CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Daniel J. Acks

Project Number

J0801

Project Title

Sending Sound Waves through Citrullus lanatus as a Model for Hidden Tunnel Detection

Abstract

Objectives/Goals

The objective was to determine whether sound waves could detect secret tunnels and sinkholes in the ground. Watermelons were used as a model of the ground, and holes represented tunnels. I hypothesized a 15,000 Hz sound wave would be able to detect holes with a 22.8 to 240 millimeters width.

Methods/Materials

Materials needed include watermelons, a sound resistant box lined with bedding foam, a knife with a 2 cm wide blade, a wooden spoon, a support rod, a 1/2 inch PVC pipe x 77.5 cm length, a 1.8 cm diameter steel ball, and a magnetic rod. A computer containing the application, Audacity and two Apple products (preferably an iPhone and iPad) containing the speaker application, Tone Generator and the microphone applications, Voice Memos and Soundbeam, are also required.

306 Hz, 500 Hz, 5,000 Hz, 10,000 Hz, and 15,000 Hz sound waves were sent through the same watermelon with selected hole sizes (2 cm x 4 cm x 11.5 cm, 2 cm x 6 cm x 11.5 cm, and 8 cm x 6 cm x 11.5 cm) to search for a pattern or a difference. The same procedure was performed for knocking the watermelon with a spoon, a fist, and dropping a steel ball at a set location. Each test was recorded through three different microphone software.

Results

The data collected showed no correlation for change in amplitudes vs. hole sizes. There was a decreasing shift of peak frequency for knocking tests from the unaltered watermelon to one after a hole was made. There was a change of waveform for the 500 Hz and ball drop tests that could be seen in all the watermelon after any hole was made. The higher the density of the watermelon, the larger the drop of peak frequency when a hole was made (for spoon knocking data).

Conclusions/Discussion

Due to inadequate microphone and data acquisition sampling rates, no clear evidence was found at 15,000 Hz. To my surprise, the lower frequencies and the knocking tests were able to detect the holes. The data greatly supported the main objective. The results proved that a hole can be detected by sound waves in a watermelon. The data did show that the project is plausible to perform in real life using sound to detect tunnels in the ground.

Summary Statement

I sent sound waves through watermelons with cut-out cavities in them, as a model for a novel method for the detection of underground tunnels.

Help Received

My parents helped glue the board; Sarah Rines (my science teacher) provided science fair advice.

Name(s)
Alexia R. Beck

Project Number
J0802

Project Title
How Do the Different Soil Types of the Central Valley Affect Their Infiltration Rates?

Abstract

Objectives/Goals
The purpose of my science project is to determine which soil type has the best or most efficient infiltration rate and which water type makes the soil have a faster infiltration rate. The reason I#m doing this investigation is to determine which soil and water types work best for agricultural/plant growth/etc.

Methods/Materials
(4) 32oz Gatorade bottles were constructed. Bottoms were cut off, a hole was drilled through the cap and a piece of cheesecloth was placed between the cap and bottle. (1) cups of sandy soil were put in (2) of the bottles and (1) cups of clay were put in (2) of the bottles. (2) cups of tap/hose water were filled in one sandy and one clay bottle and (2) cups of distilled water were filled in one sandy and one clay bottle. Each time water was poured into one of the bottles a timer was started to measure how long it took for the first drip to come through and how long it took for all of the water to finish coming through. The amount of water collected was also measured.

Results
Overall the sand with hose/tap water had the fastest infiltration rate and the clay with distilled water had the slowest infiltration rate.

Conclusions/Discussion
After completing my investigation on which soil and water type has a faster infiltration rate, I found that my hypothesis for the soil was correct but my hypothesis for the water was incorrect. My hypothesis for the soil stated that the sand will have a faster infiltration rate and my hypothesis for the water stated that the distilled water will go through the soil the fastest. When the sand was compared to the other soils it was the one to have the fastest infiltration rate and when the tap/ hose water was compared to the distilled water it was the one to go through the soil the fastest. Further testing needed because there was not enough of a difference between the soils and water.

