by far, had the most erosion, collapsing and washing away the soil causing many problems to the house and its foundation. This allowed the conclusion to be reached stating that the sand was the most stable of the three soils and protected and stabilized the houses foundation the best.	
Summary Statement My project is about which of the three main soil bases is the safest and best to build on when there is excess rain or water intrusion.	
Help Received Mother helped buy supplies; mother helped add water; mother helped dig up dirt.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Catherine Dang; Janki Kaneria	Project Number S0811
Project Title Who Dunit?	
Abstract Objectives/Goals The objective is to isolate sources of pollution in the Santa Ana watershed using Nitrogen Isotope Fingerprinting, and develop a better understanding of the Nitrogen Cycle by comparing samples from rain days and the end of the dry season. Methods/Materials Use Various tools to filter, and test the samples, in including Mass Spectrometer, Reagents, Freeze-Dryer, Combustion system, Fiber Glass filter, and much more. Use NIST standards to compare and calibrate equipment. Results The delta value of N15 decreased over rain days, and Nitrogen amount went up. Also a correlation was found between the amount of nitrogen and the delta N15 value. Hidden Valley and Prado both fell in the range indicating sewage water. City Creek was within natural limits as was Sycamore Creek, which could result in a presence of fertilizer or a natural source. Rancho Jurupa Park was the Outlier, and its odd results could perhaps be explained by it exclusion from flowing water. Conclusions/Discussion To further this project it would be beneficial to analyze the samples for Delta O18 and use the cross reference graph to better pinpoint the sources of pollution.	
Summary Statement Using Stable Nitrogen Isotope Fingerprinting to isolate sources of pollution in the Santa Ana Watershed.	
Help Received Used Lab equipment at University of California in Riverside under the supervision of Dr. Sickman. Dr. Sickman also helped us approach our final topic. Parents helped drive us to sampling sites and gather required materials.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Kayane K. Dingilian	Project Number S0812
Project Title The Ability of Sand and Soil to Adsorb Pollution from Water as Represented by Chlorine and Acidity	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Water for drinking and irrigation is important for any community to flourish, making it necessary to protect underground water aquifers from surface pollutants such as chlorine. The objective of this experiment was to study how chlorine from sodium hypochlorite (NaOCl), as found in household bleach, percolates through different types of soil. Such understanding would help prevent drinking water contamination. It was hypothesized that soil with organic content will adsorb more chlorine out of the 50 ppm chlorine aqueous solution than sandy soil.</p> <p>Methods/Materials Sodium hypochlorite from household bleach and distilled water was used to create an aqueous solution with 50 ppm of chlorine. Soil consisting of sand and another containing organic matter were compared. For each experiment, a fresh 50 gram sample of soil was placed in a coffee filter, placed in a funnel, and the solution was allowed to percolate through it and into a graduated cylinder. Using microchlorine paper, the influent and effluent chlorine concentrations were recorded. This experiment was conducted five times for each type of soil.</p> <p>Results The influent aqueous solution had 50 ppm of chlorine. The effluent from the organic soil bed had a chlorine concentration range of 15-20 ppm, and from the sandy soil 30-35 ppm. Average deviation for both sets of data was 2.4 ppm.</p> <p>Conclusions/Discussion As hypothesized, it was found that organic soil adsorbed more chlorine from the aqueous solution than did sandy soil. This information can be used to understand how quickly surface chlorine from cleaning compounds and other sources can percolate through a type of soil and cause aquifer contamination, and plan ways to prevent this. Also, by using the ionic nature and percolation rate of chlorine, percolation and potential contamination of other surface pollutants can be predicted and prevented.</p>	
Summary Statement By understanding chlorine ion percolation through soil, contamination of drinking water can be prevented.	
Help Received Dad provided materials necessary for this experiment.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Xinyue Fang	Project Number S0813
Project Title Wildfire Air Pollutants and Asthma Hospital Admissions: An Observational Study on the 2007 Southern California Wildfires	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The 2007 Southern California Wildfires induced high levels of air pollutants, causing asthmatics to be particularly at risk. To determine the specific effect wildfire air pollutants held on populations at risk for asthma, secondary data on the concentration of pollutants and the number of asthma hospital admissions for five age groups in the periods during and surrounding the wildfires were examined.</p> <p>Methods/Materials First, the associations between the fires and both ambient pollutant and asthma hospital admissions were assessed. Then, statistical regression was performed to determine the relationship between pollutant concentration and asthma hospital admissions. For control, the period before the wildfire was used as the baseline for comparison; in addition, daily pollutant concentrations during the 2007 fire period were compared with that of corresponding periods in 2006 and 2008 (non-fire years). Asthma hospital admission counts were also compared with total (asthma and non-asthma) hospital admission counts.</p> <p>Results PM(2.5) (particulate matter less than 2.5 micrometers) was found to be most correlated with the fire period; lack of data led PM(10) (particulate matter less than 10 micrometers) to be inconclusive; changes in nitric oxide, nitrogen dioxide, ozone, and sulfur dioxide concentrations had no significant relationship to the wildfires. For asthma hospital admissions, age group one (0-1 years old) was omitted due to insufficient data; group two (1-17 years old) experienced increase in admission after the fire; group three (18-34 years old) experienced decrease in admission both during and after the fire; group four (35-64) experienced greatest increase in admission after the fire; and group five (over 65 years) experienced greatest increase in admission during the fire.</p> <p>Conclusions/Discussion It was concluded that high levels of wildfire PM2.5 is most detrimental to the elderly. From these results, policy and prevention measures can be made to focus on sensitive age groups at the periods in which they are most vulnerable.</p>	
Summary Statement Using secondary data on pollutant concentration and hospital admissions from the periods during and surrounding the 2007 Southern California Wildfires, the relationship between wildfire pollution and serious asthma morbidity was analyzed.	
Help Received Mr. Nick Mangus provided pollution data from AQS data mart; Mr. Russell Gartz provided hospital admission data from OSHPD; Mother and Father helped with Excel; Mr. Brinn Belyea, Mrs. Julia Newman, and Dr. Harvey Checkoway reviewed paper and offered suggestions	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Kimberly Hong	Project Number S0814
Project Title Nanoparticulate Fouling of Polypropylene Microfiltration Membranes by Clarified Secondary Treated Wastewater and River Wa	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project was conducted in order to analyze the flux rates of nanoparticulate fouling of microfiltration membranes in two different types of feedwater: clarified secondary treated wastewater and Santa Ana River water. The initial idea was to conduct an experiment working with different types of nanoparticles, such as silver and gold nanoparticles. Some further research led to the formation of analyzing flux rates of different types of feedwater by using fluorescent nanobeads instead of actual nanoparticles.</p> <p>Methods/Materials Flux rate was determined by mimicking a microfiltration set-up. First, water samples were collected from clarified secondary treated wastewater from Orange County Sanitation District and Santa Ana River. Then, a mimic microfiltration was set up, consisting of a vacuum pump, a 4 place electronic balance, and a computer that grammatically collected flow data with an acquisition program. A microfiltration test cell was prepared using several 20-cm long tubes of 0.2 micrometer nominal size polypropylene membrane tubes. Next, base flow of deionized water was measured for 3 minutes. (A base flow rate with deionized water was done before each flux rate measurement with the feedwater.) Next, the deionized water was spiked with Fluospheres carboxylate-modified microspheres 0.1 micrometer, orange fluorescent (540/560) nanobeads using a pipet. Each flow rate was measured two times each. After, each feedwater was spiked with the same nanobeads, and the flow rate, which lasted for 22 minutes, was measured two times each. Finally, at the end of each flow rate experiment, the fiber was frozen and cross sectioned for microscopic observation and photos.</p> <p>Results Clairified secondary treated wastewater fouled more quickly (its flow rate decreased more rapidly) than Santa Ana RIVER water. By comparing the two different types of feedwater' flux rates, the flux rate at 15.08 minutes of the clarified secondary treated wastewater already had 10.02% average flux rate while the Santa Ana River water had 28.68% average flux rate.</p> <p>Conclusions/Discussion The contributions of this project were beneficial. It is seen that clarified secondary treated wastewater fouled more quickly than Santa Ana River water, a realization that further study of nanoparticles and their effect in different feedwater should be conducted.</p>	
Summary Statement Nanoparticles and other small bacteria exist in public drinking water, and scientists must conduct further research to produce a more safer and cheaper way to get rid of these nanoparticles.	
