Name(s)	Project Number
Finn Barry; Art Tiongson	**J1101**

Project Title

Acid Waves

Abstract

Objectives/Goals
How will rising carbon dioxide levels in the ocean caused by rising fossil fuel emissions affect calcium carbonate shells of marine animals? Higher carbon dioxide in the ocean make the oceans more acidic and might dissolve shells of animals. Although the animals may live, thinner shells may make them more vulnerable to predators.

Methods/Materials
We collected shells of chitons and limpets (marine mollusks) and soaked them in seawater with different levels of carbon dioxide. We dried and weighed them before being placed in tanks with different pH levels (7.8, 7.5, 7.0, 6.5; lower pH means more carbon dioxide). After 1 week we rinsed them in fresh water, dried them and weighed them. Then we repeated this process the next week. We analyzed the data by comparing the changes in weight over time among tanks with different pH levels.

Results
The shells in the tank with the lowest pH (most acidic) lost the most weight and were quite corroded. Shells soaked in the control tank (normal ocean pH) had lost no weight. In the two tanks with intermediate pH levels, shells also lost weight, but not as much as in the most acidic tank.

Conclusions/Discussion
Our hypothesis that calcium carbonate shells of marine animals will dissolve under ocean waters with lower pH (higher carbon dioxide) was supported by our data. We tested two marine mollusks that make calcium carbonate shells, but many marine animals use calcium carbonate to make shells or skeletons. Our lowest pH level was much lower than expected in the future. However, the intermediate pH levels used are similar to those expected due to future ocean ocean acidification. Therefore, our results suggest that shells of marine animals may be corroded or even destroyed by decreasing ocean pH caused by fossil fuel emissions. Thinner shells or skeletons for many marine animals may reduce their chances of survival.

Summary Statement

Our project tests how increasing carbon dioxide in the ocean affects the shells and skeletons of marine animals

Help Received

Dr. James Barry at MBARI for equipment use and acting as scientific advisor.

Name(s)

Nigella M. Baur

Project Number

J1102

Project Title

Do Bigger Watersheds Have a Higher Coliform Concentration?

Abstract

Objectives/Goals
The objective of this experiment was to explore water quality and answer a scientific question: Do bigger watersheds have more coliform bacteria?

Methods/Materials
Samples were taken from five watersheds in the Humboldt Bay area near Arcata, California. The samples were analyzed for coliforms using the presumptive and confirmative tests at the Humboldt State University Biology Department lab. The area of the sampled watersheds were determined by visiting the City of Arcata's Environmental Services Department and using their Geographic Information System (GIS). The coliform concentration (MPN/100ml) and the area (acres) of the watersheds were compared.

Results
With 10,265 acres, the biggest watershed is Jacoby Creek and it also had the lowest number of coliforms at an average of 64 MPN. The smallest watershed is Campbell Creek (with 234 acres) and it had an average of 130 coliforms, the second lowest number after Jacoby Creek (the biggest watershed). The Beith and Grotzman Creeks watershed is median sized with 1,226 acres and it had an average coliform count of 295 MPN. Jolly Giant watershed has 798 acres and the average coliform count was 45 MPN. The Janes Creek watershed is the second largest watershed with 2,668 acres and it had by far the most coliforms, with over 1600 MPN.

Conclusions/Discussion
The results of this experiment show that there doesn#t appear to be any correlation or relationship between the size of the watershed and the number of coliform.

Summary Statement

My project was to determine if the size of a watershed affects the coliform concentration in the creeks of northern Humboldt Bay area.

Help Received

Father helped collect samples and glue backboard; Technician Andrea Yip at HSU helped process water samples; Mother helped type abstract and fill out aplication

Name(s)	Project Number
Daniel S. Bruce	**J1103**

Project Title

Urban Noise: Effects on Lagoon Bird Density and Species Diversity

Abstract

Objectives/Goals

While observing wildlife in San Diego County, it became apparent that some natural habitats are surrounded by noise from busy highways, railroads and flying aircraft. I wondered how urban noise might impact birds in the wild. The goal of this project was to document the levels of urban noise surrounding the Penasquitos Lagoon Natural Preserve and investigate how noise may be affecting birds in this area. My hypothesis was that areas with higher levels of urban noise would have fewer numbers of birds.

Methods/Materials

Five sites of observation at the Penasquitos Lagoon were chosen along the trail that runs parallel to Interstate 5 Highway. Observations of birds in each area, along with serial measurements of sound levels related to the highway traffic, passing trains and aircraft, were documented during more than 32 field-hours distributed over 8 days during the Winter of 2012-2013.

Results

The range of noise at the observation sites was 54 to 80 dB of continuous noise from the highway traffic, and 66 to 83 dB of intermittent noise from trains and aircraft. Two sites had average continuous noise levels above 65dB, another averaged 61dB, and two averaged less than 60dB. The two sites with the highest baseline noise were almost devoid of birds, and sites with noise levels at or below 61dB had a greater density of birds and more bird species. An average difference of 6 dB correlates to a difference of twice the volume, so an average difference of 4 dB or more is significant.

Conclusions/Discussion

According to my findings, urban noise above 61 dB was associated with fewer numbers of birds and lower species diversity in the Lagoon Preserve. To protect this habitat, which includes endangered and threatened bird species, further evaluation of the noise effects on birds, including during nesting and breeding seasons, should be performed, and perhaps urban noise control measures should be considered.