Summary Statement
Testing the Different Soil Types of the Central Valley Affect Their Infiltration Rates.

Help Received
My Dad helped build the testing stands and drilled out the caps.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Adela T. Equihua-Sanchez

Project Number

J0803

Project Title

Up and Down: Stalagmites and Stalactites

Abstract

Objectives/Goals

The goal of my project was to see the growth process of stalactites and stalagmites. I kept record of the speleothems to document how long it took them to fully develop and if growth was affected by the materials they were grown on.

Methods/Materials

First, two glass jars and two plastic cups were filled with water (H20) and salt (NaCl) to create a saturated solution. Then a natural fiber string, about forty centimeters long, was dripped into both jars in the shape of an #M#. Thereafter, every night I checked the progress and wrote down in my journal how much it had grown every twenty-four hours for six weeks.

Results

During the initial three week period stalactites formed but didn#t trickle down to the #V# in the #M# like it was supposed to. The glass jars crystallized inside and out, due to moisture build up all around the jars. It took them three weeks to fully grow on the glass jar and bathroom counter. It took the solution in the plastic cups twice as long to fully develop, yet it did not completely crystallize all over the cups, it clustered onto the string and over the rims of the cups.

Conclusions/Discussion

In conclusion, stalactites and stalagmites depend on each other to grow and they take a long time to form. Man-made products like plastic, alter the growth of natural creations. Stalagmites started to grow on my bathroom counter, this was the drip that did not happen on the string. It took them three weeks to fully grow on the glass jar and start to grow on the bathroom counter. The plastic cups crystallized in six weeks, which leads me to believe humans can slow down, hinder, and/or alter nature#s process with inorganic things and waste. This experiment made me aware of how delicate speleothems and geological formations are and we need to protect the environment.

Summary Statement

I created stalagmites and stalactites using H2O and NaCl to see how speleothems grow and appreciate their process and delicacy.

Help Received

My mom helped me glue my poster board and proof read my work one done; My dad helped me create the solution to fill the jars and cups.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Anusha Ghosh

Project Number
J0804

Project Title
Slowing Global Warming by Nutrient and Iron Fertilization of Oceanic Phytoplankton

Abstract

Objectives/Goals
The purpose of my project was to test whether nutrient and iron fertilization of oceanic phytoplankton can reduce the amount of CO2 in the air thus slowing down global warming.
My hypothesis was that the iron and nutrient fertilization of oceanic phytoplankton will lead to a decrease in the amount of CO2 in the air.

Methods/Materials
Besides phytoplankton, nutrients and iron sulfate, I used bottles, tubes and air pumps to grow phytoplankton, distilled water, sea salt, blender and a measuring scale to simulate sea water, and a CO2 meter, sealed container and computer to measure CO2 changes.
For my 1st experiment I measured the increase in phytoplankton growth by varying nutrients between 0 (the control), 2, 4 and 8 ml and iron between 1.57 and 0.78 mg. I used 500 ml of sea water medium and 50 ml of phytoplankton for these experiments.
For my 2nd experiment I measured the change in absorption of CO2 by varying nutrients to phytoplankton selected from my first experiment mixed in sea water medium. I added 20 ml of phytoplankton from the control and the greenest bottle into 200 ml of medium.
For my 3rd experiment I measured the change in absorption of CO2 by using 200 ml of undiluted phytoplankton.

Results
In the 1st experiment I found that the best growth of phytoplankton was generated by adding 2 ml of nutrients added to 500 ml of medium and 50 ml of phytoplankton. The experiments using iron fertilization failed to produce results and the phytoplankton ended up dying.
In the 2nd experiment I found that using 0.8 ml nutrient for 200 ml of medium results in the most decrease of CO2. This combination resulted in a 16.3% average decrease in CO2 after 6 days.
In the 3rd experiment I found that using phytoplankton culture undiluted with medium results in a dramatic reduction of CO2 within the sealed container - an average of 55.8% reduction after 6 days.