Help Received Mother and father gave transportation and monetary funds; Mr. Starodub directed project and gave advice; Used lab equipment at University of California Irvine and Orange County Water District; Professor C. and Mrs. S assisted project	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Brian L. Huynh	Project Number S0815
Project Title Will Sodium Lauryl Sulfate (SLS) Affect the Absorption and Uptake of Lead (Pb) in Brassica juncea (Indian Mustard)?	
Abstract Objectives/Goals My project was to determine the effects of Sodium Lauryl Sulfate on the phytoremediation process of Brassica Juncea. Methods/Materials 10 plants separated into five categories of differing Lead and Sodium Lauryl Sulfate concentrations were observed over a course of six weeks. At the conclusion of the growing phase, a soil analysis of each plant was taken. Results The surfactant Sodium Lauryl Sulfate appeared to have no significant effects upon the absorption of lead or the growth of the Brassica Juncea plants. However, there were no negative effects or trends indicated by this experiment. Conclusions/Discussion The novel process of phytoremediation is extremely efficient compared to classical soil remediation techniques. Although some plants have been identified as hyperaccumulators, by experimenting with combinations of plants and chemicals, an increased efficacy of phytoremediation plants will allow for an accelerated renewal of contaminated environments. Although this experiment did not identify any positive characteristics of Sodium Lauryl Sulfate on Brassica Juncea, there also were no negative effects; thus, in different conditions SLS may be beneficial to phytoremediation for Brassica Juncea plants.	
Summary Statement My project distinguishes the effectiveness of Sodium Lauryl Sulfate in increasing the absorption of Lead in Brassica Juncea.	
Help Received Participant in COSMOS program; designed experiment at COSMOS with the aid of Dr. LeAnn Lindsay; used lab equipment at Napa High School with the aid of Mr. Roger Ruegg; Barry Blessing and Midwest Laboratories provided free ICP analysis reports; UC Davis Library provided access to research journals;	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Otana A. Jakpor	Project Number S0816
Project Title Indoor Air Pollution: A Comparison of Fine Particulate Matter (PM2.5) Emissions from Paraffin and Soy Candles	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Air pollution is without a doubt one of the gravest environmental threats the world is facing today in terms of its sheer toll on human lives. Each year an estimated 70,000 Americans lose their lives to air pollution -- a number equal to deaths from both breast and prostate cancer combined. Since Americans spend nearly 90% of their time indoors, more research is needed on indoor air pollution and common exposures such as candles.</p> <p>Paraffin wax is a by-product of petroleum, and similarities have been observed between fine particulate emissions from paraffin candles and diesel exhaust. The purpose of this study is to determine whether or not paraffin candles are a major potential source of indoor air pollution. Furthermore, this study aims to determine whether or not soy candles are a safer, cleaner alternative to paraffin candles.</p> <p>Methods/Materials The concentrations of fine particulate matter below 2.5 microns (PM2.5) emitted from paraffin and soy candles were measured with a DustTrak aerosol monitor in a sealed bedroom. In each test a candle was measured every 15 seconds during burning for 45 minutes, then for another 45 minutes after extinguishing the candle. Eleven trials were completed for each of four types of tests -- paraffin candle, soy candle, match only, and control. A two-sample Z-test was deemed appropriate for statistical analysis, considering the many thousands of data points in this experiment.</p> <p>Results Candles made of paraffin wax emitted 50- to 60-fold higher concentrations of PM2.5 than candles made of soy wax. The soy candles emitted only about twice as much PM2.5 as the matches alone.</p> <p>Conclusions/Discussion The amount of PM2.5 emitted by the paraffin candles was dramatically higher than the amount emitted by the soy candles. After prorating for time and applying a conversion factor, the final result reveals that burning a single paraffin wax candle caused concentrations of PM2.5 that exceeded the National Ambient Air Quality Standard for PM2.5 in outdoor air. It is reasonable to deduce that burning multiple paraffin candles could elevate the amount of fine particulate matter to very hazardous levels.</p>	
Summary Statement I used a particulate counter to find that paraffin candles emitted over 50-fold higher levels of fine particulate matter than soy candles, and burning a single paraffin candle caused levels higher than outdoor air standards.	
Help Received School board member Gordon Bourns helped me locate a particle counter. UCR CE-CERT loaned me the DustTrack Monitor. Statistics advice from teacher Shane Ludwig.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Kathryn N. Keeley	Project Number S0817
Project Title The Impact of Humans and Climate on Wildfires in California	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of my science fair project was to determine the driving causes of fires in the state of California, focusing on two issues: humans and climate. I wanted to know if there were correlations between the stress of the rapidly growing population, the potential impact of climate change, and on the number of fires and area burned in wildfires.</p> <p>Methods/Materials My investigations involved using data of fires that occurred on state land protected by CalFire. The study covered a 49 year period from 1960-2008. I also used climate data provided by the NCDC, and population data from the Census Bureau. The area I looked at represents over 11 million hectares. First, I made a number of observations from the data I gathered. Then, I formed two hypotheses from what I found: 1.) that both humans and climate affect fire activity and 2.) that the effect of humans and climate varies from one region to the next.</p> <p>Results My hypotheses were both supported by my analyses. The effect of population density on fire frequency is very different across the regions; in the North, more people means more fires, in the Sierra Nevada, more people means less fires, and in the South, adding more people doesn't change the number of fires. Also, increasing population means an increased acres burned in northern California and had little effect in the Sierra Nevada and in the South.</p> <p>In northern California had fewer fires in wet years, while southern California had more. Also, fire activity seems to be more strongly correlated with temperatures in the south than in the north.</p> <p>Conclusions/Discussion The generalization in the scientific literature and in the media--that fire activity is increasing throughout the West--is not true for all regions. Some areas, such as southern California, are more consistent with this generalization than for much of the state. The patterns I have noted suggest that climate change may affect some regions, but not everywhere, and humans clearly have an important impact that is more strongly felt in some regions than in others. There appears to be a statewide increase in fire activity in the last ten years, but when looked at it on a regional scale, we see that it is not statewide, but largely in southern California. Also, I did observe that there was a statewide peak in temperatures in the '70s and '80s, suggesting climate does have a large impact on wildfires in California.</p>	
Summary Statement I studied, on a regional scale, the effect that humans and climate have on wildfires in California.	
