



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Sara B. Bangloria	Project Number S0701
Project Title The Effect of Soil Particle Type, Saturation Level, and Slope Angle on Slope Stability and Landslides	
Abstract Objectives/Goals The purpose of the research was to determine how different types of soil particles, along with varying levels of saturation and slope angles, affect slope stability and the occurrence of landslides. In this case, sand, gravel and garden soil were tested to see which best prevented a landslide that was caused by an earthquake or heavy rainfall. The hypothesis was that in the dry experiment, the gravel would be worst because of the looseness and heaviness of the pebbles and sand would be best because of the small fine particles. In the experiment with water, the hypothesis was that the same result would remain as soil liquefaction occurred. Methods/Materials The materials which were used include sand, gravel, garden soil, measuring cups, two flat blocks, a homemade clinometer, cardboard, water, a watering can and small roots/trees. Specifically 4L of each type of soil was required. A model was set up in order to resemble the shape and characteristics of a hillside slope. To test the effects of an earthquake, each soil was placed one by one on the model and the slope angle was increased. The angle at which the landslide occurred was measured. In order to test the effects of heavy rainfall, the same soils were applied again and water was added to the model from a fixed position until a landslide occurred. The amount of water used was measured. The procedure was repeated for a total of 3 trials for each soil type and each part of the experiment. Results In dry conditions with increasing slope angles, sand was found to be most effective, withstanding the greatest slope angle, and was followed by the garden soil and finally gravel. With a constant angle and increasing levels of saturation, the gravel was best at preventing a landslide and withstood the greatest amount of water, and was followed by sand and lastly garden soil. Conclusions/Discussion Through the data, it was learned that in dry areas with a moving hillside as in earthquakes, sand would be best in keeping a hillside stable and safe from landslides. But under conditions of heavy rainfall, gravel would work best as an additive to maintain slope stability. In making the appropriate decisions to help prevent a landslide, the soil particles size, structure and composition which affect the contact forces, as well as the gravitational pull must be taken into consideration as they greatly affect the final outcome.	
Summary Statement Various soil types are tested on a mock hillside to determine which best withstands the occurrence of a landslide when the slope angle and water levels increase.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Elizabeth V. Clemmons	Project Number S0702
Project Title Extracting Oxygen from Lunar and Martian Regolith Simulant	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals As we look to colonize the Moon and Mars, my experiment objective was to extract oxygen from Lunar and Martian regolith simulant via solutions of simple alkaloids and household substances.</p> <p>Methods/Materials Lunar soil is over 42% oxygen by composition, and Martian soil is rich in oxides. Regolith simulant, manufactured for NASA by Orbitec, was acquired from Planet LLC. After I acquired the simulant, my school limited our budget to \$40.00, so instead of experiments involving heat and electricity, I created solutions of the two types of regolith with water, ZEP, yeast, sugar, baking soda and beer. Instead of flasks and test tubes, masons jars were used. The oxygen levels were measured with a borrowed gas flue analyzer.</p> <p>Results In every instance, the solutions consumed oxygen, rather than liberating oxygen. A simple alkaloid, baking soda, actually consumed the most oxygen in both experiments. My original hypothesis was disproved, however, during the course of the experiment I made some extremely interesting observations and discoveries. A vibrant yeast culture developed in both the sealed jars of the Lunar and Martian regolith simulant solutions, and the beer and Lunar regolith kept bubbling for three weeks after the experiment.</p> <p>Conclusions/Discussion First off, we are going to need a lot more than \$40.00 in funding to get to either the Moon or Mars. Simple solutions created from oxygen-rich regolith are ineffective in liberating oxygen for rocket fuel or breathable air. The sealed jars which developed a respirating culture of yeast are drawing oxygen from what source? Is the yeast drawing oxygen from Lunar and Martian soil? The beer and Lunar soil solution continues to bubble, as does the sugar and Lunar soil. Interesting.</p>	
Summary Statement This project explores liberating oxygen from Lunar and Martian regolith simulant with simple solutions and the resulting surprising observations.	
Help Received Don Wolf loaned me a gas flue analyzer, my mother bought my materials, and my brother lent me his camera.	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Sarah E. Doyel	Project Number S0703
Project Title A Cry for Help! Are the Malibu Beaches Starving for Sand?	