Conclusions/Discussion
The hypothesis that the fertilization of oceanic phytoplankton will lead to a decrease in the amount of CO2 in the air was partly proven because adding the recommended amount of nutrients resulted in the growth of phytoplankton, which led to the reduction in CO2. However the iron experiments did not produce the expected results as the phytoplankton kept dying. Using undiluted cultured phytoplankton resulted in a dramatic CO2 reduction of 55%. These reductions in CO2 will lead to a slowing of global

Summary Statement
My project explores whether global warming can be slowed by the nutrient and iron fertilization of oceanic phytoplankton.

Help Received
Dr. Behrenfeld from Oregon State Univ, Dr. Matsumoto from MBARI, Jennifer Broughton, Anna McGaraghan, and Regina Radan from the Univ of California at Santa Cruz, and Rebecca Asch from Princeton Univ answered my questions; Parents helped set up board and tubing for the project.

Name(s)
Alicia N. Hans

Project Number
J0805

Project Title
Do Mycorrhiza Fungi Physically Help Retain Water in Soil during Drought?

Abstract

Objectives/Goals
The goal of this project was to discover if mycorrhiza fungi physically help retain water in soil during simulated drought conditions.

Methods/Materials
Materials used were soil, fungus mixture, and a standard measuring scale.
A batch of sifted soil was sterilized. Ten equal samples of soil were measured out. To the remaining soil the fungus mixture was added, and then ten more equal samples of soil were measured out. All the samples were watered until the fungus had grown, then the watering stopped to simulate drought. The samples were weighed twice a day.

Results
The cups with the fungus weighed up to 2% more than the cups without fungus.

Conclusions/Discussion
It has been recently discovered that plants grown with mycorrhiza fungi tolerate drought better than plants grown without mycorrhiza fungi. It is not clear, however, how the fungi help the plants tolerate drought. The mycorrhiza fungi do make a difference in terms of retaining water in the soil. However, it appears that the mechanism through which the fungi help plants tolerate drought comes from a relationship between the plants and the fungi.

Summary Statement
My project investigates if mycorrhiza fungi help retain water in soil.

Help Received
Community college professor sterilized soil and provided fungus mixture.

Name(s)

George J. Khouri, III

Project Number

J0806

Project Title

Earthquake! Put Your Soil to the Test!

Abstract

Objectives/Goals

This experiment was purposed to find soils that are earthquake proof and find a way to limit damage from earthquakes. Because of the Pacific Plate colliding with the North American plate, everyday there are earthquakes in California. This makes it necessary to have the right conditions for homes and buildings. My hypothesis was that different types of soil can affect the condition of a house after an earthquake, and this was supported.

Methods/Materials

I tested my hypothesis using clay, gravel, sand, and garden soil (control) as my independent variable. I made twenty graham cracker houses using a glue gun and glued a rectangular plastic bin, used to hold the soil, to the top of a shaking table. Then, I poured clay into the bin, leveled it, and then gently forced the house into the clay. The shaking table, powered by an electric drill, was turned to a medium speed for twenty seconds. I accelerated the pace for the last ten seconds, and after thirty seconds of shaking, I examined the graham cracker house and recorded the results. Five trials were run for each soil.

Results

On all trials, the houses rocked and tilted. With clay and gravel, none of the houses broke or cracked, but houses did turn over frequently. On the garden soil trials, some houses turned over and there were two cracks. Sand limited damage the most, with only one chip and two times that a house turned over. I found that a house will be better protected when sand is its foundation.

Conclusions/Discussion

In this experiment, I found that the right soil is vital to limiting damage and can make a difference in a house#s condition. Earthquakes have been a big problem to California over the last one hundred years. To add, long term forecasts show, because the separation of the 1972 and 1994 earthquakes is 22 years, another big quake may be expected to hit Southern California around 2016. Therefore, with sand as a building's foundation, it will be better suited to limit damage when an earthquake strikes.

Summary Statement

Using four different soils with graham cracker houses and a shaking table, this experiment tested if different types of soil affected the condition of a house after an earthquake.