Help Received CalFire, National Park Service, National Climatic Data Center, and Census Bureau all supplied data; Advisor provided feedback, websites, and locations; Mother helped glue	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Annemarie R. Kelleghan	Project Number S0818
Project Title An Analysis of Coliform Bacteria Levels in Ballona Creek	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project determines whether or not Ballona Creek has high levels of bacterial contamination. I will also determine if the Del Rey Lagoon impacts the contamination of the creek. Samples were taken during dry weather and after rainfall to see how increase freshwater and other inputs affect the creek. This study is a continuation and extension of work that I have been doing at Ballona Creek since 2005.</p> <p>Methods/Materials Water samples were collected at seven points along the creek, one point in the lagoon, and one site at the beach during dry and wet weather. Ten milliliters of water was sampled at each site. Water samples were placed on petri dishes and incubated. The conductivity of the samples was also measured using a conductivity meter, and the salinity was calculated using the conductivity measurements, based on the conductivity of a seawater sample of a known salinity. The density was measured using a hydrometer, and the pH was measured using test kits.</p> <p>Results In this project E. coli was used as an indicator bacterium. During dry weather, the bacterial level at the ocean outlet was zero colonies per 100 milliliters and increased to 80 colonies at 10,600 feet inland from the ocean outlet. During dry weather, the lagoon had more bacteria than the creek testing locations closest to the lagoon. During rainfall, the creek had greater concentrations of bacteria than it did during dry weather. During rainfall, the storm drains along the creek permit high concentrations of bacteria to enter the creek. The rainfall serves only to dilute the bacterial content of the lagoon. These results show that the lagoon water does not drastically impact the water quality of the creek. The density over the last five years has ranged from 0.0998 to 1.029. This variation has not been great and no significant trends were noted; the average standard deviation of all density over the five years was 0.005. The salinity of the creek decreased significantly during rainfall, but the water in the lagoon and beach was not as affected by the rainfall.</p> <p>Conclusions/Discussion Bacterial contamination in the creek increased during rainfall, but the lagoon was not a source of contamination for Ballona Creek. I have determined that the flow of water from the Del Rey Lagoon has little effect on the water in the creek. In my comparison of dry weather sampling over the past five years, the water properties have not changed significantly.</p>	
Summary Statement E.coli bacteria was used as an indicator to determine whether the Del Rey Lagoon is a source of bacteria in Ballona Creek, and the creek's salinity, density, and pH were measured to identify changes throughout the five year study period.	
Help Received The Southern California Academy of Science provided some financial support through their research training program, and Professor Doug Hammond allowed me to use his equipment in Radium Lab in the Geochemistry Department at the University of Southern California.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Joshua J. Kim	Project Number S0819
Project Title Investigation of Beach Pollution in Southern California	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To find out where the pollution is coming from, how the environmental factors such as wind and lunar cycle contribute to the spread of beach pollution, and what the major time and space patterns of beach pollution in Orange County are.</p> <p>Methods/Materials Field grab sample collection was conducted at 3 study sites, total 16 times, 13 samples during dry season and 3 samples during wet season. The samples were analyzed for the total coliform (TC), escherichia coli (EC), and enterococci bacteria (ENT). To verify my study with 16 field samples, year-long public data were used. In order to investigate a year round water quality of study area, daily surf zone monitoring data for fecal indicator bacteria by Orange County Sanitation District were used. Daily wave and wind directions recorded by lifeguards in the City of Newport Beach were used. Daily water flow data into ocean from Santa Ana river outlet were used.</p> <p>Results Laboratory test data show that the storm events generate high concentration of fecal indicator bacteria from the Santa Ana River outlet compare to other sampling locations for all 3 fecal indicator bacteria measured. The data show that TC appears to be transported by wave driven force to the beaches. Also, the data show that TC, EC and ENT concentration is relatively high at each full moon and the lunar cycle could affect on the variability of fecal indicator bacteria concentration.</p> <p>Conclusions/Discussion Conclusions of my study are 1) Storm water runoff would be the primary source of pollutant loading to the urban ocean mostly due to non-point loading exposed to surface water runoff. Higher levels of beach pollution were recorded around rainfall events. 2) Fecal indicator bacteria will be transported by wave and wind driven forces to the beaches. Dominant space variation patterns of beach pollutions are controlled by direction of local coastal current, 3) Fecal indicator bacteria levels are elevated and affected by two-week lunar cycle due to stronger gravity forces between Earth and Moon at the beginning of cycle. The stronger gravity forces creates higher tide which cause resuspension of ocean bottom sediments thus elevated levels of microbial contamination has been found at the beginning of each lunar cycle. Dominant time variation patterns of beach pollutions are seasonal rainfall events and two-week lunar cycle.</p>	
Summary Statement Storm water runoff is the primary source of beach pollution and fecal indicator bacteria are transported by wave and wind driven forces (space variation) and affected by rainfall and two-week lunar cycle (time variation).	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Grant King; Sarah Lamp; Matt Rhodes	Project Number S0820
Project Title The Effect of Light Frequency and Intensity on the Flora of Winogradsky Columns	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project is a microbiology experiment on the effects of light frequency and intensity on growing Winogradsky columns. A Winogradsky column is essentially a self-contained ecosystem that can be grown using pond mud and water, a sulfate source, and a carbon source. Since the ecosystems within them are carefully balanced, we tried to determine how temperature increases similar to those that might result from global warming would influence a typical pond ecosystem as well as if different frequencies of light actually influence chloroplast function to a measurable extent.</p> <p>Methods/Materials In order to do this, we set up light bulbs of different frequencies and intensities (the independent variables) within self-contained boxes, and allowed the columns to grow within without outside influence. Our control group was 450 Lumens, and we periodically tested temperature and pH (the dependent variables). We also observed each Winogradsky column during these tests for any plant, algal and bacterial growth.</p> <p>Results Through our experimentation, we found that acidity increased over time likely due to cellular respiration, while the higher the intensity, the higher the temperature. Algae growth overwhelms plant growth at 1600, though generally vegetation increases with intensity and decreases under color bulbs, and bacterial growth was strongest under the full light spectrum bulb.</p> <p>Conclusions/Discussion These results were expected, though our columns in general exhibited less growth than predicted. In the future, we would be interested in determining at what temperature the algae growth exceeds plant growth as well why was bacterial growth hindered in some of the columns.</p>	
Summary Statement Our project tested the effects of various light frequency and intensity on a pond ecosystem to simulate global warming.	
Help Received Dr. Maholtra helped us with brainstorming and provided many materials from our High School; Used lab equipment at Cal Lutheran University under the supervision of Dr. Kenneth Long	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Amy H. Lee; Thomas T. Wooding	Project Number S0821
Project Title Are the Fish We Eat Killing Us?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to determine if pollution from fishing weights, plastic, fishing line, aluminum, pesticide and sewage are absorbed by the digestive systems of fish and are subsequently absorbed by humans when they ingest fish.</p> <p>Methods/Materials To represent the pollution, fishing weights, plastic, fishing line, aluminum, pesticide, and sewage (dog fecal matter) were used. The stomach solutions were simulated at a pH level of 2 for fish and a pH level of 4 for humans. The pollutants were collected and placed into the respective simulated stomachs and heated on a hot plate to 37 degrees C for the appropriate digestive periods. These fluids were then filtered through acid-free filter paper and the resulting solutions were placed in beakers. The solutions were allowed to evaporate for 24 hours and a precipitate formed at the bottom of the beakers. A qualitative and quantitative test was conducted for the amount of absorption occurring in the digestive fluids. To test the amount of bacteria in the sewage solution, a streaking method was used on blood and chocolate agar plates. The plates were observed at 24, 48, and 72 hours. The tests were repeated three times for accuracy.</p> <p>Results For the fish digestive fluids, all the pollutants showed positive results. The fishing line was absorbed the least and was shown through the thin layer of precipitate at the bottom of the beaker. The next least absorbed pollutant was the plastic. Although the fish line and the plastic showed the least amount of absorption, these pollutants are the leading causes of fish death because the fish is unable to digest the plastic and it is consequently lodged in the fish's digestive tract. Aluminum was the next least absorbed and showed a thick layer of precipitate. The fish weight showed a great amount of absorption. The pesticide showed the greatest amount of absorption as a thick black layer of precipitate. The human stomach showed similar results to that of the fish. No bacteria growth at the 24, 48 hrs. period, and a rare bacteria growth at the 72 hrs. period on the fish. The human stomach had no bacteria growth at the 24 hrs. period, rare bacteria growth at the 48 hrs. period, and a few bacteria growth at the 72 hrs. period.</p> <p>Conclusions/Discussion The pollutants are absorbed into the fish digestive system and then, in turn, absorbed in the human stomach.</p>	
Summary Statement This project is to determine if pollutants from the ocean are absorbed in fish and human digestive system.	