Summary Statement

Determining the effects of various urban noise sources on bird density and species diversity in one of the few Lagoon habitats remaining in California.

Help Received

My parents helped accompanying me during my field explorations. My science teacher provided guidance in the field and lent me needed equipment. Audubon Society volunteers and Mr. Philip Unitt from the Natural History Museum guided me in how to identify birds while preparing for this project.

Name(s)	Project Number
Jay Chiruvolu; Max Dillon	**J1104**

Project Title

Are We Killing Our Creeks? How Land Use Affects Water Quality in the Permanente Creek Watershed

Abstract

Objectives/Goals
We wanted to understand the impact of human land use on the health of a local watershed. This was motivated in part by news that a cement plant was polluting our local creek, Permanente Creek. Because the creek travels from a large county park through residential and commercial areas before it gets to the Bay, we believed that we would observe increasing levels of pollution as you moved further downstream.

Methods/Materials
Our project methodology included (1) identifying 5 sites, 4 of which were used by the Santa Clara Valley Urban Runoff Prevention Program (SCVURPPP) to monitor water quality; and (2) testing three indicators of watershed health: water chemistry, macroinvertebrate life, and metals in the soil and water. One site, at the headwaters of the Creek (a pristine location in the forest) was our control site. We tested water quality at each site on 5 days, at the same time of day. We measured pH, fecal coliform, dissolved oxygen, nitrates, phosphate, turbidity, along with water and air temperature, and water height levels. We used dead leaf debris bags at 3 sites to collect and analyze bottom-dwelling bugs. Finally, we collected soil sediment/water samples from 2 sites and had a laboratory measure a range of metals typically in watershed studies, including mercury and selenium.

Results
Water chemistry data showed that pollution increases with increasing human land use. As we moved downstream from Site 5 (our Control) to Site 1, turbidity, pH, nitrates, and phosphates increased and dissolved oxygen decreased. The macroinvertebrate study was inconclusive due to difficulty identifying bugs. Metals testing showed lead, nickel and zinc levels were higher in site 2 (residential and commercial area) and mercury and selenium were not detectable in the soil sediment.

Conclusions/Discussion
Based on literature research, we expected to find increased levels of pollutants as we moved downstream, more pollution-tolerant bugs, and high levels of mercury and selenium in the soil/water from the cement plant. Our hypothesis is partially correct. Higher turbidity, phosphates and nitrates in sites further down from our control site indicate human use of land from pesticides, fertilizers, detergents and animal waste are polluting the watershed. More study is needed on macroinvertebrates and metals. We would suggest repeating the experiment on a seasonal basis and with more sensitive test equipment.

Summary Statement

Our project shows the impacts of land use on the health of Permanente Creek watershed in Santa Clara County, as measured by water chemistry, macroinvertebrate life, and the presence of metals.

Help Received

Our parents helped: Identify Acterra to train with, GreenTown Los Altos Creek meetings to attend, narrow list of sites to test (due to site access) from SCVURPPP study, purchase test kit and materials, drive to sites, identify laboratory and deliver lab jars, and advise on data analysis.

Name(s)	Project Number
Jack Donohoe	**J1105**

Project Title

By Land or by Sea: Where Does Beach Trash Come From?

Abstract

Objectives/Goals
The objective of my study was to determine if population size affects the amount and type of trash found on Santa Cruz County beaches. I predict there will be a greater amount of land trash on the beaches in populated areas than in remote areas, but an equal amount of styrofoam or sea trash on all beaches.

Methods/Materials
I surveyed two high population beaches in town and two low population beaches at remote spots on the north coast of Santa Cruz County. At each beach, 2-3 people walked along the high tide line for 0.7 miles and returned along the low tide line. I collected all trash (except very large items) and counted the people on the beach. I then sorted, counted, and weighed the trash according to the Save Our Shores Cleanup Data card (Save Our Shores, 2012). Each beach was surveyed three times over six weeks.

Results
High population beaches had more trash by weight than the low population beaches (46 lbs vs. 7 lbs.), but low population beaches had more pieces of trash (1498 vs. 964). High population beaches had more pieces of land trash (e.g. plastic, paper, metal, glass) than low population beaches (624 vs. 126), but low population beaches had more pieces of styrofoam or sea trash (1372 vs. 350). The weight of trash varied among the three dates for high population beaches, with the most trash collected after a large storm that produced high flows in local rivers.

Conclusions/Discussion
My research showed that, as predicted, there was more land trash on the populated beaches in Monterey Bay. The patterns and types of trash suggest some beach visitors do not dispose of their trash properly but also that some land trash washes down nearby rivers. I predicted the amount of sea trash would the same at all beaches, but more was found on low population beaches. This may be because the less populated beaches were on the open coast, while the more populated ones were in a protected bay, making less sea trash wash up. Also I think styrofoam bits were easier to find on the cleaner, less populated beaches. Beach trash can be reduced if people dispose of their trash properly. Bans on styrofoam may also help reduce sea trash.

Summary Statement

I compared the amount and type of trash found on popular and remote beaches in Santa Cruz County to identify how much trash came from beachgoers, the sea, and nearby rivers.

Help Received

Mom drove me to beaches and helped collect trash; dad taught me to use GPS, Excel and Google Earth to make graphs and maps.

Name(s)	Project Number
MacGregor Douglass	**J1106**

Project Title

Got Water?

Abstract

Objectives/Goals
The goal of this project was to measure the impact of a man made water source on the local wildlife. Further, the potential benefits of multiple water sources, spread throughout the conservation area, were assessed.

