CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Gabriel Arroyos; Jose Benitez Ponce; Victor Ornelas

Project Number

S1201

Project Title

The Effect of Altitude on Tropospheric Ozone

Abstract

Objectives/Goals

The objective of this experiment is to find the correlation between ozone concentration and altitude.

Methods/Materials

Ozone test strips with a scale to measure
Reliable transportation (car, train, bus)
Camera
Altimeter
Means of measuring weather conditions (Smartphone, psychrometer, thermometer, etc.)

Results

Across all trials, ozone concentrations were measured at 7 different altitudes at increments of 1000 feet (approximately, 300 meters). All 4 trials consistently showed that elevation and ozone concentration are directly proportional; in other words, higher altitudes appear to feature higher levels of ozone. Each sample was taken within 20 minutes of each other on average, and each trial was conducted within 4 hours (roughly from 8am to 12pm). This was done because of the fact that different levels of human activity subsequently affects ozone levels. This phenomena can also be observed in the data. For example In Trial 2, which was taken later in the day than other trials, displays slightly higher ozone levels. Finally, the most important detail to note, is how the control group (sea level) disobeys the aforementioned trend in the first two trials. This anomaly did not show up in our subsequent trials, which controlled for air quality index.

Conclusions/Discussion

After conducting the experiment, the relationship between ozone concentration and altitude was determined through a couple of trials. It was discovered that ozone concentration increases as elevation was increased, showing a positive correlation. These results contradicted the hypothesis as it was first believed that ozone would have an inverse relationship when associated with altitude. To expand upon this subject, other studies like testing the correlation between population density and ozone concentration can be explored; as well as the correlation between ozone levels and other environmental factors. Perhaps, even testing to see what environmental factors influence ozone levels most.

Summary Statement

We measured the concentration of ozone at various altitudes and found that ozone concentration and altitude are directly proportional.

Help Received

None

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Deveshi Buch

Project Number
S1202

Project Title
Atmospheric Rivers: From Drought to Deluge

Abstract

Objectives/Goals
Atmospheric Rivers (ARs) are long, narrow plumes of moisture responsible for over 90% of poleward water vapor transport across the mid-latitudes. AR events bring significant precipitation to California and are known to end droughts as well as cause floods. The objectives of this study were: 1) perform a case study of a significant AR event over the Eastern Pacific and U.S. West Coast in February 2014; 2) consider the event in a climatological context of February ARs over a 20-year period.

Methods/Materials
Atmospheric River (AR) characteristics (IWV, IVT, 500 & 850 hPa Z, wind) are calculated based on data from NASA MERRA and ECMWF datasets. Data is processed and analyzed using self-written code based on Numerical Python. ARs are isolated in the dataset from the raw IWV & IVT values.

Results
The AR is characterized by high levels of IWV (~29 mm) as well as IVT (~759 kgm-1s-1). Analysis of the synoptic-scale progression of upper-level extratropical cyclones and anticyclones shows the flow of vapor transport in a narrow channel ~450 km in width and ~2600 km in length. 20-year composite mean charts for February ARs show peak IVT of 500-600 kgm-1s-1 at the core.

Conclusions/Discussion
The February 2014 AR event is one of five significant events in the 20-year period as measured by IWV & IVT relative to the composite mean. The absence of ARs impacting the region in particular years was also explored. This regional characterization provides a better understanding of the formation and frequency of ARs and impacts at landfall#crucial for water resource management, environmental protection, and public safety.

Summary Statement
I performed a case study of a significant Atmospheric River event over the Eastern Pacific with in-depth analysis and climatological context.

Help Received
Thanks to Prof. Ullrich of UC Davis for introduction to climate modeling and meteorology. I wrote the Python code to perform the analysis myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Emma W. Chusid

Project Number

S1203

Project Title

Environmental Effects on Health and Behavior of Nematodes

Abstract

Objectives/Goals

The purpose of my research project is to isolate nematodes from collected soil samples, track their behavior and use this information and information about the soil they are isolated from, to observe and measure the relationship between the health of the nematodes and the health of their environment.