Abstract Objectives/Goals The objective of my project is to determine whether the beaches in the Malibu area are eroding at an unnatural rate due to human development. Methods/Materials I compared beach profile maps of my six selected beaches in the years 1967 and 1969 to 2002 and 2005. Using the Cartesian coordinates of the profiles and the location of the mean high tide line, I determined if there was significant beach retreat from 1967 to 2005. I then compared aerial photographs of the Malibu coastline from 1972 to 2004-2006 to examine possible further photographic evidence of erosion. Results My results showed that four of the six beaches I surveyed have experienced significant erosion since 1967. I couldn't use the profile data for one of the beaches due to lack of modern survey data, but photographic evidence of that beach showed the most dramatic retreat of all. The last beach was relatively stable due to an offshore rock formation that shielded the beach from wave impact and trapped sand onshore. Overall, the evidence supporting the existence of unnatural erosion was overwhelming. Conclusions/Discussion My results clearly show a trend of noticeable retreat - on average, the beaches have receded thirty meters over the last three decades. My results do not support the theory that the missing sand is stored offshore; therefore, I believe that the Malibu beaches are experiencing true retreat. This, I believe, is due to human development. I believe that "armoring" of the coast, which is the construction of sea walls, bulkheads and other artificial structures designed to protect beachfront houses, is the cause of this erosion. The City of Malibu needs to take this beach retreat under serious consideration, as the beaches are the economic, social and recreational hub of the area. The loss of these beaches would mean the loss of tourist dollars, decreased tax revenue due to damaged private property, and the elimination of one of Southern California's most loved amenities.	
Summary Statement My project concerns beach erosion on the Malibu coastline and whether human development is accelerating it to an unnatural rate.	
Help Received Mother helped with obtaining permission to use survey data from consultants, finding research sources and manipulating data into Microsoft Xcel format.	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Annemarie R. Kelleghan	Project Number S0704
Project Title Breathing Ballona: An Analysis of Dissolved Oxygen and Density in Ballona Creek	
Abstract	
Objectives/Goals The purpose of my project was to measure the dissolved oxygen at various test sites throughout Ballona Creek. I compared the dissolved oxygen to the salinity of the creek water. I also evaluated the salinity levels from previous years and compared those results to the salinity levels from this year.	
Methods/Materials Water samples taken at various points along Ballona Creek were tested for non-volatile residue (NVR) and density. I kayaked throughout the creek in order to get dissolved oxygen readings and water samples from the center of the creek. I also tested the dissolved oxygen, took water samples at the edge of the creek, and compared them to the water properties measured at the center of the creek. Dissolved oxygen readings were obtained using a Milwaukee SM600 Dissolved Oxygen Meter. All of the results were graphed in order to determine if there was any correlation between the various properties I tested.	
Results The dissolved oxygen in the creek increases the further inland traveled. Although there was a slight increase in the dissolved oxygen at the edge of the creek, there was only a minimal difference between the dissolved oxygen in the center of the creek and that at the edge of the creek at the same distance inland. The density and NVR tests indicated that the salinity in the creek decreased he further inland traveled. My density and NVR tests are precise, as shown by the standard deviation calculations. My density and non-volatile residue results from this year show the same trend that was found in the salinity tests from previous years.	
Conclusions/Discussion The dissolved oxygen tests and the nomographs prepared from the data show that Ballona Creek has a sufficient amount of dissolved oxygen to sustain aquatic life. It has been shown that aquatic life must have a dissolved oxygen saturation well above thirty percent, and all of my results measured more than forty-nine percent saturation. Through my research, I found that dissolved oxygen is inversely related to salinity; as the salinity in the creek decreased, the dissolved oxygen increased.	
Summary Statement The focus of this research was to determine the dissolved oxygen levels of Ballona Creek and to compare the data to my past three years' measurements of temperature, density, non-volatile residue, and other water properties.	
Help Received My father provided transportation to and from the creek. He also took photos of me working in the field.	