Methods/Materials
1. Dig trench with the gas powered trenching machine and by hand, to specifications.
2. Connect pvc pipe to drinker with over flow device.
3. Lightly compact soil with rake and shovel.
4. Set up two (2) game cameras to collect data. Photos triggered by motion.
5. Observe how many animals come to the drinker. (Daily, weekly)
6. Record results and analyze the data.

Results
When it became apparent that the hypothesis would be proven in a matter of a few days, the scientist expanded the research to include different species and weekly averages. Even within the first week of data collection it became apparent that multiple species would benefit from this new water source. These results suggest that the longer a drinking station is available, the more animals will use it. The game camera picked up mostly larger animals such as, turkey wild hogs and deer.

Conclusions/Discussion
Without these two new water sources, at least three hundred and sixty animals would have had to find water at another location over this four week period. With further research, it is reasonable to believe that the weekly average of ninety animals benefiting from this available water source will continue to grow. With minimal human impact, these drink stations have provided freedom of movement for all forms of wildlife. It seems very reasonable to project that similar projects in any wildlife area, that needs diverse water sources, could benefit our environment just as the committed volunteers of Canada de los Osos has done.

Summary Statement

Review and discussion of a man made water source's impact on the local wildlife, and entire eco system.

Help Received

Interviews with Henry Coletto of Canada de los Osos. Editing and project help from parents and science teacher,

Name(s)	Project Number
Nathan R. Fennacy	**J1108**

Project Title

Plastic: Productive or Destructive

Abstract

Objectives/Goals

​In the ocean there are slow rotating whirlpools called gyres that#with the help of wind, currents, and the earth#s gravitational pull#have become a trap for billions of pieces and particles of plastic. In the North Pacific Gyre alone, there is about two-times the size-of-the-United-States-worth of plastic. Very little research has been conducted on whether the plastic affects water in terms of pH and bacteria growth. Both of these key factors of water quality are extremely important to the aquatic ecosystem. My project examines whether plastic affects pH and bacteria growth in water, and if so, it considers which of the common Plastic Route Numbers will impact water quality the most.

Methods/Materials

My hypothesis was that plastic would have an adverse effect on water and that Plastic Route Number 6, being the most regenerated type having been broken down several times, would leach the most chemicals and have the most negative impact. I collected 30 grams of each common plastic#Route Numbers 1, 2, 3, 5, and 6#and placed 5 grams of each into individual bottles of water (six bottles for each route number for a total of 30 bottles containing plastics). Additionally I also had six bottles of just water to be used as my control tests. A set of the bottles representing each route number and a control bottle were then placed into different environments: lighted and non-lighted sections of a refrigerator, an incubator, and a room-temperature shelf. (In other words, there were six bottles each in six different environments, with 36 bottles tested in all.) Readings for pH and bacteria were taken at various time intervals over 30 days, 720 hours.

Results

Plastic would have an adverse effect on water and that Plastic Route Number 6, being the most regenerated type having been broken down several times, would leach).

The results supported my hypothesis in that plastic in water over a long period of time does have a negative effect on key life-supporting water quality factors. And while Plastic Route Number 6 did cause the most reduction in bacteria within water, Plastic Route Number 5 resulted in water having higher acidity.

Conclusions/Discussion

The results are important not only as they raise concern for water ecosystems polluted by plastics, but also, this raises the question about the quality of water and other liquid products consumed by humans that are contained or stored with plastic.

Summary Statement

My project is testing whether or not plastic affects pH and bacteria.

Help Received

Name(s)	Project Number
Emma R. Freedman	**J1109**

Project Title

How Endangered? Modeling the Effects of Logging and Poaching on Orangutan Viability

Abstract

Objectives/Goals

The Bornean orangutan, classified on the IUCN Red list as endangered since 1986, is threatened by illegal poaching and habitat loss due to logging. Borneo, one of the only two remaining places where the orangutans live in the wild, was almost completely covered by rainforest in 1950, and is now only 50% covered. The remaining pockets of rainforest are diminishing, leaving groups of orangutans isolated. Though some areas are protected, illegal poaching, logging, and forest degradation occur. These human actions pose as threats to the orangutans. On the current path, the remaining orangutan populations are threatened with extinction. We need to know how logging and poaching affect the populations so we can take more effective action on saving this species.

Methods/Materials

In this study, using a student version of MATLAB, I have modeled orangutan populations using a density dependent logistic simulation to test the effects of various levels of logging and poaching on the sustainability of orangutan populations in 120 scenarios. Models were also run projecting the sustainability of #real# populations when affected by 1% logging and 1% poaching.

Results

In scenarios affected by neither logging nor poaching, all populations besides those with a relatively low initial population size restricted to low quality habitat are sustainable. Reduced levels of poaching can be tolerated by most of the populations, but currently, estimated poaching rates are unsustainable. No populations affected by any of the tested logging rates are sustainable if these rates are allowed to continue indefinitely. All #real# population scenarios affected by the lowest mentioned logging and poaching rates are unsustainable. The data suggests that one, large, high quality reserve is better for orangutan survival than many small, or low quality habitats.

Conclusions/Discussion

This work shows that both poaching and logging adversely affect the sustainability of orangutan populations, but logging is more devastating. Overall, both logging and poaching must both be reduced to save this species, and reforestation interventions must be made in areas with low quality habitat. Because of the orangutans# life history and population biology, there is a strong time lag between disaster for the orangutans, and a noticeable decrease in the population. Therefore, precautionary efforts must be made to protect this species from extinction.