Help Received Mr. Cosner, our science teacher helped us run the project.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Rose Leopold; Ella Madsen	Project Number S0822
Project Title Sandy Beaches: Pleasure or Pollutant? Year 3	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals We tested as a continuation of the previous 3 years to see if river water could be a source of the ocean water and sand contamination causing many Californian beaches to be closed frequently. We tested 3 beaches in different environments (urban, farming and undeveloped) to see if those environments had any correlation with the amounts of Escherichia coli (E.coli) and total coliform we found moving along a transect (at 0, 20 and 40 feet away) from the river mouths. We also tested to see if we could qualify the source of DNA in the river water.</p> <p>Methods/Materials We built an incubator from a Styrofoam cooler and a light bulb. We collected water from river mouths and the ocean they flowed into. We then collected sand along a transect from the river mouth 0, 20 and 40 feet away. We tested for Escherichia coli (E.coli) and coliform bacteria strictly by following the state regulations using materials such as distilled water, pipettes, sterilized jars, an iron, Quanti-Trays and bacteria reagent. We then put the sealed Quanti-Trays into the incubator for 18-22 hours. We also tested DNA in the river water to see where the bacteria we found was from. We tested using a PCR test, looking for human specific bacteria.</p> <p>Results Farming: Escherichia coli (E.coli) bacteria decreased in 2 out of 3 rounds, total coliform bacteria decreased in 2 out of 3 rounds. Urban: Escherichia coli (E.coli) bacteria decreased in 2 out of 3 rounds, total coliform bacteria decreased in 1 out of 3 rounds Undeveloped: Escherichia coli (E.coli) bacteria decreased in all 3 rounds, total coliform bacteria decreased in 1 out of 3 rounds PCR: we found human specific DNA in 2 of the 9 river water samples we tested</p> <p>Conclusions/Discussion In conclusion, we can reject our hypothesis for Escherichia coli (E.coli) bacteria in Urban vs. Undeveloped vs. Farming environments. We can accept our hypothesis for both bacteria for some of the beaches with distance from river and we can accept our environmental hypothesis for total coliform. We can reject our hypothesis for the PCR test for DNA.</p>	
Summary Statement We tested the river water in three different land environments and sand bacteria in order to find the source of the bacteria; we also qualified the DNA in the river water.	
Help Received Iddex Company for donating our supplies, Steve Peters for doing the PCR tests, Marc Los Huertos for helping analyze our data, Darrel Steely for mentoring us and helping prepare project, parents for driving and helping to test	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Judy J. Li	Project Number S0823
Project Title Alginate: The Nontoxic, Biodegradable Tool for the Firefighting Arsenal	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The ingredients of many common fire retardants and suppressants have both immediate and long-term negative effects on ecological communities. Common active ingredients include toxic chemicals that bio-magnify in food chains or nitrates and phosphates that can cause eutrophication in nearby water sources. The purpose of this project is to determine if a viscous spray made with alginate, a natural, biodegradable compound produced in the cell walls of brown algae, is an effective fire-retardant alternative based on its ability to prevent combustion and burning.</p> <p>Methods/Materials Each trial tested three 3.0g hay pellets with varying levels of alginate exposure [a dry, unsprayed hay pellet (control, pellet A), a hay pellet sprayed 5 times with 0.5% alginate (pellet B), and a hay pellet sprayed 5 times with water (second control, pellet C)]. Each hay pellet was exposed to a Bunsen burner flame at a distance of 5cm from the side of the pellet to the tip of the Bunsen burner, for 15 seconds. Then, pellets B and C were allowed to dry, and all the pellets were weighed to determine the percent mass left after burning. Forty-seven trials were conducted, each involving three pellets, for a total of 141 tested pellets.</p> <p>Results Pellet A, the control, burned the most, with a mean of 45.9% mass burned. Pellet B, the alginate pellet, burned the least, with a mean of 16.0% mass burned. Pellet C, the water pellet, burned more than pellet B but less than pellet A, with a mean of 32.5% mass burned.</p> <p>Conclusions/Discussion The gel-like properties of viscous alginate solution prevented burning and combustion consistently better than water. The standard deviation of the mass of burned pellet B was 0.185 while the standard deviation of mass of burned pellet C was 0.355 and for Pellet A was 0.507. This implied that hay pellets sprayed with alginate were much less flammable than those sprayed with an equal volume of water. This finding is significant based on the z test, which suggested an extremely low p-value of <0.00003. These results indicate that alginate could possibly be used as an alternative, more environmentally friendly fire retardant. More studies are necessary to further explore the fire suppressant/extinguisher potential of alginate.</p>	
Summary Statement This project tested the novel idea of using alginate - a natural chemical produced in brown algae - as a nontoxic fire retardant and results suggest that a coating of alginate solution reduces flammability more than a coating of water.	
Help Received Used lab equipment at Canyon Crest Academy and used fire under the supervision of Ms. Slijk; Funding from an Intel Research Grant awarded by COSMOS	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Jimmy Lin; Michael Lin	Project Number S0824
Project Title Enhanced Sprinkling System with Energy-Efficient Applications at Stevenson School	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals All over the world, the issues of renewable energy and efficient use of energy are being frequently discussed. Following the thought, we noticed that our school's sprinkler sometimes sprinkles onto the pathways, which should have some energy wasted. Besides, there is a shortcut in our campus without lights, which is dark at night causing tripping and danger. Linking these, our project is to combine the engineering and Physics to enhance the existed sprinkling system for energy-efficient applications, and provide an inspired outlook for this environmental issue.</p> <p>Methods/Materials We employed several components: the turbine generators are used to generate electricity from sprinkling and stored in the battery. The valve and the timer provides control over the sprinkling time. Solar panel is integrated into the system for stable operation. For evaluation, we conducted Water Pressure Tests to measure the pressure. We met with the school's maintenance to study the existed system and proposed an installation plan to the school for approval. After installation, we conducted Flow Volume test to find how much water would be consumed and conduct associated cost calculation.</p> <p>Results Presuming 100% energy conversion, the system would create electricity equivalent saving of \$4.86 in water usage per month, which totals to 75.6% saving of the original sprinkling cost. The system has been operating over three months. Many Physics theories have been testified with our results. This project has successfully demonstrated how we can employ the energy originally insignificant or ignored in the environment, but create an efficient application with some benefits. We received a gratitude certificate from School recognizing our contribution to campus safety and demonstration of energy-efficient concept.</p> <p>Conclusions/Discussion #gWater is precious on California#fs Central Coast#h is a popular tag on dining table showing the importance of water conservation. The water for sprinkling at our school is 20% of the total consumption. Thus, this project is much contributed to demonstrate how we can save water and create some values from the originally wasted energy. The engineering in the real world is tough, but we have overcome many issues and learned a lot. We wish to expand the existed system in the campus and apply this concept in various applications.</p>	
Summary Statement The Project takes renewed energy from wasted water of the Stevenson School's sprinkling system for the use of energy-efficient applications.	
Help Received School Maintenance helped to install solar panel	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Vivien Macnguyen	Project Number S0825
Project Title Determining the Phytoremediation Potential of Brassica rapa with Arbuscular mycorrhizae	
Abstract Objectives/Goals Phytoremediation is an environmental-friendly, cost-efficient, and entirely natural method of extracting unwanted hazardous heavy metals from soils and water as opposed to other common methods of soil remediation which include excavation and pump and treat. In my project, I attempt to optimize phytoremediation by combining a rapid-growing hyperaccumulative plant, Brassica rapa, with Arbuscular Mycorrhizal fungi (Glomus Mosseae) which lives in symbiosis with plants and elongates its roots for easier access to nutrients and trace elements. Methods/Materials In my experiment, I grew non-mycorrhizal and mycorrhizal plants in two separate water culture hydroponic systems with each containing 400 ppm cadmium chloride. Data collection consisted of taking samples of the water supply in which the roots of the plants were submerged each day, using dithizone as a heavy-metal indicator and measuring specific concentrations through a spectrophotometer. Results After two trials, running from 7-14 days, Mycorrhizal-inoculated plants proved to have a faster cadmium uptake than non-mycorrhizal plants. In general, the plants were able to tolerate the high concentration of cadmium fairly well, but mycorrhizal plants were more tolerant. Conclusions/Discussion The Brassica genus of plants is known for the ability to accumulate unusually high concentrations of heavy-metals in soil without significantly affecting its development and health, which makes Brassica rapa a promising candidate for phytoremediation. In symbiosis with the mycorrhizal fungi, my data shows that Brassica rapa plants' phytoremediative capabilities have noticeably improved.	