Help Received

Parents helped buy materials and take photos, mother assisted with construction of shaking table (which was not one of my variables), and my teacher reviewed my project at different times.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Paul C. Lauermann

Project Number

J0807

Project Title

Monitoring the Decline of Sea Fan Populations Near Anacapa Island Using a Remotely Operated Vehicle

Abstract

Objectives/Goals

Gorgonians, commonly referred to as sea fans, are a type of octocoral that are slow growing and sensitive to environmental fluctuations. Studies have shown that in areas with dense gorgonian populations, thermal stress can lead to widespread disease and eventually death. The objective of my project was to determine if there was a gorgonian die off near Anacapa Island from 2009 to 2014 and if so, was it caused by an increase in seawater temperature.

Methods/Materials

Using Remotely Operated Vehicle (ROV) video imagery collected on the same four 0.5 km long transect lines in both 2009 and 2014 were compared. Gorgonian data extracted from the video included health and total coverage by transect line and year. NOAA monthly sea surface data and satellite thermal imagery were used to track monthly seawater temperatures near Anacapa Island from 2009 to 2014.

Results

My data showed that there was in fact significant decrease in the population health of gorgonians from 2009 to 2014 and that during this time there were periods of significant sea surface temperature increase. Data collected in 2009 showed that living gorgonians covered between 6.9% and 44.4% of a transect line and there was no noticeable dead gorgonians. Data collected in 2014 showed that living gorgonians covered between 1.0% and 4.8% of a transect line and dead gorgonians covered between 12.2% and 28.0% of a transect line. NOAA sea surface temperature data showed an unusual spike in temperature during the summer of 2012 and 2014, with winter temperatures not cooling down to normal between 2013 and 2014.

Conclusions/Discussion

My conclusion is that seawater temperature does affect gorgonian population health, but may not have been the only factor involved in this die-off. Because I did not have a control site with gorgonians that did not receive the thermal stress, seawater temperature can not be scientifically determined to be the direct cause for the die-off of gorgonians.

Summary Statement

The effects of climate change on sensitive marine populations.

Help Received

My dad helped set up data collection; Dr. Peter Etnoyer provided access to NOAA sea surface temperature.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Jacob H. Nahama

Project Number

J0808

Project Title

Let It Flow

Abstract

Objectives/Goals

My objective was to learn how the porosity of a porous medium impacts flowrate. My hypothesis was that the larger the porosity the faster the flowrate would be.

Methods/Materials

Using 4 different grain sizes (golf balls, marbles, bees bees, and sand), I calculated the porosity and then measured the flowrate of water through these different grain sizes. The porosity varied from 33% for sand to 57% for golf balls. I ran water through a bucket full of the different grains and measured the flowrate. I was careful to keep the pressure constant by always having the bucket of grains overflowing with water. Except for the sand, the flowrate was essentially the same. After my initial results did not show a significant difference, I ran the experiment with no grains (100% porosity) and a mixture of sand and bee bees. I modified my project mid-stream and included permeability as a factor. I was able to calculate permeability with the data I gathered using Darcy's Law.

Results

I found very little difference in flowrate, even though the grains' porosity was different, until I used sand. Once I included permeability, my results showed that even though golf balls, marbles and bees bees had a change in porosity, they didn't have a change in flowrate and this is because flowrate is directly related to permeability, not porosity.

Conclusions/Discussion

My initial results showed little difference between flowrate and porosity, except in the case of sand. With further testing, I realized that it is not how big the pores are (high porosity), but how well they are connected to each other (permeability) that determined flowrate. Darcy's Equation illustrates this.

Summary Statement

My project shows how permeability (how well the pores are connected) is the determining factor in flowrate through a porous medium, not porosity.

Help Received

My parents helped me at Home Depot figure out the configuration of parts I needed to design my experiment. They helped me research Darcy's Equation to include permeability in my experiment. My parents helped with my excel graphs. Also my teacher helped me find this project.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Lily C. Oglesby

Project Number

J0809

Project Title

How Do Different Ground Materials Affect Seismic Wave Propagation?