Methods/Materials

Isolation of nematodes: using a test tube, funnel, filter paper, distilled water, microscope, and spit tube. Mix soil with water and filter overnight into the test tube. Locate nematodes in the liquid and move them onto a separate plate using a spit tube. Touch assay: Move one nematode onto a petri dish. Lightly touch with a sterile eyelash on the head, tail and middle of nematode, waiting thirty seconds between each touch. Soil depth analysis: collect soil with soil sampler measuring the depth of each sample. Complete each isolation using a fifteen gram sample, count the number of nematodes found at each depth and compare. Defecation study: place a nematode on a petri dish, use a microscope to watch it and track time between defecations using a stopwatch. Thrashing assay: place one nematode onto a petri dish filled with M9 solution. Record the nematode in thirty second increments, counting the number of thrashes.

Results

I have been able to see some distinct differences between EC nematodes and C. elegans. Most notably they are visually different, C. elegans are thinner and more elongated while EC nematodes are curved (displaying unc phenotype). C. elegans have an unc phenotype mutation, but curve from the tail and unc EC nematodes curve from the middle. ECs return to the coiled (unc) shape when stressed. Based on defecation assays I have been able to determine that EC nematodes have much slower metabolic rates than C. elegans, whose rate of defecation is generally more than twice as frequent as EC nematodes. I have observed ECs are very tactile, they clump together in groups and move over each other, comparatively C. elegans distribute themselves more evenly across a plate and avoid being on top of one another. ECs are most prevalent when the soil is moist and healthy and prefer to live in the top level of the soil.

Conclusions/Discussion

EC nematodes seem to be most present when the soil is healthy and I plan to use the health of the nematodes as an indicator for the health of the soil by comparing plant growth, moisture and nutrient content to the number and behavior of the nematodes.

Summary Statement

I found a strong correlation between the health of the soil and the health of the isolated nematodes and categorized wild type behaviors of these nematodes.

Help Received

I completed all of the assays myself but got instruction on basic techniques for manipulation and study of nematodes from my advisor, Dr. Aidyl Gonzalez and found the basic structure for the isolation assay from an online resource. I was also given access to lab facilities by my school, The Buckley School.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Clay Corippo; Jakob Friedrichs; Nathan Whittle

Project Number
S1204

Project Title
Ideal Habitat for Bass

Abstract

Objectives/Goals
Our objective was to find the ideal habitat for bass based on dissolved oxygen and temperature.

Methods/Materials
We used lots of technology including a temperature and dissolved oxygen probe, and a drone to test for the ideal fishing spots in the Lake of the Pines. We counted the amount of fish caught in each area and put this together in a graph with the temperatures and dissolved oxygen levels.

Results
We found that the temperature and dissolved oxygen levels did affect the fish population in the area.

Conclusions/Discussion
Our goal was to find the ideal habitat and we did so. Our hypothesis was correct and there was a ideal habitat with a certain dissolved oxygen level and temperature.

Summary Statement
After gathering data on temperature and dissolved oxygen levels in the Lake of the Pines, we found the ideal habitat and fishing spots for the lake.

Help Received
Our Environmental Science teacher, Jennifer Weir, sparked our idea for the project and provided the tools to measure the data.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Samuel Gleason; Ian Hughes

Project Number

S1205

Project Title

California Tide Pools: Environment in Crisis? What We Can Learn from Algae and Rocks?

Abstract

Objectives/Goals

California#s local tide pools are home to thousands of species of organisms that are vital to our aquatic ecosystem. Largely due to human impacts, these ecosystems are becoming increasingly threatened. The purpose of this project is to examine how human induced climate change is affecting our local algae populations as a proxy for the overall health of Southern California tide pools through the testing of the following three hypotheses:

1. Populations of Sargassum multicum, an invasive algae species, will have increased over the last four years, impacting tide pool life.
2. Healthy populations of coralline algae will have decreased over the last four years due to ocean acidification and warming.
3. The distribution of algae is not random but is governed by the rock formations forming the tide pools. Thus, rising sea level may also impact tide pool life.