Summary Statement Plants in symbiosis with root-elongating fungi may be a cost-efficient and all natural way to clean our environment of heavy-metal pollution.	
Help Received Mr. Allen helped me order plants and materials and gave me suggestions for my procedures.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Violeta Martinez	Project Number S0826
Project Title Investigating the Physical Characteristics of Beach Sand from Around the World	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals While walking along the shoreline of a beach, does it ever come to mind what it is you are walking on? Of course, it is sand; but what is it made out of and where did it come from? These are interesting questions to think about. As a result, it is fascinating, yet puzzling, to consider how sands from different locations could be similar or different. Some people may wonder about these little things while they walk along a beach, but it is important to understand where such things come from and where they are now.</p> <p>Methods/Materials Materials 1 Clear tape; 30 Name Labels; 30 Slides; 30 Beach Sand Samples; 1 Dissecting Microscope; 3 CDs; 1 Luster Chart; 1 Color Chart (Marine Bio. Pg97); 6 Napkins; 1 pair of Gloves; 1 Data Table: Size, Color, And Luster; 1 ruler.</p> <p>Results If different samples of beach sands are collected from around the world, and their physical characteristics size, luster and color are examined, will there be similarities and differences among the samples? Since they are from different locations, it is expected that there will be both similarities and differences. About 65 % of the samples shared similarities, and 35% showed differences within the samples. In conclusion, different samples of beach sand from around the world were tested for their physical properties, and they were shown to have similar size, color and luster.</p> <p>Conclusions/Discussion In this study, thirty samples were collected from around the world including Aruba, Japan, Puerto Rico, and Spain and examined for their physical properties. Most of the samples have a majority of similarities and some differences as well. Most of the samples share both similarities and difference. As a result, my results contradict my hypothesis; nevertheless, my results confirm my question, Do different beach sands from around the world have similar physical characteristics size, color and luster? Yes, they do. My results verify this</p>	
Summary Statement Different samples of beach sands are collected from around the world, and their physical characteristics size, luster and color are examined.	
Help Received Mr. Johnstone for helping me prepare my project. Mr. Espinoza, Ms. Reyes and especially Mr. Estrada for lending me equipment, as well as providing sand samples. Mary Ann Lucking, Heidi M. Ullberg, Dave Douglass, Charisa Wernick, and Tamano Omata for providing me with beach sand samples.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Francesca McClintic; Janel Raab	Project Number S0827
Project Title Got Shade? How Hot Are Your Shingles?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment is to find ways to reduce the heat that builds up on housing shingles due to the constant heat source of the sun. The process is to find an inexpensive way to help keep a house cool, reducing cooling cost, thus resulting in saving energy.</p> <p>Methods/Materials Cut five, same size wooden boards and staple pieces of 30lb felt to the wood - after this drill a hole in the center to place the thermocouple wire. Tape the wire to the back of the board with the tip through the hole, staple down brown roll roofing material on 3 of the wooden pieces with the brown side facing up. The fourth on will be white and the last turn the shingle roofing material up-side down so the black side is facing up. Last two, build wooden frame that will hold up a shade cloth, a single and double-layered side. Then connect the wires to a Measurement Computing USB-TC which is an 8 channel temperature measurement device; after this, hook it to a computer that will gather the data over an extended period of time. Place the five wooden pieces in direct sunlight to measure the changes in temperature of the shingles and a separate thermocouple wire in the shade to measure the ambient air temperature. Let the computer run.</p> <p>Results After collecting data, we discovered that the black shingle resulted in the hottest temperature (measured in Celsius), followed very closely by the brown regular control shingle. The white shingle's temperature was significantly lower than both the brown and black, followed by the shingle under the single-layered shade cloth. The lowest temperature was the shingle under the double-layered shade cloth. All shingles were hotter than the base-line air temperature</p> <p>Conclusions/Discussion Results showed there will be a significant difference in temperatures absorbed by roof shingles if a homeowner use different shingles. Also our hypothesis was correct in stating that the shingle under the shade cloth would result in the lowest temperature of all the shingles. This suggests that by doing simple things, like building a simple wooden shade cloth frame to shade the roof, as well as having white shingles; a homeowner can reduce their carbon-foot print by reducing the amount of energy they use on cooling cost. Though the temperature of every shingle did rise above the air temperature, there was a significant difference, and anything done to help the environment is worthwhile.</p>	
Summary Statement The project is to test if adding a shade cloth makes a substantial difference in keeping the shingles of the roof cool, helping reduce cooling cost due to reducing the amount of heat transferred into the house through the roof.	
Help Received Mother for grammar errors, Father for supervising, and all parents for support and transportation	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Andrew C. Ng	Project Number S0828
Project Title Simple Field-Assembled Laser Spectrometer for the Detection of Air Pollutant Nitrogen Dioxide	
Objectives/Goals The objectives of the project are to design and construct a simple, field-assembled laser spectrometer for the detection of nitrogen dioxide pollutants in air.	
Abstract Methods/Materials Nitrogen dioxide gas absorbs light optimally at 400 nanometer wavelength. The theory of molecular absorption spectrometry forms the basis of the instrument being constructed. The key components used are a blue (405 nm) laser pointer, a laser power meter, and an optical rail. The laser pointer and the laser power meter are aligned and mounted securely at the two ends of the optical rail, detecting the presence of nitrogen dioxide gas in air.	
Results The absorption of the 405 nm laser radiation by nitrogen dioxide gas was verified by passing the laser beam through an atmosphere containing concentrated nitric acid. The portable spectrometer could be assembled and aligned for use within ten minutes. The engagement of a 405 nm band-pass optical filter on the power meter allowed daytime, outdoor operation with negligible background readings. The spectrometer was applied in detecting potential nitrogen dioxide gas presence near an operating vehicle and in school parking lots. The readings suggested nitrogen dioxide gas pass in-and-out of the laser path at different times.	
Conclusions/Discussion The current measurements are relative. When the spectrometer is calibrated with known concentrations of NO ₂ in air, quantitative measurements can proceed with Beer's Law, that is, the linear relationship between Absorbance and concentration. Light scattering by molecules and aerosol particles will reduce the laser radiation being detected and, beneficially, this spectrometer may also measure these trace substances in air.	
Summary Statement A portable laser spectrometer is designed and constructed for the detection of nitrogen dioxide gas in air.	
Help Received Mom helped cut papers and presentation board	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Sonia A. Patel	Project Number S0829
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Project Title
Phytoremediation: Clean Up of Contaminated Soil Containing Selenium Using the Hyperaccumlator Plant, Brassica juncea

Abstract

Objectives/Goals
The goal of my experiment is to measure the efficiency, absorption rate, of phytoremediation of sodium selenite for two different concentrations using the plant, Brassica juncea.

Methods/Materials
I purchased 9 grown Brassica juncea plants that were 3 weeks old from a local nursery. I separated them into 3 groups of 3 plants. In the first group I added 10 mg of sodium selenite. This group is Treatment 1 group which has a 0.0035% concentration of sodium selenite by weight. In the second group I added 50 mg of sodium Selenite. This group is Treatment 2 group which has a 0.017% concentration of sodium selenite by weight. In the third group, my control group, I did not add sodium selenite. At the end of the first week, I snipped the 5 leaves from each sample: A1, B1, and C1 and placed these leaves in separate Ziploc bags to be dried. At the end of the second week, I removed the 5 leaves from each sample A2 and B2. At the end of the third week, I removed the 5 leaves from each sample A3 and B3. The leaves collected were sent to EXOVA labs to be analyzed by EXOVA labs using an Inductively Coupled Plasma Mass Spectrometry (ICP-MS machine.) I recorded observations and daily photographs.