Summary Statement

I am interested in saving the orangutans so I modeled the effects of logging and poaching on orangutan viability to find out which action poses the greatest threat.

Help Received

Dr. David Bernick was my mentor; Lauren Lui, UCSC graduate student, tutored me in MATLAB; Patty Freedman helped me with background research; John Rosasco, M.A. gave me an introduction to calculus; Dr. Tim Tinker gave me an introduction to evolutionary biology.

Name(s)	Project Number
Anita Garg	**J1110**

Project Title

The Effect of the Native Plant Community Seeded in Restoration on the Growth of Salvia apiana

Abstract

Objectives/Goals
My project investigated how the seeding style of a plant community affects the stomatal conductance and height of the Salvia apiana at the Loma Ridge restoration site.
The purpose of the project was to compare two different kinds of restoration method groups : the mixed group, in which both shrubs and perennial plants are grown together, and the shrubs-only group, a group in which only shrubs are grown. Salvia apiana is a native California plant. It is a sage shrub type plant that has large leaves suitable for porometer measurement. In my project, stomatal conductance and height of the Salvia apiana in mixed group and the shrubs-only group were tested.

Methods/Materials
The stomatal conductance of the Salvia apiana was measured with a Decagon leaf porometer at the Loma Ridge Restoration site for 48 plants over 3 weeks. Each plant was measured with 3 stomatal conductance measurements. The height of the 48 plants was also measured using a standard meter stick. Both the mixed and the shrubs-only plots were measured.

Results
The average height for the Salvia apiana in the mixed plot was 20.86 cm, while the average height in the shrubs-only plot was 27.53 cm. Whereas the average stomatal conductance for the Salvia apiana in the mixed plot was 312.32 mmol/m^2s, and the average stomatal conductance in the shrubs-only plot was 245.5 mmol/m^2s.

Conclusions/Discussion
The data and results that followed the measurements partially supported the hypothesis. Although the hypothesis stated that both the stomatal conductance and the height of the plants in the shrubs-only plot would be higher than that of the mixed plot, only the height of the shrubs-only plot was higher than the measurements taken in the mixed plot. The stomatal conductance of the mixed plot was higher than the shrubs-only plot. One possible reason for these results was that the height measurements are reflecting the plant activity back in the spring of 2011, while the results for the stomatal conductance measurements are reflecting the plant activity that occurred during the measurements were taken in the fall of 2012.

Summary Statement

My project investigated how the seeding style of a plant community affects the stomatal conductance and height of the Salvia apiana at the Loma Ridge restoration site.

Help Received

Thanks for the support of my parents for driving me to the site to take measurements.

CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)	**Project Number**
Gina R. Gwiazda	**J1111**

Project Title

Forest Recovery after Logging

Abstract

Objectives/Goals

My objective was to measure the distribution of tree sizes in a secondary-growth Redwood forest to see if topography affects the distribution. I also used the distribution of sizes to determine tree growth patterns and the stage of forest development.

Methods/Materials

Using a satellite photo of the Redwood forest in the undeveloped part of the UC-Santa Cruz campus, I picked two areas (60 m X 30 m each) with different topographies, one steep and one flat. I measured the circumference of each Redwood tree at 1 meter from the base of the tree. I measured 81 trees in the steep area and 137 trees in the flat area. I binned the data into groups to look for patterns.

Results

The average circumference of the trees is almost the same in the two areas. In both areas, the distribution is spread out with three most abundant circumferences at 25-50 cm, 150-175 cm, 300-375 cm in the flat area, and at 50-75 cm, 150-200 cm, 350-275 cm in steep area. Taking all trees together, the three main size peaks are 25-50 cm, 150-175 cm, 300-325 cm.

Conclusions/Discussion

This area was logged about 100 years ago, and there are now three clusters of tree sizes that represent three cycles of sprouting. The topography did not affect the rate of trees sprouting because the two areas I measured are close to each other and probably received the same amount of fog and rainfall. The 300-325 cm cluster may include either small trees not cut down during logging, or the first to grow after the forest was cut. Because of their size and number, the 150-175 cm trees are probably most of the mass of the forest. I would not expect the trees in the 25-50 cm cluster to all survive because they have to compete with the adult trees for light and nutrients. This forest is at the second stage of development called step exclusion. The forest has not reached the old growth stage because the distribution is not dominated by the largest tree sizes.

Summary Statement

About 100 years after logging, the distribution of tree sizes in a Santa Cruz Redwood forest shows that it is recovering, but is not yet mature.

Help Received

Mother helped me measure trees. Father helped me make graphs.

Name(s)	Project Number
Suyeon Ju	**J1112**

Project Title

Korea and San Diego: What Is the Difference in Water Quality?

Abstract

Objectives/Goals
The objective of this experiment is to compare the water quality of three cities located in Korea and U.S.A., specifically Gangneung, Seoul, and San Diego.

Methods/Materials
In this experiment, several important and well-known water sources from each city were selected and located for water testing. To make sure results were accurate and free of human error, three samples were taken from each source. Each water source was tested for the nine parameters temperature, pH, dissolved oxygen, biochemical oxygen demand, nitrates, turbidity, total dissolved solids, hardness, and fecal coliform. After every test was completed, the results were calculated and averaged using the National Sanitation Foundation (NSF)'s graphs and curves. Using the NSF's calculator, each city was given an overall water quality index value that determined how bad or excellent the water in that city was, and these values were used for comparison.