Methods/Materials

This project was conducted using 10 m line transects to calculate the percent cover of different species of sessile marine invertebrates. Three to four of these transects were used for each of the two localities. 24 species of algae were identified and normalized to 100 percent.

Results

Comparison of percent cover data for each of the algae species with data from a 2012 study conducted using the same methods and localities demonstrates that the distribution of algae has changed dramatically since 2012. S. muticum shows a significant decrease at both localities. Coralline algae increased at both localities but 30 to 50 percent of the coralline algae was dead or bleaching. Finally, data showed that species have very strong distribution correlations to types of geologic outcrops.

Conclusions/Discussion

Major inferences about the current and future health of our local tide pools can be made. S. muticum, previously thought of to be a major problem on our coastline, is not as big of an issue as projected and may actually be declining. Second, although percent cover of Coralline algae has actually increased in the past four years, populations of healthy colonies are in decline and finally, rock formation has a dramatic effect on the species distribution. Furthermore, the strong correlation between some of the most common algae with the tide pool geology is worrisome as current projections suggest rate of sea level rise will be much more rapid than erosion of coastal rock formations which are essential

Summary Statement

Analysis of the impact of human induced climate change on tide pools in California indicates that tide pools have been impacted by environmental factors.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Laura Gong

Project Number

S1206

Project Title

Analysis of Optimal Locations for Ocean Wave to Maximize Energy Generation

Abstract

Objectives/Goals

Energy making-related emissions from power plants and other traditional fuels cause major respiratory and cardiovascular health risks. Producing reusable, environment-friendly energy such as harnessing energy from ocean waves is necessary. This project#s long term goal is to develop the most efficient way to harness potential energy from ocean waves with the use of point absorber buoys, which produces more usable energy as there are greater wave heights. The first-year goal is to analyze which areas along the coast of California have the largest waves in specific future weeks, thus producing more energy.

Methods/Materials

Collecting previous wave height data from coasts along the California coast is crucial to predict where and which weeks will have the greatest wave heights. Python 2.7 program is capable of predicting and graphing previous and future wave heights. It is necessary to predict and graph the wind speed in those certain locations to analyze the how wind speeds affect the height of waves. Graphs of the wave heights, wind speed, gust speed and air temperature show the relationship between them to predict which week will have large waves.

Results

Optimal sites to place point absorbers are in Cape Mendocino, Diablo Canyon, Half Moon Bay, Humboldt Bay, and San Francisco. The second week of December will have the highest waves. Therefore the optimal week to harness energy from ocean waves is during the second week of December.

Conclusions/Discussion

The data analysis goal was reached as the optimum locations to produce the most energy were found. Most data regarding wind speed and gust speed show that higher waves have speeds greater than average speeds that year. The graphs concerning sea surface temperature greatly differ. Thus, sea surface temperature isn#t a major factor to determine wave heights, but wind speed and gust speed are.

Summary Statement

This analysis decides the optimal locations along the coast of California to put point absorbers by finding the relationship of possible factors: wind speed, gust speed, and sea surface temperature - to wave heights.

Help Received

Mrs. Julie Munoz provided support throughout the process. I received my data from NOAA National Data Buoy Center. I then ran the data through a Python script I had created on my own

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Alicia N. Hans

Project Number
S1207

Project Title
Fertilizer vs. Fungi: How Nitrogen Fertilizers Affect Beneficial Mycorrhizal Fungi

Abstract

Objectives/Goals
The objective of this project was to measure the effects of exposure to water containing nitrogen fertilizer runoff on the number of beneficial mycorrhizal fungi in the root systems of plants. The fungi assist their host plants in water and nutrient uptake, and protect the host plant from pathogens.

Methods/Materials
Collected plant and water samples, washed plant roots in water, stained plant roots using 2.5% potassium hydroxide, 1% hydrochloric acid, an acidic glycerol/trypan blue mixture, and acidic glycerol. Made permanent slides and counted fungi using a compound light microscope. Tested for nitrate in the water samples using cadmium powder and a nitrate testing kit.