Results
The results show how height was stunted (for Treatment 1 there was an average 2 cm decrease in Treatment 1 and 2.5 cm in Treatment 2.). In Treatment 1, A1 showed 166 parts per million of sodium selenite absorbed, A2 showed 109ppm, and A3 showed 147ppm. B1 showed 540 parts per million, B2 showed 488ppm, and B3 showed 376ppm. The control group had extremely low traces of innate amounts of sodium selenite equaling 2.7 parts per million. The efficiency rates for Treatment 1 were: 46%, 30%, and 41%. The efficiency rates for Treatment 2 were: 30%, 27%, and 21%.

Conclusions/Discussion
My results show that when more sodium selenite was placed in the soil the plant absorbed more of the toxin, which supports my hypothesis. The process at the molecular level supports my data. The bacterial endophytes degrade the toxin taken in resulting in more of the toxin being absorbed by the plant. My results show that the most sodium selenite was absorbed in the first week of the experiment as compared to the second and third week for Treatment 2 unlike what I thought would happen. The average 32% efficiency rate of phytoremediation is successful. Therefore, my hypothesis was partially supported by my experiment.

Summary Statement
Efficiency of Brassica juncea of the phytoremediation process for sodium selenite averages 38% efficiency when placed in a soil with 10 mg of sodium selenite and a 26% efficiency with 50 mg of sodium selenite.

Help Received
Mother bought the display board and helped complete it; Father helped safely handle sodium selenite; EXOVA Labs agreed to perform plant tissue analysis for my samples; Dr. Howe was a great mentor who helped considerably along the way



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Kyle R. Rothschild-Mancinelli	Project Number S0830
Project Title Assessing the Effects of Solar Ultraviolet Radiation on Aquatic Ecosystems Using a Supercoiled DNA Dosimeter	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To test the effects of UV radiation on aquatic ecosystems. To do this I will use a DNA dosimeter made of the pUC18 plasmid and expose it to solar UV radiation underwater and on the surface while using DNA damage, specifically thymine dimer production and phosphate backbone damage, as a proxy for solar UV radiation damage in aquatic ecosystems.</p> <p>Methods/Materials On August 3, 2009 I tested this by exposing a DNA dosimeter made of the plasmid pUC18 1.5 m underwater in a hot tub, and on the surface. I measured the thymine dimer production and breakage of the DNA backbone. The controls were exposed under: Mylar, UV opaque and transparent plastic, and in the dark. I also tested the clarity of different water samples from around the Bay Area, and measured transmittance with a spectrophotometer in order to calculate the different dosages of UV aquatic organisms would receive at different depths.</p> <p>Results At 1.5 m below the surface, single-strand breaks and thymine dimer production was nearly half that of the surface. This means that in #clear# water, the strength of the UV is about half of what it is at the surface. The clarity test showed that ocean water had the lowest percent transmission of UV radiation when compared to distilled water, followed by the Lagoon water and hot tub water.</p> <p>Conclusions/Discussion My data suggest that UVB and UVA cause equal amounts of DNA damage, because when I took away the UVB reaching the DNA, there was half as much damage. It also suggests that as UV is increased on the surface of the Earth, damage to DNA will increase even in aquatic ecosystems.</p>	
Summary Statement To test the effects of UV radiation on aquatic ecosystems through using a DNA dosimeter made of the pUC18 plasmid and expose it to solar UV radiation underwater to test for thymine dimers and DNA phosphate backbone damage.	
Help Received Used lab equipment at NASA Ames Research Center under the supervision of Dr. Lynn Rothschild	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) David N. Schmidt	Project Number S0831
Project Title Examining Air Quality	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective was to learn all I could about air quality by comparing outdoor air conditions with indoor air conditions.</p> <p>Methods/Materials I gathered data with a Dylos Corporation DC1100 Air Quality Monitor. I ran it every two hours in five locations inside and outside of my house. I then took the data and inserted it into an Excel spreadsheet.</p> <p>Results I found that outdoor air quality is worse than indoor air quality. There are times when indoor air is worse than outdoor air, but only under conditions when the inside air is greatly stirred up. Outdoor air quality is constantly changing, while inside air quality is mostly unchanging.</p> <p>Conclusions/Discussion According to my data, the amount of PM 2.5 (Particulate Matter 2.5 microns in diameter) in the air is raised by large quantities of car exhaust, dust, movement in small, dusty areas, and various forms of weather. There are still many aspects that can be narrowed down to further find the specific causes for spikes and drops in the amount of PM 2.5.</p>	
Summary Statement My project is about testing the specific aspect of air quality called Particulate Matter 2.5	
Help Received Mother helped put together board, Father helped gather data and sort data, and younger brother helped gather data.	



CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s) Dorothy L. Silverman	Project Number S0832
Project Title The Effects of Anthropogenic Biomes on Perceived Ground Shaking	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Do anthropogenic biomes, or man-made environments, affect our perception of ground shaking? I hypothesize that: 1. Ground shaking reports, or Modified Mercalli Intensity (MMI) reports, are affected by the man-made environment, or anthropogenic biome, in which a person lives. 2. MMI reports are most influenced by highly populated urban anthromes because there is more destruction to witness. 3. Objective peak ground acceleration recordings are more accurate in predicting ground motion than MMI reports.</p> <p>Methods/Materials MMI reports were collected from 5 major earthquakes ($7 < M < 7.9$) that occurred in different global regions. 10 reports were collected from each earthquake. I used a Google Earth anthropogenic biome map, and MultiSpec, a satellite image analysis program, to find the anthropogenic distribution surrounding all 50 response sites. I normalized the data and ran multiple regression analyses to establish a relationship between MMI and anthropogenic biomes. I created a "General Model" by running an analysis on all 50 MMI reports, and five "Specific Models" by running analyses on MMI reports specific to their corresponding earthquake. All models were compared to the equation used by the USGS for shakemaps.</p> <p>Results The Village anthrome is directly related to MMI in the #General Model#, where $F(x) = 4.803 - 0.003(\text{Distance}) + 0.028(\text{Village})$. The #General Model# is directly related to and dependent on the village anthrome, while the #Specific Models# are inversely related to and dependent on a variety of anthromes. In the residual model for slope analysis, the #General Model#, #Specific Models#, and #USGS Model# had slopes within a 0.005 range of each other. Finally, a one-sample T-test comparing the #General Model# to the #USGS model# produced a P-value=0.002, suggesting that MMI reports are not significantly inflated.</p> <p>Conclusions/Discussion The T-test and slope analysis suggest that humans can accurately estimate ground shaking. Because the #General Model# is created from a globally-diverse pool of data, it may be used to estimate MMI from around the world; the nuances of a single global region will not greatly affect estimated MMI. The synergy between Village#s high population and total area may be why is it the most influential anthrome</p>	
Summary Statement My project aims to determine how our perception of seismic shaking is influenced by the anthropogenic biome, or man-made environment, in which we live.	