CALIFORNIA STATE SCIENCE FAIR 2008 PROJECT SUMMARY

Name(s) Adrianna Lynch; Bryan Pearn	Project Number S0705
Project Title Why Is There No Water in Alder Creek?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The main goal of our project was to identify factors that have adversely impacted the Alder Creek Watershed, the salmonid habitat, the demise of the local steelhead population, and the dewatering of Alder Creek.</p> <p>Methods/Materials First, we reviewed literature and talked to local resource agency professionals to determine the limiting factors for salmonids. We then conducted biological, aquatic resource, and plant inventories dependent on Alder Creek. Utilizing a GPS unit and software, we then created a map of existing known water diversions within the Watershed. These sites were determined by surveying the watershed on foot. Utilizing methods described in the California Department of Fish and Game Salmonid Habitat Restoration Manual, we performed a stream survey of Alder Creek to determine the amount of salmonid habitat available. Our project then addressed the most crucial limiting factor: water availability. Hydrological assessments were performed on 8/15/07 and on 3/8/08. Employing both a bucket method that produces gallons per minute(gpm)and cross section method(flow meter) which results in cubic feet per second, 19 flow stations were set up above, below, and at the mouth of the watershed's major tributaries. Five replications were taken at each site, averaged, and then standardized to gallons per minutes(gpm).</p> <p>Results The Alder Creek Watershed survey revealed 21 water diversion sites consisting of water flow collection boxes, onstream dams, and water storage tanks. Data collected during the summer months indicated that all the Alder Creek tributaries were heavily diverted. Our 8/15/07 variable measurements revealed a complete absence of flow at all 19 flow stations. Our 3/8/08 control measurements revealed flow starting in the headwaters of Alder Creek at 10.7gpm increasing to a measurement of 399.4gpm at the mouth of mainstem Alder Creek.</p> <p>Conclusions/Discussion The results of the site visits revealed a large number of water diversions in a relatively small watershed. We have concluded the cumulative nature of the numerous water diversions has artificially dewatered the Alder Creek Watershed during the summer months. The seasonal dewatering has probably had an adverse impact on the Federally designated "Salmonid Critical Habitat" resulting in the loss of sensitive aquatic resources, and the continued demise of the steelhead population.</p>	
Summary Statement The objective of our project was to identify and quantify the limiting factors found for salmonids and establish any adverse impacts on the Alder Creek Watershed which could result in the dewatering of Alder Creek.	
Help Received Equipment use and supervision under Mr. Harris Fisheries Biologist California Department of Fish and Game	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Alexa K. Mason	Project Number S0706
Project Title Bamboo Backup: Arundo Stocks Change Santa Ana River's Course during 2005's Winter Storm	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project was to determine if the Arundo was capable of stopping the flow and forcing the water to erode the surrounding area. It is believed that if the Arundo is able to make a dam, then the Santa Ana River bed will be eroded and diverted.</p> <p>Methods/Materials A stream table is made to recreate the events. A piece of 4x8 plywood, elevated to 30 degrees, covered with a foot thick of sand. Then turn a hose on, letting it create a natural path, from the top. After 5/10/15 minutes, block the course with leaves, mud, and sticks. After another 5/10/15 minutes, unblock the path and wait for it to backtrack.</p> <p>Results Six out of nine times, the stream will return to its natural path. All three of of three 5 minutes intervals returned, two of the three 10 minute intervals, and one of the three 15 minute intervals returned.</p> <p>Conclusions/Discussion In conclusion, when a river's (or water's for that matter) course is blocked, it erodes the soil, creating a new path. Water will always go the path of least resistance. Once the blockage is destroyed, it reverts back. Exactly like the Santa Ana River did after the storm.</p>	
Summary Statement The diversion of water and it's erosion.	
Help Received My Honors Chemistry Instructor helped me put together my board; Mr. Mains (hydrologist) helped with field work	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Divya Nag	Project Number S0707
Project Title Thermal Analysis and Thermogravimetry Techniques to Quantify and Prevent Forest Fires	
Abstract Objectives/Goals The objective of this project was to examine the properties of soils around the UC Davis area and to create methods and materials which will aid in the prevention of forest fires. Methods/Materials Materials include the use of machinery such as Differential Scanning Calorimeters, Thermogravimetry and X-Ray Diffraction. Methods of sieving and thermal analysis were performed using these various instruments. Conclusions/Discussion The creation of techniques to analyze forest fire damages on location, the creation of a ratio which will accurately and effortlessly calculate soil organic matter loss in a soil, and a fire-retardant soil.	
Summary Statement The creation of a fire-retardant soil to prevent forest fires.	