Results
Beneficial mycorrhizal fungi were counted for plant root systems with and without exposure to nitrogen fertilizer runoff. The plant roots not exposed to the runoff showed more mycorrhizal fungi in their root systems than the plant roots exposed to the runoff.
Nitrate levels in the water before and after going through treatment were tested. The water before going through treatment had a slightly higher amount of nitrate than the water after going through treatment. Data obtained from the Irvine Ranch Water District indicated higher levels of nitrate in earlier months, when the plants were growing.

Conclusions/Discussion
The plant roots exposed to the nitrogen fertilizer runoff had fewer beneficial mycorrhizal fungi in their root systems. I concluded that nitrogen fertilizer runoff is lowering the number of beneficial mycorrhizal fungi in plant root systems. This indicates a previously little-known harmful effect of chemical fertilizers on plant health.

Summary Statement
I found that exposure to nitrogen fertilizer runoff can lower the number of beneficial fungi in a plant root system.

Help Received
Dr. Kathleen Treseder of the University of California, Irvine, allowed me to work in her laboratory, provided all materials, and explained all the procedures.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Jennifer Hernandez-Mora

Project Number

S1208

Project Title

A Quantitative Analysis of PM 2.5 um in Santa Maria, CA

Abstract

Objectives/Goals

The objective of this experiment was to determine what time of day, out of four times being tested, there would be a higher concentration of particulates in the air.

Methods/Materials

For this experiment, I utilized the Dylos Air Quality monitor, its accompanying equipment for data transfer to a computer, a computer, and the Dylos driver. I tested outside my home with the monitor and recorded for 30 minutes at four times throughout the day for several days.

Results

The level of particulates in the air was tested with a Dylos Air Quality monitor at distinct times of the day. After several days of the same method being used everyday, it was found that particulate concentration is highest in the morning in my area.

Conclusions/Discussion

It can be concluded that particulate matter concentration is the highest in the morning compared to later times within my neighborhood. Five in the morning, in comparison to other times which were tested is the specific time at which air pollution levels were the worst and therefore a larger threat to health of people residing in my neighborhood.

Summary Statement

I was able to determine that out of four times being tested, the earliest morning time was the time at which the level of particulates in the air was the highest within my neighborhood.

Help Received

My summer science institute advisor, Mr.Magni, provided me with the device which I used for this project. He too provided me with resources to analyze my data after the experimentation took place. I conducted the experiment and logged data on my own.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Shloka V. Janapaty

Project Number
S1209

Project Title
The Effects of Pseudomonas putida Bioremediation of Agricultural Runoff on Low-Density Polyethylene Decomposition Rates

Abstract

Objectives/Goals
According to the EPA, there are 5.25 trillion pieces of plastic trash in the world's oceans with 300 million added each year. It is vital to understand how to decompose plastic responsibly. NCBI research shows that the bioremediation of certain bacteria has been effective at decomposing plastic. This project uses agricultural runoff to decompose plastic through Pseudomonas putida bacteria. The plastic used was low-density polyethylene (LDPE) commonly used in bags, six pack rings, and computer hardware.

Methods/Materials
The first part of my experiment was solely aimed at understanding whether agricultural runoff could be used to spur P. putida growth, while the second part assessed the impact on plastic decomposition.
Culture A: (control) Water and P. putida,
Culture B: Water, P. putida, and a eutrophicated water concentration of agricultural runoff (N- 0.03 mg, P- 0.08 mg)
Culture C: Water, P. putida, and higher concentration agricultural runoff (N- 1.65 mg; P- 1.1 mg)
After a 50 day period, bacterial growth and plastic decomposition rates were measured.

Results
The results indicate that eutrophicated water had three times greater growth of bacteria and the highest plastic decay at 20-30%. Culture C, with the higher concentration and nutrient content, had the next highest cell count and plastic decomposition at 17%, compared to the control, with 2%. Overall, the results show that increase in concentration does not result in higher P. putida growth and higher plastic decomposition likely due to the impact of pH of the culture on bacterial growth.