Help Received Mr. Frost taught me statistics. Dr. Steve Chien introduced me to satellite image analysis.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Alexander C. Slavitz	Project Number S0833
Project Title The Effect of Common Household Materials on Their Ability to Consistently Absorb Phosphate from the Environment	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment was to find which common household material could absorb the most phosphate. This experiment measured the amount of phosphate remaining before (control), and the amount of phosphate remaining after filtration in order to find how much difference a phosphate absorber could make.</p> <p>Methods/Materials In this experiment I used an electrophotometer to analyze the color of my filtered solution after a reagent had been added. This reagent was a phosphate tester that produced a different shade of blue depending on the concentration of phosphate in solution. I did three trials for each independent variable.</p> <p>Results In this experiment with no filter, there was 4.426 Mg/L of phosphate in the solution. Each independent variable's phosphate concentration was measured after filtration to then be divided by the amount of phosphate before filtration. This percent allows one to observe the percent phosphate that each filter is capable of removing. Thus, in this experiment the cloth absorbed 4.54% of the phosphate, rocks/dirt absorbed 9.78%, charcoal absorbed 22.96%, and the sponge released 4.06% or .18 Mg/L upon filtering the solution.</p> <p>Conclusions/Discussion This information refutes most of my hypothesis because I originally inferred that the cloth would absorb the most phosphate, followed by the sponge, charcoal, and then rocks/dirt. From my experiment, I have actually found that the charcoal absorbs the most phosphate, followed by rocks/dirt, cloth, and then finally the sponge. This data suggests that individuals in developing countries could use the charcoal from their burnt trash to absorb almost 23% of the phosphate from a running stream. This data also demonstrates that sponges used can actually leech small amounts of phosphate back into the environment through being utilized.</p>	
Summary Statement My project endeavors to find the cheapest, most widely available, and easiest to use apparatus to help mitigate phosphate concentrations in local rivers in developing countries.	
Help Received I received time to access our school's electrophotometer with the superficial guidance of my chemistry teacher.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Alisa Smith	Project Number S0834
Project Title How Do Culverts and Rainfall Intensity Affect Erosion?	
Abstract Objectives/Goals The goal of this project was to see how rainfall intensity and culverts affect erosion on an 18 degree slope. Methods/Materials In this project, I built a model hill slope to test erosion produced from runoff. I simulated rain at the top of the hill, and collected the run off at the bottom in a bucket. Then, I weighed the bucket with water and eroded soil and compared it to the weight of the bucket containing only water to determine the mass of eroded soil. Each trial used them same amount of water, but I varied the intensity of the "rain" (rate of water flow from a hose into a pipe with holes drilled in it). Half the trials used this process on a "barren hill" while the other half were done to a hill with an added model culvert. Materials: Shovel, Saw, Level, Tape Measurer, Hose, Rake, Wheelbarrow, Scale, Sandy Loam Soil, Screws, Staples, Screw Gun, PVC Piping, Water, Lumber, Plywood, Inclinometer, 20 lb weight, Half Inch Screen, 18 Liter Bucket, 4 Liter Bucket, 1 Liter Measuring Cup, Timer, Metal Flashing, Duct Tape. Results After testing, I found that "light rain" on a hill without a culvert produced, on average, .22 kg of eroded soil. "Medium rain" on a hill without a culvert produced an average of .70 kg of eroded soil, and "heavy rain" eroded an average of 1.19 kg of soil. With a culvert, "light rain" produced an average .22 kg of soil, "medium rain" produced an average of .45 kg of soil, and "heavy rain" produced an average of 1.95 kg. Conclusions/Discussion My results supported the hypothesis that runoff from heavier rain would produce more erosion than that from lighter rain. However, my hypothesis that culverts cause more erosion wasn't really confirmed. I think that more trials are necessary to fully prove my hypothesis correct or incorrect.	
Summary Statement My project involved building a model hill slope in order to test if culverts and rainfall intensity have an affect on erosion produced from runoff.	
Help Received Grandfather helped me build and set up parts for the experiment	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Sashank S. Srinivasan	Project Number S0835
Project Title A Device to Measure Atmospheric Haze	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Atmospheric haze is caused by several factors, including pollutants in the atmosphere. While few cities routinely measure Aerosol Optical Thickness (AOT) a unit of atmospheric haze, not much is known about this phenomenon on a global scale. The goal of this study was to construct, calibrate, and test a device, a sun spectrophotometer, to measure atmospheric haze using the method of Forrest Mims(1991).</p> <p>Methods/Materials While the intensity of the sunlight striking the top of the earth's atmosphere is constant, its intensity at ground level is less and varies as a function of absorption and scattering of light by air, including pollutants. By measuring intensity of sunlight at a given location and knowing the thickness of the atmosphere that it has passed through, one can determine how much light has been scattered and/or absorbed, and hence the amount of haze present. A light emitting diode (LED) generates an electric current when light of a certain wavelength strikes it. The strength of this current is an indirect measure of the quantity of light striking the LED. The device has a circuit that enables measurement of the electrical output from an LED. So, when the device is pointed at the sun, the intensity of sunlight that hits the LED can be quantified as a function of electrical output. The device was assembled per circuit diagram and first calibrated. Multiple readings were taken as the sun rose and the extraterrestrial constant(ET) was calculated. Preliminary AOT readings were gathered in Saratoga, Daly City, San Mateo, and San Francisco</p> <p>Results The ET was 10.18. The AOT readings at various locations were .065 in Saratoga, .074 in San Mateo of Hwy 280, .105 in Daly City off Hwy 280, and .313 in San Francisco on 19th avenue.</p> <p>Conclusions/Discussion The spectrophotometer was constructed, calibrated, and tested. Preliminary AOT readings demonstrate a fivefold increase in haze from residential Saratoga to an urban part of San Francisco, illustrating the device's efficacy. The device has a potential long-term future in measuring haze on a global scale. While the device has limitations, further and extensive longitudinal studies are required. Being involved with monitoring AOT with a homemade device increased my own awareness of our polluted environment.</p>	
Summary Statement A sun spectrophotometer to measure atmospheric haze was constructed using the method of Mims(1991) was constructed and tested successfully	
Help Received Father helped in the construction of the device.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Isabella Tromba; Lara Tromba	Project Number S0836
Project Title Utilizing the Isotopic Signature of Macroalgae to Identify Sources of Nitrogen in Streams and Rivers	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To utilize the isotopic signature of macroalgae to identify the sources of nitrogen pollution in streams and rivers and to evaluate the usefulness of stable isotope analysis of macroalgae in lotic ecosystems.</p> <p>Methods/Materials Algae samples were placed into 50mm x 9mm petri dishes and stored in a cooler. Samples were placed in a 50°C oven for a minimum of 48 hours to ensure removal of all moisture. Samples were then homogenized. A microbalance was used to weigh 2.00 - 3.00mg of algae into 3.5mm x 5mm tin capsules. Exact weights were recorded for each sample. The samples were then run through a CE Instruments NE2500 Elemental Analyzer coupled to a ThermoFinnigan Delta Plus XP isotope ratio mass spectrometer (IRMS). Using Google Earth Pro, we were able to gain access to a Landcover Mosaic map (LCM) based on 2001 National Land Coverage Data (NLCD). Land surrounding the sites was classified according to the 19-color categories given by the Landcover Mosaic map and then classified into one of our seven categories and percentages were recorded.</p> <p>Results Agricultural sites had mean $\delta^{15}N$ values of +15.15‰ and spread +9.49‰ to +19.73‰. The semi-natural sites had mean $\delta^{15}N$ of +6.44‰ with values ranging between +1.09‰ and +14.34‰. The urban sites had mean $\delta^{15}N$ values of +7.97‰ and ranged from +4.81‰ to +10.15‰. Elkhorn Slough had average $\delta^{15}N$ of +10.47‰ and ranged from +7.20‰ to +12.33‰. Using an ANOVA test, we determined that the means were not all the same. We subsequently performed a comparison of means tests in order to analyze differences between two land use categories. When comparing the semi-natural and agriculture $\delta^{15}N$ values we obtained a t-statistic of -7.427 with $p < .0001$, suggesting that the agriculture $\delta^{15}N$ means were different from those of the semi-natural means.</p> <p>Conclusions/Discussion The macroalgae at our agricultural sites, urban sites and semi-natural sites all have nitrogen isotopic signatures that reflect the surrounding land cover. Thus, the influence land cover has on the nitrogen isotopic signatures of macroalgae suggests that macroalgae can be used as indicators of anthropogenic inputs of nitrogen to the environment.</p>	
Summary Statement Our project illuminates the usefulness of isotopic signatures of macroalgae in identifying sources of nitrogen pollution in streams and rivers.	