Results
The results of each test were averaged using the NSF's water quality index calculator to find the overall water quality of each source, and later, the water quality of each city. Every water source had three trials for each test, and there were 14 sources in all. The results were averaged into water quality index values. Each city was given a grade or value that was averaged from the results of each test. Those values range from 0-100, 0 being bad water and 100 being excellent. Gangneung had an overall water quality index of 80, Seoul had a value of 76, and San Diego, 81.

Conclusions/Discussion
The overall water quality indexes of the three cities were very comparable and close to the hypothesis. Surprisingly, the water quality from Seoul had a larger difference with Gangnueng compared to San Diego, even though they are located in the same country. The difference in regions and environmental surroundings may have caused these results. This information will help the water authorities in the source area to improve the quality of the water and the surrounding environments.

Summary Statement

In this experiment, several water sources located in three cities in Korea and U.S.A. were tested for the nine water quality parameters, and the results obtained were averaged and compared.

Help Received

Mrs. Elaine Gillum provided the water testing kit; Professional Geologist Brian Oram mentored me and guided me through my experiments; parents and relatives drove me to different water sources and proofread my writing; sister assisted in the clean-up process of testing.

Name(s)

Owen C. Keith

Project Number

J1113

Project Title

The Effect of Biodiversity on Ecosystem Health

Abstract

Objectives/Goals
The experiment's intent was to find the effect of biodiversity (more specifically species diversity as measured by the Simpsons Diversity Index) on the overall health of an ecosystem. It was expected that since a larger biodiversity generates greater vigor, resilience and ecosystem output the greater the species diversity the higher the health of the ecosystem would be.

Methods/Materials
Four ecosystems of the same geographical type each were plotted with two 15ft2 (4.5m2) areas using construction stakes, flags and nylon string. Over a period of three weeks each plots' species richness and evenness was documented. Then, the diversity of each plot was calculated using the Simpsons Diversity Index [(Sum ni (ni-1))/(N (N-1))] and the number of stressed organisms (an indicator of ecosystem health) was measured at each location.

Results
The ecosystems with a higher diversity were home to the fewest stressed organisms (high health) whereas ecosystems with low diversity had a greater number of stressed organisms (low health). For example an ecosystem with a species diversity of 0.64 contained sixteen stressed organisms whereas an ecosystem with a diversity of 0.82 had a relatively perfect health (no visible stressed organisms). The equation delineated from the results was, Health = -170(Diversity) + 137.

Conclusions/Discussion
The greater the biodiversity of an ecosystem the healthier it was, the health being close to perfect from a diversity of 0.75 to 0.99 (0.99 being the greatest possible diversity).

Summary Statement

Biodiversity loss has become a global issue, this project seeks to determine the affect of this loss on ecosystem health and works as a step towards solving the crisis.

Help Received

Mom/Dad provided moral and financial support along with transportation; Science teacher Mrs. Moore guided work.

Name(s)	Project Number
Dylan T. Lerner	**J1114**

Project Title

Investigating Whether Atmospheric Conditions Affect Emission/Dispersion Rates and Levels of Ash Particulates

Abstract

Objectives/Goals
Determining the validity of two hypotheses using the best type of wood to burn and the worst type of wood to burn as concluded in the 1st year study: 1. If the atmospheric conditions change naturally (temperature/humidity), then the dispersion rate/level of ash particulate will decrease. 2. If humidity levels are increased in a controlled environment in temperatures exceeding 100 degrees Fahrenheit, the the dispersion rate/level of the store bought wood ash particulate will decrease because of the inversion layer that is created.

Methods/Materials
A controlled study was performed, and a study using enviromental conditions over three different temperatures and humdity levels was performed using ash from two types of wood. The controlled expermiment was done in temperatures exceeding 100 degrees using a humidifier near the top of the plexiglass cylinder. The other study was done in temperatures exceeding 100 degrees, in the 70s and in the 30s (10 trials each using the 2 types of wood determined in the first year experiment to be the best for the environment (Douglas Fir) and the worst to burn (store bought). How far each type of wood ash traveled and how long it stayed airborne in the clear plexiglass tube was measured in centimeters and seconds. The results were then averaged after each of the ten trials.

Results
The hypothesis using natural conditions was partially correct. Both types of wood had a decreased emission/dispersion rate with respect to how far the ash particulates traveled in cool temperatures with increased humidity. The inversion layer created in cold weather kept pollution from rising. The controlled experiment hypothesis was correct. Because of artificial humidity, the amount of time the ash particulate remained airborne decreased by about 40% when compared to the airborne time during the actual weather related trials. The time the store bought ash was airborne in the controlled experiment was close to the time that the Douglas Fir had remained airborne in the weather related trials because of the direct inversion layer created from the humidifier.

Conclusions/Discussion
It is clear that temperature/humidity play a significant role with respect to wood ash pollution as the numbers from the 1st year study and the 2nd year study vary greatly. Even with cooling temperatures, it is clear that there is still a pollution problem that needs to be reduced year round with efficient wood burning.

Summary Statement

This project determines whether atmospheric conditions play a role in the efficiency of wood burning and related pollution levels.

Help Received

My mom helped type the report.

Name(s)	Project Number
Lee J. McEligot	**J1115**

Project Title

Bisphenol A: The Big Plastic Adversity

Abstract

Objectives/Goals
My objective was to study how different environmental exposures affect Bisphenol A (BPA) levels in household items.