Conclusions/Discussion
Small amounts of nutrients, such as those found in eutrophicated waters spur P. Putida growth which use enzymatic degradation to breakdown the carbon backbone of LDPE plastic. P. Putida are advantageous because they have most genes to break down aromatic and aliphatic hydrocarbons (ex: LDPE Plastic). Higher concentrations of agricultural runoff render the culture more acidic and resulted in suboptimal conditions for bacterial growth. Thus, a low concentration of agricultural runoff put to good use maximizes the growth of P. Putida and can help achieve a much-needed increase in plastic decomposition rates.

Summary Statement
This project utilizes nutrients in agricultural runoff to enhance the growth of Pseudomonas putida bacteria which in turn significantly increases the decomposition rates of LDPE plastics.

Help Received
My advisor, Dr. Tracy Hughes, guided me in experimental procedure, taught me how to use a hemocytometer, and showed me how to make a nutrient broth culture.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Ethan Jean; Johnson Ku

Project Number

S1210

Project Title

Water Quality in Silicon Valley

Abstract

Objectives/Goals

We strongly believe that urbanization has greatly impacted many watersheds in Silicon Valley due to the decrease of natural land, which increases chemical and ion concentrations in the creeks. Because of the rapid urbanization of this area, we wanted to analyze the effects on the water quality. The water quality in rural areas is better than that in urban areas due to different land use patterns and point source pollutions. With the increase in impervious area as the environment becomes more urban, the water is unable to penetrate the ground and filter out any chemicals and toxins.

Methods/Materials

We selected twelve sampling points located on four different watersheds around Silicon Valley and collected data for three months. During each visit, we used the Yellow Springs Instruments (YSI) Pro Plus meter to measure several parameters crucial to the analysis of water quality. The data was then compared to the most recent Environmental Protection Agency (EPA) standards set by the government. We compiled this data into an Excel spreadsheet and created several graphic images to display the data. Geographical Information System (GIS) softwares were used to process and map out the impervious area of the studied region.

Results

We observed that as we moved downstream, sampling points became more and more polluted due to higher impervious area percentages, and dissolved oxygen concentrations decreased. Alluvium formed creeks tended to have higher SPC values because the ions dissolved more easily in the alluvium formation as compared to other geological formations like JV.

Conclusions/Discussion

Urbanization will bring more pollution to ambient water, but with proper management plans, creek ecosystems can be preserved and sustained. For example, Google proposed best management plans throughout the course of the construction, which proved to be effective in the conservation of the creek's health.

Summary Statement

Through GIS softwares and different lab equipment, we analyzed water quality in Silicon Valley and the trends that are apparent between factors of water pollution.

Help Received

We received aid in taking photos for us while we were conducting lab tests, and our teacher/project advisor helped out through teaching us how to use the Dionex Ion Analyzer and how to interpret the data.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Samuel B. Kahn

Project Number
S1211

Project Title
Post-Fire Regeneration in Coastal Sage Scrub: Third Year of Study

Abstract

Objectives/Goals
I studied plant numbers and species (native vs. non-native) that grew in burned (BA) and unburned areas (UBA) after fire in Coast Sage Scrub (CSS). I measured Artemisia californica number and height in a BA versus an UBA. I tested how weeding out non-natives in a BA affected native species. Finally, I compared the chemistry of soils from BA and UBA.

Methods/Materials
I began in October 2014 after a fire in July 2014. I put 8 meter long transect lines in a BA and an UBA. I sampled 4, 1 meter square quadrats along each line once a month, recording the type and number of plants. In July 2015, I added a third transect in the BA, that I weeded all non-natives out of. I counted and measured the height of Artemisia californica, a native plant, in two large 8 meter by 3 meter quadrats in the BA and UBA. I sent samples of burned and unburned soil to Wallace Laboratories for analysis of nutrients, pH, and salinity.