Help Received Used lab equipment at UCD under the supervision of Dr. Ushakov	



CALIFORNIA STATE SCIENCE FAIR 2008 PROJECT SUMMARY

Name(s) Benjamin G. Rosenblum	Project Number S0708
Project Title Transforming Terrain: An Analysis of Man's Effect on the Absorption of Solar Radiation by the Earth's Surface	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This project was to determine the percent increase of solar radiation absorbed by the earth's surface when man alters: A coniferous forest into a grassland. (Process #1) A grassland into urban asphalt. (Process #2) A coniferous forest into urban asphalt. (Process #3)</p> <p>Methods/Materials The software program SBDART was used to produce the raw data for this experiment. SBDART stands for Santa Barbara Discreet Atmospheric Radiative Transfer. It is a FORTRAN (FORMula TRANslation) computer code designed by established atmospheric scientists to analyze a wide variety of radiative transfer problems encountered in satellite remote sensing and atmospheric energy budget studies.</p> <ol style="list-style-type: none">1. Using SBDART, radiative flux in the longwave radiation spectral range was graphed, for the bottom of the atmosphere downward, with wavelength (in microns) versus Watts per square meter, for the three surface albedo models: "Conifers", "Grass", and "Asphalt".2. The critical region (the integral) of each graph was calculated using a method of my own derivation.3. The difference between each of the three critical regions was calculated.4. Each numerical difference was divided by its respective original value (the area of the larger critical region) to obtain the expected percent increase in the absorption of solar energy by the earth's surface. <p>Results According to the data, the absorption of solar radiation at the earth's surface increases by... 3.32% when man deforests a coniferous forest into grassland. (Process #1) 5.24% when man urbanizes grassland into asphalt. (Process #2) 8.58% when man urbanizes a coniferous forest into asphalt. (Process #3)</p> <p>Conclusions/Discussion The percent increase of radiation absorption when humans deforest or urbanize a region may be slight, but when millions of acres of land are altered, the effect can be globally significant. Clearly, the practices of deforestation and urbanization are counterproductive if humankind aims to offset global climate change. Society can implement new, efficient technologies and fresh, innovative alternative energy sources to lower global greenhouse gas emissions. But if humans continue a trend of landscape development, an increase in radiation absorption could potentially negate any decrease in greenhouse gas emissions.</p>	
Summary Statement This project concerns the absorption of solar radiation at the earth's surface, and how humans can affect this phenomenon.	
Help Received I studied under Dr. Catherine Gautier at the University of California, Santa Barbara last summer. Dr. Gautier, one of the three designers of SBDART, introduced me to the software program. My ability to use SBDART allowed me to independently pursue answering the question posed in this experiment.	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Dorothy L. Silverman	Project Number S0709
Project Title Influence of Site Effects on Peak Ground Acceleration in the Northridge and Whittier Narrows Earthquakes	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The normal intuition is that increased distance from an epicenter results in a decrease in amplitude and therefore a decrease in intensity. This line of thought is called attenuation of a wave. However, site effects can make attenuation an incorrect parameter for the prediction of strong motion/intensity. The main purpose of this study was to determine how and to what extent site effects can account for peak ground acceleration (PGA). Soil type and distance were employed as site effects. Data was only taken from seismic stations that recorded for both the Northridge and Whittier earthquakes to determine whether site effect estimates from one earthquake will apply to those of another.</p> <p>Methods/Materials Acceleration files for the Northridge and Whittier Narrows earthquakes were collected from USGS shakemaps. From these catalogues, seismic station names, the stations' coordinates, distances from the two epicenters to the stations, and PGA for the two earthquakes were recorded for further analysis. Soil types of each seismic station were located using a geologic map. The map used was a Geologic Map of California Los Angeles Sheet, with a scale of 1:250,000. A technique was developed to pinpoint the locations of each station on the map, thus finding its corresponding soil type.</p> <p>Results PGA records from the two earthquakes did not match up perfectly, due to the greater magnitude of the Northridge earthquake. All recordings clearly showed a negative correlation between increasing distance and PGA. All young soils from the Quaternary Period of the Cenozoic Era responded very similarly to one another's the average PGA.</p> <p>Conclusions/Discussion Distance is still the dominating component of earthquake intensity and will normally override other site effects. The study did confirm a correlation between increased PGA and younger soils. Many other site effects such as basin effects and soil thickness may have influenced the data. It is important to acknowledge these additional factors and incorporate them into future studies. A greater pool of data and Graphic Imaging System will further sharpen these results.</p>	
Summary Statement The main focus of this project was to find the degree of impact site effects have on Peak Ground Acceleration.	