Abstract

Objectives/Goals

This experiment was designed to determine which ground material (loose sand, packed sand, gravel, asphalt, or concrete) would make a seismic wave decrease most rapidly as it travels from a seismic source to a detector.

Methods/Materials

A shot put ball was dropped from a fixed height onto a steel plate. The resulting seismic wave was recorded by a seismograph placed at 10 different distances from the impact on 5 different ground materials: loose sand, packed sand, gravel, asphalt, or concrete. The loose sand, packed sand, and gravel represented the broken-up rocks of the West Coast, while the asphalt and concrete represented the more solid rocks of the Eastern US. The median peak ground acceleration was taken across the 10 drops at each distance for each ground material.

Results

When traveling through the unconsolidated materials (loose sand, packed sand, and gravel), the median peak ground motion decreased by a factor of 2 when the seismic wave traveled 80 cm from the source. Traveling through more solid asphalt, the seismic wave went 160 cm before the median peak ground motion decreased by a factor of 2--a significant difference. Traveling through the even more solid concrete, the median peak ground motion decreased by a factor of 2 after going 360 cm from the source--an even greater difference.

Conclusions/Discussion

The hypothesis was supported by the data. In the experiment, seismic waves decayed more quickly in unconsolidated materials than in more solid materials. This experiment agrees with the observation that seismic waves travel farther on the East Coast (through hard, solid rock) than the West Coast (through soft, broken up rock).This information is important to architects and engineers all over the US. In the eastern US, even though the earthquake are rare, they are felt over a much larger area. On the west coast, the earthquakes are much more frequent even if they are not felt over as large an area. Thus, buildings all across the US must built to withstand earthquakes.

Summary Statement

My project investigates how different ground materials cause seismic waves to decay at different rates as they propagate through the earth.

Help Received

Corrie Neighbors and Kayla Kroll at UC Riverside loaned me the seismic sensor, and Gareth Funning at UC Riverside loaned me the steel plate. My parents assisted me with running the experiment and the spreadsheet software, and helped proofread the poster.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Taryn K. Tolhurst

Project Number

J0810

Project Title

Sand Reflectance: Does Beach Sand Reflect More Light than Desert Sand?

Abstract

Objectives/Goals

The problem/purpose of this project is to test which location#s sand reflects more light, beach or desert. I figured this out by using a spectrometer to measure the light reflectance of all the beach and desert sand samples.

Methods/Materials

1. Find five beaches and three desert sand dunes (make sure none of the locations are in state parks).
2. Collect three sand samples from each location.
3. Using a spectrometer find the light reflectance for all the colors and energy (infrared) for each sample.
4. Chart these numbers.
5. Graph the percentages of light reflected back for each color of each sample.
6. Find the average light reflectance for the three samples of each site.
7. Find the average for beach and desert samples and graph the results.
8. Compare and analyze to see if hypothesis is supported.

Results

After finding the overall beach desert averages and comparing them to my control, I got my answer. The beach sand was brighter than the desert sand and less bright then the control. The desert sand was less bright than the beach sand and less bright than the control. I also compared the averages for each location to the Carmel Beach average (the control).

Conclusions/Discussion

In conclusion, my data supported my hypothesis. This may be because the minerals that make up sand are different by the ocean than they are in the desert. Plus, sand dunes are created by wind, and beaches are created by water, so maybe the process affects the separation of dark minerals and light minerals, but I would have to do further research on this topic.

The bottom line is, in my study, beach sand reflected more light than desert sand.

Summary Statement

The purpose of this project is to test which location#s sand reflects more light, beach sand or desert sand.

Help Received

My dad Jeff Tolhurst and his girlfriend Ginger Rohlen helped collect sand samples; my grandmother Charlotte Tolhurst drove me to my beach sample locations; my sister Courtney Tolhurst helped take photos; my dad helped record data and type parts of my board.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Audrey Q. Webb

Project Number

J0811

Project Title

Thermal Microcosm: A Study of Climate Change and Its Causes

Abstract

Objectives/Goals

I simulated an earth-like climate system, applied temperature forcing agents and observed their relative effects on the system temperature.