Results
Plant growth correlated with the winter rains. There were more non-native plants in the BA and more species overall, though the percentage of native and non-native species in the transects was the same. Different native and non-native species were seen in the BA and UBA. Rattlesnake Spurge, Sun Cups, and 6 Weeks Fescue were the most common native species in the BA; Matchweed and 6 Weeks Fescue the most common natives in the UBA. Indian Sweet Clover and Black Mustard were the top non-natives in the BA, and Red-Stemmed Filaree and Smooth Cats Ears in the UBA. In the BA there were significantly more and larger Artemisia californica than in the UBA, possibly due to increased nutrients like nitrogen, carbon, magnesium, sulfur and calcium in the burned vs. the unburned soil. Weeding out non-natives did not increase the number of native species, but it did increase the number of plants of some seasonal native species. It also decreased the number of non-natives by the second winter.

Conclusions/Discussion
My project shows in detail how CSS recovers from fire. This can help with management as I identified major non-native invasive species, which could be the focus of removal efforts, and I identified what natives grew and when they grew, which could help with restoration. I plan to continue taking data until July 2017 (3 years post-fire) to look at the effect of continued removal of non-natives and increased rainfall on plants. Finally, I hope to create an app or website to help others identify seedlings.

Summary Statement
I studied the recovery of plants in Coastal Sage Scrub after a wild fire, in particular the numbers and species of native and non-native plants that grew.

Help Received
Ranger Chris Axtmann provided me access to the burn area, Garn Wallace of Wallace Laboratories performed chemical analysis on my soil samples, Kyle Ince, Ranger Heidi Gutknect, Bruce Hanson, John Hopper and Jasmine Bakker helped with seedling identification.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Jamie M. Lin

Project Number
S1212

Project Title
The Effect of Acidification on Mytilus edulis Shells

Abstract

Objectives/Goals
The pH of seawater was changed to test how different acidities affected the total composition of Mytilus edulis shells over time.

Methods/Materials
An equal number of Mytilus edulis shell halves were separated in 4 separate containers (labeled A,B,C,D) of distilled water with instant ocean sea salt. Each container was mixed with different amounts of distilled white vinegar and their acidities were measured with a pH meter. Each week, the shells were removed, cleaned, and their masses recorded. The process was repeated for 3 more weeks.

Results
Out of the 4 groups of shells tested, Group C (pH=7.4) appeared to have the greatest overall change in mass with its mass decrease at an average of 0.045 grams. Group B (pH=7.6) had the second greatest overall mass decrease of an average of 0.21 grams. Group D (pH=7.2) had the second least overall change in mass while Group A (pH=8.4) showed the least amount of mass change.

Conclusions/Discussion
This experiment supported the hypothesis that the seawater with a lower pH (more acidic) would cause the shells to lose more mass over the span of 3 weeks. This translates to greater devastation of marine life in the future as the ocean continues to become more acidic.

Summary Statement
I demonstrated the affect of ocean acidification by observing mussel shells that were placed in acidic solutions for a span of three weeks.

Help Received
My science teacher provided the guidelines and equipment in order to conduct the experiment.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Titus M. Patton

Project Number

S1213

Project Title

Effects of Ocean Acidification on Primary Consumers in a Marine Ecosystem

Abstract

Objectives/Goals

Oceans make up seventy percent of our world#s surface, and contain some of the most diverse ecosystems. The ocean also serves as a gigantic carbon #sponge#, absorbing humanities excess carbon dioxide. Within fifty years at the current rate of global CO(2) production, our oceans may become too acidic for those ecosystems to continue to thrive. This is do impart to Ocean Acidification, which is the increase in atmospheric CO(2) dissolving into the ocean reacting with hydrogens creating bicarbonate. Bicarbonate then saturates the water reducing the pH and the amount of available carbonate for organisms to produce calcium carbonate for shells and skeletal structures. Less available carbonate for organisms to use to make their shells, could affect the final mass of an organism because it is forced to exert more energy breaking apart bicarbonates into hydrogen and carbonate to produce its shell. This project aims to study the effects of ocean acidification on the base level consumers Artemia salina (brine shrimp).