Methods/Materials
My materials included hard and soft plastic bottles, cans, a car, a freezer, a pot, and a Hach certified test kit. The test kit included three different types of reagents, a color wheel and comparator, a buffer solution and two test tubes. My methods were to add water in cans and bottles, and place them in three different environments for a week, then measure BPA with my test kit. The environments were heat (boiling water), freezing temperatures (freezer), and inside a car. Five trials were conducted in each environment. I used the Hach certified test kit to measure BPA (mg/L) in the cans and water bottles.

Results
My results were, when the cans were exposed to heat (boiling water), it leached the most BPA (mean = 0.635 mg/L), while plastic bottles had little to none (0.000-0.012 mg/L). The plastic bottles and cans exposed to the other environments (freezing and car) were between 0.000 and 0.017 mg/L.

Conclusions/Discussion
In conclusion, the results supported my objectives of measuring BPA levels in household items. Overall exposing cans to heat leached the highest levels of BPA. Placing number one plastic water bottles and BPA free water bottles in the refrigerator, freezer, and car is relatively safe, but cans still leach an unsafe amount of BPA.

Summary Statement

My project was about studying how different environments (heat, freezing temperatures, and inside a car) affect BPA levels in plastic bottles and cans.

Help Received

My mom, Archana McEligot helped me find and approve my test kit. Harold Rogers, a CSUF biochemist explained to me that Bisphenol A has two phenol molecules and showed me the mathematical equation to convert a phenol level to a Bisphenol A.

Name(s)

Leo J. McGrath

Project Number

J1116

Project Title

Are You Sure That Air Is Safe to Breath? Acidity and Particles in the Air of Newark, CA

Abstract

Objectives/Goals

This project is about the air quality around my local area. The purpose of this project is to answer the questions:

1. Does the pH and/or particle level vary from sample to sample?
2. If they do vary, does it have to do with the time of the day?
3. If they do vary, does it have to do with the day of the week?

Methods/Materials

Twice daily, I used pH strips and a beaker to measure the acidity of the air condensation. Then I used a 5 by 10 rectangle of grid paper taped to an index card. I put Vaseline on the paper and put it outside to collect air particles for 12 hours. I then counted the amount of particles under a microscope.

Results

I found that there is a pattern for both the acidity and particles in the air during the week and during the day and night. The acidity goes up in the mornings and work week days and down in the evenings, weekend days and holidays. Acidity goes up in the work week days and down in the weekends. For particles, I found a pattern of both up in the work week and down in the weekend and up in the mornings and down in the evenings. In summary:

1. pH and particle levels do vary from sample to sample.
2. In the mornings and evenings there was no change in pH level, but when I look at particles I get a different answer. During the day the particle level is higher in the morning than in the evening.
3. During the week both the pH and particles are higher than they are during the weekends.

Conclusions/Discussion

Looking at the air quality of my local area in this project I came to the conclusion that there is a pattern in the acidity of the condensation and air particle count throughout the week. The air particle count and acidity went up during the work week days and down during the weekend days. The second pattern was that the particle count went up during the day time and down during the evening. These patterns suggest that there is a link between traffic and air quality. In my experience, the traffic in my local area goes up during the work week days and down during the weekend. The traffic in my local area goes up during the mornings and down during the evenings.

To look more into the link between the traffic and the patterns I observed, I would need to consider the weather, location, air quality and time of year. I would collect data in places closer and farther from roads. I would collect data from car exhaust and try to link it to my observational data.

Summary Statement

The goal of this project was to see if there were any patterns in the changes of air quality in my local area throughout the week or within the day.

Help Received

I would like to thank my dad who helped me throughout my project. I would also like to thank my science teacher, Mr.Drumm, for reviewing my project proposal.

Name(s)	Project Number
Ashwini Narayan	**J1117**

Project Title

Reducing Our Plastic Footprint: The Promise of "Bio-Plastic"

Abstract

Objectives/Goals
The objective was to see whether natural plastic degraded faster than synthetic plastic.

Methods/Materials
The project was conducted in two phases: Phase 1 involved manufacturing natural plastic frommilk and vinegar (casein plastic). Milk was heated and treated with vinegar - the solids were filtered and kneaded, and then dried to form a sheet of natural plastic. Phase 2 involved comparing rates of biodegradation of the natural plastiuc and synthetic plastic (obtained from an empty plastic milk jug): 10 cups were filled with potting soil and watered. A strip each of the natural plastic and the synthetic plastic were inserted into the soil. Every day, one cup was emptied, and the lengths of the two strips of plastic were compared with the help of an inch-ruler

Results
The natiral plastic gradually decayed over time - in the first few days, the natural plastic showed increasing moistening, and had clumping of the soil on the surface. From day 5-6 onwards, the natural plastic showed signs of softening and liquefaction, and later, gradual breakdown; by day 9-10, the part of the natural plastic underneath the soil surface was seen to be completely disntegrated. In comparison, the synthetic plastic did not show any signs of change at all.

Conclusions/Discussion
Ntural plastic degrades faster than synthetic plastic. This may have enormous impliations for the future, e.g., preventing landfills from being clogged by synthetic plastic, if natural plastic were used instead in the manufacture of consumavbles, etc. However, additonal research is required to determine other factors that might be used to regulate the rate of bio-degradation of natural plastic, such as additives, humidity, heat and/or soil composition.