Help Received Uncle gave background information on site effects; Dr. Yong at USGS provided some advice.	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Quinn Y. Stewart	Project Number S0710
Project Title The Effect of Perennial Ryegrass (<i>Lolium perenne</i>) Presence and Growth Stage on the Erodibility of a Sandy Clay Soil	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this investigation was to evaluate the extent to which the presence and growth stage of perennial ryegrass (<i>Lolium perenne</i>) would affect the erodibility of a sandy clay soil.</p> <p>Methods/Materials The experiment called for 12 plastic rectangular soil pans (10 cm by 18 cm), 12 circular soil collection pans (diameter of 20 cm), 1 water-flow apparatus (previously constructed using a 1000-ml measuring cup, a valve, and a sprinkler fitting), 13 kg of sandy clay soil, 180 g of topsoil, 150 g of ryegrass seed, 1 electronic precision scale, 1 cylindrical lead weight, and 1 large oven.</p> <p>Experimentation involved three test groups of four samples each: a control group, a group with ryegrass planted fourteen days prior to testing, and a group with ryegrass planted twenty-one days prior to testing. To evaluate the effect of the manipulated variable (that is, the presence and growth stage of ryegrass), samples were tested for the responding variable (erodibility) using a water-flow apparatus. The apparatus maintained a consistent intensity, angle, and duration of water flow onto the soil samples in order to maximize the reliability of the testing. Eroded matter was collected in pans and massed to quantify the amount of erosion that had occurred.</p> <p>Results The average eroded masses for the control samples, 14-day samples, and 21-day samples were 40.27 g, 2.32 g, and 0.72 g, respectively. Qualitative observations of soil behavior during erosion testing supported quantitative measurements. The standard deviation ranged from 24% to 29% among the three sample groups, but the small size of sample groups limited the robustness of deviation figures. A t-test analysis proved differences between sample group means to be statistically significant.</p> <p>Conclusions/Discussion Statistically distinct data collected from each sample group, in addition to qualitative observations, supported the hypothesis that the presence of vegetation would reduce erodibility. Further, it was supported that more advanced growth stages of vegetation were more effective in preventing erosion than earlier growth stages. The findings of this experiment suggest that re-seeding may be effective in reducing erosion after wildfires. Further investigation would be needed to evaluate and compare the benefits and drawbacks of re-seeding and natural re-vegetation.</p>	
Summary Statement This project examines the role of vegetation in determining soil erodibility.	
Help Received Geomatrix Consultants donated soil samples and ran gradation tests to ensure soil consistency.	



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Jamie J. Tian	Project Number S0711
Project Title The Effect of Surface Area and Volume on the Temperature and pH in a Tide Pool	
Abstract Objectives/Goals The purpose of this project was to find out if the surface area and volume of a tide pool affect the temperature and pH and how much the temperature and pH of a tide pool changes over a short period of time. Methods/Materials During the experiment, the dimensions, depths, temperatures, and pH of 40 tide pools were measured. The approximate surface areas and volumes of each tide pool were calculated and relationships between surface area, volume, temperature, and pH were observed. The temperature and pH of one specific tide pool was recorded every 30 minutes over a 2 hour period. Results As surface area and volume increased, the temperature decreased. There was no relationship between either surface area and pH or volume and pH. The tide pool studied for 2 hours experienced a decrease in temperature and little change in pH. The % deviations within the trials were small, showing that the experiment was precise. Conclusions/Discussion The hypothesis that a tide pool with larger surface area and volume would have a lower temperature is supported. The hypothesis that a tide pool with larger surface area and volume would have higher pH is not supported. The hypothesis that the temperature and pH of a tide pool would both increase over a short period of time is not supported. Smaller, shallow tide pools are heated by air temperature and sun rays and heat up more quickly than large, deep tide pools. There seemed to be no relationship between surface area and pH or volume and pH which may have been because all of the tide pools had different amounts of plants which means that there was a different amount of photosynthesis occurring in each tide pool, affecting the CO ₂ level and changing the pH. The lack of change in pH in the study of the specific tide pool over the 2 hour period was probably due to the fact that the tide pool was mostly rocky and had few plants so there was no photosynthesis and therefore no change in CO ₂ or pH. The reason that the temperature dropped over time instead of increasing like expected was probably because the experiment was conducted in the late afternoon and during that time, the sun was beginning to set and the air temperature was dropping.	
Summary Statement The purpose of my project was to study the relationships between surface area and temperature, surface area and pH, volume and temperature, and volume and pH in a tide pool.	
Help Received Father helped take pictures	