Methods/Materials

Using a custom made apparatus, nine 500ml salt water tanks were split into three different pH groups: 7.1, 7.6, and 8.1. The pH was maintained in each tank using a series of valves to combine CO(2) gas with compressed air. This mixture was then selectively delivered to each tank via a three-way valve to maintain a constant pH, and naturally recreate ocean acidification in a controlled laboratory environment. Artemia cysts were then introduced into each tank and allowed to grow over a two week period at 25C. At the end of that period, 50 brine shrimp from each tank were collected and dried to obtain a dry mass weight.

Results

A one-way ANOVA was conducted to compare each of the weights from the tank populations. The mean weight of each population was very different with a pH of 7.1 having a mean of 4.567 + 216 mg, 7.6 having a mean of 7.133 + 293 mg, and 8.1 having a mean of 10.033 + 513mg. The means of each pH treatment are statistically significant with a p-value less than .001. A scatterplot of the data shows a strong linear relationship.

Conclusions/Discussion

This data demonstrates that more acidic pH environments may affect growth rates of Artemia salina. This could be do to exertion of more energy to create their shells thus reducing the amount of energy stored and preventing growth.

Summary Statement

This project aims to look at the correlation between more acidic pH marine environments and the affects on the growth and energy use of Artemia salina.

Help Received

Dr. Brian Tsukimura, provided environmental chambers to grow Artemia, provided brine shrimp cysts, scale, forceps, weigh boats, and low weight scale

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Lekha Pillarisetti

Project Number

S1214

Project Title

Variations in Soil Microbial Growth Responses to Climate Change and the Consequences for Carbon Cycle Feedback

Abstract

Objectives/Goals

Of all Green House Gases (GHGs), CO2 causes highest surface warming and shows highest correlation with temperature. Currently majority of CO2 emissions are from fossil fuels. But while CO2 emissions from fossil fuels stayed flat during 2013-2016, studies show CO2 released from soil carbon has been increasing. Soil microbial activity is the best indicator of soil CO2 emissions. The objective of this project is to study the variations in microbial growth response to an increase in surface temperature in different soil types, depths and land uses to identify the top contributing factors to increase in CO2 emissions from soil.

Methods/Materials

3 soil samples each were collected from 6 different land uses, 8 locations in Northern California using a soil core sampler at 2 different depth profiles (3 in. and 12 in.) All 48 samples were tested for pH, N, P, K. From each sample, 2 diluted solutions (1/100 concentration) were created using serial dilution. These 96 solution samples were incubated in Tryptic Soy Agar petri dishes for 72 hrs. under both normal and temperature-controlled surface created using thermostat controlled seed heat mat at 2 deg C higher. The microbial growth in all 96 dishes was measured using CFU count, Microbial surface area and Optical Density

Results

At constant normal temperature, the microbial activity shows minor variations across all soil characteristics, land use types, depths, or soil properties (pH, N, P, K). However, at elevated temperature (2 deg C higher), the microbial activity shows significant variations among the soil types. While most soil types and land uses show moderate changes in microbial growth (range -20% to 100%), forest cover soils show sharp increase in microbial activity (up to 500%) at all depths.

Conclusions/Discussion

A 2 deg C change in temperature causes an average increase of 53% in microbial activity and soil respiration. Based on FAO data, this could mean an additional 0.2 Giga tons of Carbon per year in the atmosphere. Also, FAO estimates current forest deforestation rate is 6 million hectares / year and removal of forest canopy results in a 2-3 deg C increase in surface temperature of forest soil. So deforestation is potentially one of the most important factor in increase of CO2 emissions from soil carbons (500% higher rate than rest of the land) that in turn causes surface warming leading to a cycle of continued increase in CO2 emissions.

Summary Statement

Study of the effects of surface warming on soil microbial communities to understand the differences in responses and identify top factors contributing to an increase in soil CO2 emissions.