Summary Statement

Bio-plastic degrades faster than synthetic plastic, and if used in the manufacture of consumavbles, could help reduce the clogging of landfills.

Help Received

Father helped with generating the experimental design, and mother helped with preparing the display board.

Name(s)	Project Number
Venkat N. Sankar	**J1118**

Project Title

Ecology or Economy: How to Have It Both Ways! Managing the Impact of Infrastructure Projects on Endangered Species

Abstract

Objectives/Goals
As the global population grows, it has become common for infrastructure projects (e.g. dams, solar farms) to adversely impact the habitat quality and overall viability of wildlife in general, and endangered species in particular. The goal of my project is to identify and validate a computer simulation based approach to assess and manage the impact of an infrastructure project on the population viability of an endangered species. I have used the Panoche Valley Solar Farm project in California and its impact on the giant kangaroo rat (Dipodomys ingens, GKR) population as the case study example. Hypotheses: 1. The solar farm as proposed will adversely impact GKR population viability, and drive it to extinction within the next 100 years; 2. It is possible to identify a modified scope and footprint for the solar farm that does not significantly threaten GKR population viability.

Methods/Materials
The control group is the GKR population in Panoche Valley, current population and projected growth, if the solar farm is not built. The experimental scenarios are: (a) the solar farm project as currently proposed, (b) a few variants of the solar farm in the same location, but with modifications to the footprint. Based on detailed research, I selected the Vortex Population Viability Analysis Software as the computer simulation system for this project. A customized stochastic model was built using Vortex to capture the specifics of the Panoche habitat and the GKR population. This model was run iteratively to estimate the projected GKR population over 100 years under each scenario using numerous simulation runs.

Results
Simulation results show that the Panoche Solar Farm as proposed will likely have a significant adverse impact on the GKR population, with an estimated >40% likelihood of GKR extinction over 100 years. I was also able to identify an alternative footprint for the solar farm with the potential to significantly mitigate the impact and reduce the likelihood of GKR extinction to <15%.

Conclusions/Discussion
My research project validates computer based simulation as an effective approach to the assessment and management of the impact of infrastructure projects on the viability of endangered wildlife species. In the real world Panoche Solar Farm case study, I was able to identify an alternative proposal that represents a good balance across ecological conservation and economic development.

Summary Statement

A study that validates the use of computer based simulation as an effective approach to managing the impact of infrastructure projects on the habitat quality and population viability of endangered wildlife using a real world case study.

Help Received

Name(s)

Ethan Uetrecht

Project Number

J1119

Project Title

The Effects of Greywater on the Development of the Pieris rapae Butterfly

Abstract

Objectives/Goals

The practice of using greywater in home gardens is becoming more popular as a way to conserve water. While researchers have found that greywater has little effect on plants, it is unknown whether greywater has an effect on the consumers of the plants. The purpose of this project was to test whether eating plants watered with greywater would affect the development of the Pieris rapae caterpillar from larva to butterfly. This experiment is important because an increase in greywater use may affect plant consumers and other animals in the food web.

Methods/Materials

In this project, 24 caterpillars were divided into two groups of twelve. One group was fed Brassica oleracea leaves from plants watered with greywater. The control group was fed leaves from plants watered with regular water. Larvae growth, pupa length, and pupation time were recorded. Photographs were taken of the butterflies and were analyzed to measure hindwing area and forewing length.

Results

Data for this experiment was collected over 45 days. All 24 larvae emerged as butterflies with no mortalities or deformities. There was no significant difference in caterpillar, pupa, or forewing length. However, the greywater specimens spent longer on average in the pupa stage and had a larger average hindwing area than the control specimens.

Conclusions/Discussion

These results indicate that greywater may affect Pieris rapae development. More studies should be conducted to determine whether greywater has a harmful or beneficial effect on plant consumers.

Summary Statement

The purpose of this project was to test whether eating plants watered with greywater would affect the development of the Pieris rapae caterpillar from larva to butterfly.

Help Received

My mom taught me how to use Excel and ImageJ; My sister provided guidance on how to organize the research report; Jessica Pratt of UC Irvine provided suggestions on how to design the experiment.

Name(s)	Project Number
Louis C. Wooliever	**J1120**

Project Title
Pampas Grass Grows Wild!

Abstract

Objectives/Goals
My objective was to determine the main growing conditions of Pampas Grass.

Methods/Materials
I conducted three different field study experiments. In my first experiment I walked out to a hilly area behind El Granada,a small town on the coast of San Mateo County, and observed the Pampas Grass growing locations and soil and terrain conditions. I used a camera and a journal to record my observations. For my second experiment I determined if Pampas Grass grows near human disturbances by counting how many individual Pampas Grass bushes were growing five, ten, and fifteen meters from a human made pathway. I used a measuring tape and a journal. For my third experiment I observed a hillside where there was landslide evidence. I observed the same area on Google Earth historical images and found the exact year and month that the landslide occurred. I could see how long it took for Pampas Grass to begin to grow on the exposed earth.

Results
I conducted three experiments because of the difficulty in controlling all variables. The data supported my hypothesis that Pampas Grass grows mainly on disturbed earth.

Conclusions/Discussion
In the three experiments I conducted, I concluded that Pampas Grass grew on disturbed or exposed earth. In my field studies, historical image review and interviews with long-time residents of the coast, I learned that Pampas Grass growth has increased in the past 30 years and that the growth is isolated to areas of erosion, grazing and human disturbances. By controlling erosion and human impact, Pampas Grass invasion can be prevented.