Help Received Used lab equipment at University of California, Santa Cruz under the supervision of Dr. Adina Paytan but did research independently.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Juan A. Vasquez	Project Number S0837
Project Title Eco-Breeze	
Abstract	
Objectives/Goals To determine if solar-powered fans can cause enough air circulation to decrease the ambient temperature inside automobiles in warm climates.	
Methods/Materials Materials: DC Motor Cardboard Housing Solar panel A small fan Duck-tape solder gun Method-The Solar Fans were placed in the identical positions on the dashboards of three different models of vehicles over a period of time. Everything fifteen minutes the vehicles internal ambient temperature was taken and recorded, and subsequently graphed. The outside temperature was compared to the inside temperature so that it could be compared and contrasted giving us a perspective on the efficiency and effectiveness of our contraption.	
Results Within a time span of two hours and thirty minutes, the solar fans reduced the Honda Civic's internal temperature by five degrees Celsius, the Honda Accord's by three degrees Celsius, and the Honda Pilot's by 2 degrees Celsius.	
Conclusions/Discussion Solar-powered fans can cause enough air circulation to decrease the ambient temperature inside automobiles in warm climates.	
Summary Statement Utilizing a reusable natural resource to decrease the ambient temperature in the interior of a vehicle in warm climates.	
Help Received Teacher helped conduct experiments.	



CALIFORNIA STATE SCIENCE FAIR 2010 PROJECT SUMMARY

Name(s) Matthew W. Wallace	Project Number S0838
Project Title The Effect of an Organic Catalyst on Microbial Degradation of Petroleum in Saline Water	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this project is to increase the process of microbial degradation of an oil spill. It has been proven that bacteria, <i>Pseudomonas Aeruginosa</i>, have the capability to metabolize oil, but the process can take 30 years to be fully effective. Through my research I will try to speed this process up and reduce the harmful effects of oil spills, I will also see if my tests will hurt any wildlife in the ocean using a brine shrimp test.</p> <p>Methods/Materials This experiment was tested by simulating a typical ocean water oil spill. I used three tests in which I evaluated the size of an oil spot to see if the bacteria was breaking down the oil more quickly. The indicator was for the oil spot tests to gradually decrease in size across the experiment, especially in the tests with the catalyst, ethylene, added. I used a "spot" test to evaluate the amount of oil in a specific quantity of water every three days.</p> <p>Results After a period of three weeks and all 42 samples were evaluated, the average of test one (with just oil and water) was 5.45cm. The test two average (with oil, water, and bacteria) totaled 4.53cm. Finally, the test three total (with oil, bacteria, water, and catalyst) was 3.11cm. The brine shrimp test results are still pending.</p> <p>Conclusions/Discussion To determine whether my project was significant compared to my null hypothesis, which stated that all tests were equal, I used an F ANOVA test. The F statistic was calculated at 10.738. This gave me a P value of 0.00075. By using 0.05 as my confidence factor, I have concluded that I have very strong evidence against my null hypothesis of them all being equal. My test was a success. I can now say that the addition of an organic catalyst makes microbial degradation about 57% more effective; thus, we may be able to reduce bio remediation from a period of 30 years to a period of 13-15 years. This would save billions of salmon and herring eggs, thousands of fish, and many volunteer clean up hours. This helps make our earth a healthier place for all of us to live in each and every day.</p>	
Summary Statement Can oil spills be cleaned up in a more efficient and less harmful manner?	
Help Received Consulted with Marine Biologist, Scott Cashen.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Alex Zivkovic	Project Number S0839
Project Title The Effects of Rainfall on the Composition of Creek Water and the Correlation Between These Effects and Lining Soil Comp	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective was to see how rainfall affects creek water. The project also tests how soil impacted these changes.</p> <p>Methods/Materials Water testing supplies that test pH, water hardness, nitrate, nitrite, phosphate and iron, as well as soil testing supplies that test pH, phosphate, and nitrogen are required for this experiment. Three soil and three water samples were collected from two locations. Two creeks were selected to collect samples from; the Muddy Canyon Creek (Location A), which passes through a state park, and the other, the San Diego Creek (Location B), passes through an urban area. First, the samples were collected from one location and tested, and then samples were collected from another location and again immediately tested. This was repeated three days before rainfall, during rainfall, and three days after rainfall. Water and air temperatures were taken to ensure that the samples were collected under similar conditions.</p> <p>Results The bacterial levels rose by about 1500 colonies in location B. The pH dropped in both locations during rainfall by nearly 1. Nitrate, nitrite, and iron levels changed without following any fixed pattern. Phosphate levels in both locations dropped to about 10 parts per million (ppm) after the first rainfall, rising again in only location B. The water hardness in location A dropped to 125 ppm, while in location B, it remained at 500 ppm throughout the entire experiment.</p> <p>Conclusions/Discussion Differences in the trends of the water hardness and the levels of phosphate may be attributed to the type of soil present, with the finer soil particles remaining suspended. Finer soil had a greater impact upon water quality than coarser soil, since it remained suspended in the water, instead of settling to the bottom as the others did. Both rainwater and soil affect the quality of creek water.</p>	
Summary Statement This project tests the effects of both rainwater and soil on creek water during and after rainfall.	
Help Received My parents paid for the supplies that I ordered and drove me to the creek locations whenever necessary for my experiment.	



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Sumit Mitra	Project Number S0899
Project Title The Environmental Implications of Nanotechnology	
Abstract Objectives/Goals When Fullerene-based Nanoparticles (FNPs) undergo photoexcitation from the sun they produce toxic reactive oxygen species (ROS). The objective of this study was to investigate the environmental impact of this toxicity. Methods/Materials FNPs were placed into the ten different environments and vials were made for each time step. The first time step (t-1) was the starting point, i.e., (t-1 = 0 day). After two weeks, time step two (t-2=14 days) was tested and one month after that, time step three (t-3= 30 days) was tested. Using high performance liquid chromatography, the degradation of an organic compound was tracked. Also, stock solutions of E.coli were prepared and tested with nanoparticles to determine if the particles were toxic to the bacteria. Viruses were then tested in 3 scenarios: First, viruses with no nanoparticles were exposed to UV-A to see if the virus was inactivated. Second, viruses were mixed with nanoparticles but were not exposed to UV-A light. Third, nanoparticles were added to viruses and were exposed to UV-A light. Results t-2 and t-3 data revealed that samples which contained humic acid seemed to have a greater inhibitory effect on all nanoparticles than samples without humic acid. It appeared that sample with FNPs + MgCl2 + humic acid had the greatest inhibitory effect on the generation of singlet oxygen compared to the other environments. In creek water samples, the generation of singlet oxygen by both single and multi walled carbon nanotubes was negligible. Fullerol still produced singlet oxygen in the creek water because it was dispersed in the sample better than the other nanoparticles. For viruses, the T7 phage was highly resistant to inactivation by UV-A, indicated by insignificant inactivation rate constant 0.000 min ⁻¹ . Conclusions/Discussion It was observed that in the presence of salts, nanoparticle aggregation increased, and ultimately reduced ROS generation. Furthermore, it was noted that humic acid seemed to inhibit ROS production. In addition, because of its low concentration, it was evident that FNPs had limited inactivation on the virus. From this it was concluded that the toxicity of nanoparticles may not be too damaging if released in low concentrations into the environment. However, further research needs to be conducted on the ecological impact of the aggregation of these nanoparticles to fully assess how safe FNPs are.	
Summary Statement This project investigates the effect of photosensitization of Fullerene-based Nanoparticles on reactive oxygen species generation and toxicity to viruses in various aqueous environments	
Help Received Dr. Mark Wiesner, Prof.- Duke University gave me the opportunity to work in his lab and provided the guidance needed to carry out this project ; Dr. Appala Raju Badireddy helped me with virus testing ; Jeff Bardner guided me on the day to day work in the lab ; Parents helped me with the supplies ; My science	