Methods/Materials

I simulated the earth-like climate system with a 725ml spherical flask of water with a heat lamp pointed at it.

I simulated two climate forcing agents: Greenhouse Effect (layers of bubble wrap around the flask) and Ice Cap Reflectivity (coverage of the "poles" with white electrical tape). Resulting in 5 configurations:

- 0 layers bubble wrap, 0% cap coverage (CONTROL)
- 0 layers bubble wrap, 25% cap coverage
- 0 layers bubble wrap, 50% cap coverage
- 1 layers bubble wrap, 0% cap coverage
- 2 layers bubble wrap, 0% cap coverage

I recorded the temperatures of each configuration until stabilized, then compared them.

Results

Temperature change relative to control, per configuration:

- 4ºC 0 layers bubble wrap, 25% cap coverage
- 9ºC 0 layers bubble wrap, 50% cap coverage
+ 2ºC 1 layers bubble wrap, 0% cap coverage
+ 2ºC 2 layers bubble wrap, 0% cap coverage

Temperatures stabilized after 7-10 hours.

Conclusions/Discussion

My hypothesis that ice cap coverage would have greater effect on climate temperature proved to be true. However my secondary hypothesis that increasing a forcing agent would further increase the change in temperature was not supported; the addition of a second layer of bubblewrap yielded no further change in temperature than a single layer of bubblewrap.

Extending these findings to draw conclusions about the earth's climate would be an oversimplification of the earth climate system and it's temperature forcing agents. The earth's climate is far more complex and there are many forcing agents I didn't account for in my simulation.

Summary Statement

I simulated an earth-like climate system, applied climate temperature forcing agents and observed their relative effect on the system temperature.

Help Received

My parents helped me get the materials and had my board printed for me.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Natalie C. White

Project Number

J0812

Project Title

Measurement of Cosmic Rays in the Earth's Stratosphere

Abstract

Objectives/Goals

The primary objective was to determine if the number of cosmic rays changes with altitude. The secondary objective was to obtain temperature, other flight data, and video.

Methods/Materials

This project is a continuation from last year. So far, I have made three weather balloon flights. The Falcon I recorded data to only 56,000 feet when the flight computer stopped working. The Falcon II was lost when my GPS transmitter stopped sending signals near Mt Whitney. It was found in Texas several months later and returned to me. Unfortunately, it had very little data since the flight computer stopped working shortly into the flight. At this point, I decided to concentrate on ground testing my equipment before any more flights. I found that my flight computer could stop taking data at random times even when it had a good battery. I decided to use an Arduino mini-computer to monitor my flight computer and to reset it when necessary. I also needed a better way to track my balloon. I found that an APRS (Automatic Packet Reporting System) radio would be a big improvement over my SPOT GPS transmitter. However, to use an APRS radio I needed to obtain my Technician level amateur license. In February 2015, I passed the exam and received my call sign: KK6SDN. The Falcon III was launched on March 8, 2015 and reached an altitude of 86,000 feet. Both the flight computer and APRS radio on the Falcon III worked perfectly.

Results

The radiation count is low and constant below 10,000 feet. Between 20,000 feet and 50,000 feet the count rises rapidly as the altitude increases. Finally, above 50,000 feet the radiation count levels out. Above 60,000 feet the counts decrease gradually. In addition, three cameras obtained a total of nearly three hours of movies at altitudes up to 44,000 ft.

Conclusions/Discussion

The radiation count increases with altitude but then decreases. I would like to launch another balloon to obtain data in the region from 86,000 to 110,000 feet. I would like to determine if the count levels out at higher altitude. Also, I would like to improve the reliability of my cameras and obtain video of the entire flight, from launch to landing.

Summary Statement

I measured how the cosmic rays count changes with altitude using a Geiger counter on a weather balloon.

Help Received

My father taught me how to solder and use a multimeter. Simon Gonzales helped to find my equipment after it landed.