Summary Statement
This project studies the growing conditions of Pampas Grass through field study and observation.

Help Received
My parents drove me to the field study locations. They assisted with measuring the 5 meter plots in Experiment 2 and my mother proofread my display board.

Name(s)	Project Number
Kate C. Murray	**J1197**

Project Title

Which Earthworm Best Affects the Soil?

Abstract

Objectives/Goals
Objectives: My objective was to find out which earthworm best affected the soil (produced the best pH, N, P, and K levels).

Methods/Materials
Methods/Materials: I counted and weighed the worms and tested the pH, N, P, and K levels of the soil at the beginning and end of two months to see which worms produced better soil in that time. I also showed when I fed and gave the worms water and which species grew more in both numbers and weight.

Results
Results: I found that the Red Worms produced slightly better soil than European Nightcrawlers, though they were very comparable.

Conclusions/Discussion
Conclusions/Discussion: My conclusion is that Red Worms produced better soil because they reproduce faster, so there are more of them to help improve the soil. They also are smaller which means they eat softer foods that they can get their small mouths on like coffee grounds and the soft insides of banana peels that have a lot of nutrients for the soil. The European Nightcrawlers are bigger, so they have bigger mouths and can eat the tough egg shells that have less nutrients for the soil.

Summary Statement

I wanted to find which earthworm (Red Worm or European Nightcrawler) could create better soil.

Help Received

My science teacher, Ms. Ligeti, had a workshop at the Middle School where students from her class could come and work on their project.

Name(s)	Project Number
Edwin L.L. Uglum	**J1198**

Project Title

Clean Air... Where?

Abstract

Objectives/Goals
Ground level ozone causes many health problems, so when I found this out I started thinking: what about my town? My objective was to find out how ground level ozone levels compare at various locations in my community? I believed the area around the Costco gas station in my town would have the worst ground level ozone and the area around the Thunderbird campus for my school would have the least. In my research I learned about a chemist named Christian Shoenbein who discovered ground level ozone and a type of paper used to measure ground level ozone.

Methods/Materials
I made Shoenbein paper, by mixing distilled water, cornstarch, and potassium iodide to make a paste that was applied on filter paper. I hung one piece of treated and untreated filter paper for two hours at each of my ten locations for four separate days. I recored the drop off, pick up times, the weather conditions, and humidity for each day. Nine locations were outdoors and one was in my room being the control as well as the untreated filter paper so as to demonstrate that the filter paper does not react to ozone alone.

Results
Using the Shoenbein color scale I gave each sample a number (the higher the number the more ground level ozone present) then I averaged the numbers for each location and compared the averages to make my conclusion.

Conclusions/Discussion
My conclusion was that my hypothesis was half correct. The Costco gas station did by far had the most ground level ozone but the Thunderbird campus didn#t have the least ground level ozone. A way for this to be changed is for greener cars that produce less pollutants, and to make the workers at the Costco gas station or other workers at similar situations more aware of the dangers they may be facing. If I were to do this experiment again I wold try doing it during the warmer months, at different times of the day, or even try to put each sample higher in the air.

Summary Statement
My project is about how the ground level ozone levels compare around my town.

Help Received
Mother and father drove me to each location, mother helped with placement of items on display board.

Name(s)	Project Number
Sarah Wilcox	**J1199**

Project Title

Ozone Ogone

Abstract

Objectives/Goals
The ozone will be 100% in 2060

Methods/Materials
Computer, large balloon, laser, wireless sensor, Helium, Weather patterns, old data charts, lunar chart, scientific assessment of Ozone Depletion: 2010
Methods:
Contact with a doctor that studies Ozone.
Observe testing of Ozone.
Prepare balloon what is going to be let go.
Get computers in lab ready.
Bring balloon outside.
Release the balloon into the sky.
Balloon will pop at 80,000 meters.
Laser test: Turn on computer to record ozone laser information.
Wear safety goggles
Turn on laser and shoot beams.
Once intake is completed observe two slopes of the laser.

Results
Ozone dropped drastically from 1988 to 1994, and in 1994 the ozone was the thinest if ever was, 86.4 DUs. The ozone recovered at 155.2 DUs in 2002, but then dropped again to 96 DUs in 2006. This shows that the ozone is constantly changing and is very hard to predict when the ozone wil be at 100%. In 2010 the ozone started to thicken steadily all the way through 2013, and it is hypothesized that the ozone will continue to thicken steadily and become healthier.

Conclusions/Discussion
My science question was can I discover what year the ozone hole will be recovered. My hypothesis is that the ozone will be 100% recovered by 2060. I learned that the ozone being destroyed by CFC gases, DU#s is the measurement of ozone thickness, lasers are used to gather data on the ozone, balloons are used to carry tiny machines up into the atmosphere. I learned that scientists discovered that the ozone was being destroyed in the 1980#s due to large amounts of CFC#s. I also learned that scientists shoot two lasers up into the sky where the lasers are either absorbed into the ozone or bounced back to the scientists. Using lasers is not the only way to gather data, one can use balloons! By tying a machine to the balloon

Summary Statement
I used past and present research, data, and information to predict when the ozone holes will be fully recovered.

Help Received
Dr. Thierry Leblanc allowed me to observe him while he conducted his measurements using balloons and lasers, answered many questions via phone and email. Russell Wilcox, my father, drove me to Table Mountain Research Center, and took pictures. Mrs. Rodriguez helped me create a question and interpret