Help Received

Thanks to Ms.Amulya, Principal Microbiologist for professional guidance on incubation techniques, Ms.Basu, my biology teacher for overall advice, and my parents for driving me to all locations.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Ashley Welch; Maxwell Zinkievich

Project Number

S1215

Project Title

Using a More Sustainable Data Collection Method to Determine the Effects of the Pacific Decadal Oscillation on Particula

Abstract

Objectives/Goals

Our purpose this year is two-fold: investigating the role of the PDO (Pacific Decadal Oscillation) on atmospheric inversions and developing a lower cost, more sustainable method of collecting atmospheric data. Last year, we determined that the frequency and strength of atmospheric inversions in the San Lorenzo Valley were influenced by El Niño-caused sea surface temperature increases. This year, we are researching whether a longer term oceanic-atmospheric event, the PDO, affects the frequency of inversions and concentration of PM 2.5 (particulate matter less than 2.5 microns in diameter) which has a detrimental effect on human respiratory health. Every 20-30 years, when the PDO shifts from a warm phase (negative) to a cool phase (positive), we hypothesize that there will be a decrease in both the strength of inversions, and the number of days in which air quality standards for particulate matter are exceeded.

Methods/Materials

To support this hypothesis, we are correlating historical temperature data to the number of PM 2.5 exceedances in order to extend our data to include several oscillations of the PDO. Our second mission is to eliminate the need for expensive, consumable helium balloons and radiosondes, as well as modernize the data collection process. We have already re-engineered the data collection package, and are working on obtaining a drone to test as a launch vehicle. We are continuing to use the standard data collection and launch system to obtain our inversion measurements, until we have thoroughly tested and perfected our alternative method.

Conclusions/Discussion

We would like to thank Bob Nunes and Scott Norton from the Monterey Bay Unified Air Pollution Control District for their time and technical assistance.

Summary Statement

Identified a correlation through statistical analysis and extensive data collection between the PDO as well as PM 2.5 Concentrations

Help Received

We received logistical help from Jane Orbuch, a teacher at our highschool, but we also received data collection instruments from the MBUAPCD, all of the data we collected and analyzed is our own.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
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Project Number
S1299

Project Title
Fertilizing with a Conscience

Abstract

Objectives/Goals
Serious environmental consequences, like eutrophication, occur from the runoff from industrial fertilizers. The purpose of this experiment is to observe the advantages and disadvantages of different fertilizer types. These include cover crops, industrial, and natural fertilizers. For this project I examine four important questions: What are the advantages and disadvantages of using natural or chemical fertilizers? Which fertilizer causes the most plant growth? Which fertilizer causes the highest nitrogen content in the runoff? Which fertilizer runoff causes the most growth or death of algae?

Methods/Materials
I used several procedures, but made a mistake in my first procedure. For this procedure, I acquired all of the materials and set up 4 pots with top soil and the respective fertilizers. I allowed for plant growth over the course of two weeks. I did a nitrate test on the runoff for all 4 pots. I set aside some of the runoff in beakers and put 3 algae tablets in the runoff from each of the different fertilizer types and recorded algae growth. Using the first procedure I found that all four tests showed very high levels of nitrates in the runoff. I decided to redo the experiment using soil with less nitrates. It#s very difficult to measure growth of algae on the surface of water. I took a high quality digital photo of each beaker. I then conducted RGB pixel test to estimate percentage of surface is algae using Photoshop.

Results
From my procedures, I found that the cover crop had the least algae growth and nitrate runoff. I also found that the plants using the cover crop grew as well as the plants using Miracle Grow. The cover crop had less runoff than the control because the nitrates in the nodules from the cover crop allow for absorption of nitrates.

Conclusions/Discussion
Cover crops may be a good substitute for industrial fertilizers. Surprisingly, this fertilization method caused increased growth over Miracle Grow. Cover crops have the least nitrates (in ppm) in the runoff, as well as the least amount of algae growth. This is extremely important, because if less algae growth occurs in waterways, then less eutrophication will result. It would be interesting to do a larger scale version of this experiment using more industrial agriculture techniques.

Summary Statement
My experiment tests the effects of different fertilizers on plant growth and algae growth from runoff.

Help Received
My teacher helped me get nitrate tests.