



**Project ID: 631**  
**Junior Division**  
**Earth and Environmental Sciences**

**Frankie Alcanciado**  
**Nazareth School**  
**Gr. 7**



### *Eco-friendly Food Transport*

This project's motive was to find an alternative for plastic food packaging used for transportation. The idea was to add on to the issue of the dangers of plastic and its chemicals that are harming the environment, and humans. It was hypothesized that banana leaves would be the most biodegradable and efficient material tested.

Materials were cut out, and inserted into the sides of boxes, so that each material had their own box. Food's temperature was taken with a thermometer, and weight was measured with a scale. The food was placed into the boxes, and left for fifteen minutes. After the time passes, temperature is evaluated, as well as the weight. After all data was collected, rice was said to be the most eco-friendly, and competent material experimented with. The thermometer showed that the rice's temperature had not changed during the cold food testing, and to have an average temperature change in the hot food trial (a decrease of 44g) -- which is all less than the others in the group of mediums tested. The scale revealed that there was, as well as the cold food temperature, no change in the cold food weight. It was also revealed that, for the hot food weight, rice had an increase of 4 grams, which is way less than the others.

Given the data, the original hypothesis was not supported, as banana leaves were suspected to be the most economical and work-effective material. In summary, this project in its whole gives more insight about the hazards of plastic, and it shows the materials in which could be used as an alternative.



**Project ID: 632**  
**Junior Division**  
**Earth and Environmental Sciences**

**Remy Ally**  
**St. Michael's School – Poway**  
**Gr. 8**

**Kira Jones**  
**St. Michael's School – Poway**  
**Gr. 8**



*How Well Do Plants Grow on Mars vs. Earth?*

The purpose of this experiment is to determine whether life can grow on Mars. Our hypothesis is that radishes will not grow well on Martian soil compared to Earth's soil because Martian soil does not contain the same nutrients as Earth's soil. If a seed can grow into a plant on Martian soil, then life on Mars is possible.

The process included soaking radish seeds into water two days prior to pouring sand in the Martian soil tray and the Earth soil tray. We planted 45 seeds two centimeters deep into each tray. We controlled the amount of water used, frequency of watering the seeds, temperature, exposure to sunlight, and the size of the planter box. We measured the height of the seeds every other day for 4 1/2 weeks.

Our hypothesis was supported because the radishes in the Martian soil did not sprout at all. The height of radishes on Earth's soil was averaged out to 6.68 cm on Day 25 after the seeds were planted. The tallest radish was 8.89 cm tall.

There are many ways that we are able to expand on the idea of life on Mars. Nutrients in the soil are contributing factors in determining whether plants are able to grow and survive. Future studies might investigate if plants can grow on Martian soil if nutrients from the Earth's soil can be added into it. This remains fascinating to see if it is possible for life to survive on this alternate planet.



**Project ID: 633**  
**Junior Division**  
**Earth and Environmental Sciences**

**Mia Bi**  
**La Jolla Country Day School**  
**Gr. 7**



*Is Your Sunscreen Really Safe for the Ocean?*

**AWARDS:**

*Torrey Pines Docent Society - Junior Division 1st Place*

This project aimed to understand if sunscreen labeled "reef-safe" or "reef-friendly" protects sea life like algae. If not, could a concentration-dependent negative impact on algae be observed? The premises were that even if sunscreens were labeled with only inorganic oxides listed in their active ingredients, they could still be harmful to sea life such as microalgae. The microalgae, *Dunaliella tertiolecta* were grown for fourteen days with two control groups and a 1%, 5%, and 10% ratio of the seawater to two brands of sunscreen; one labeled "reef-friendly" (Coral Isles) and one labeled "reef-safe" (Reef Repair). The chlorophyll levels in each bottle of sunscreen were tested in relative fluorescence units (RFU) in a Trilogy machine every other day. The outcomes were that the "reef-safe" algae grew better than the "reef-friendly" with the 5% bottles being 27401 RFU and 10616 RFU. The higher numbers conclude that there is more chlorophyll, meaning they're more alive. The 1% CI bottle contracted mold, so it's challenging to conclude from. The numbers showed that the lowest concentration used, 1% of reef-safe sunscreen caused chlorophyll levels to be lower than the control condition numbers, supporting the first hypothesis, that even if sunscreens are labeled as "reef-safe" or "reef-friendly", they could still harm marine organisms because they are unfamiliar to their environment. The second hypothesis, that if the concentration of sunscreens is higher, then the damage to algae growth will be more severe, was also supported. More tests would be needed to be conclusive.



**Project ID: 634**  
**Junior Division**  
**Earth and Environmental Sciences**

**Embry Blais**  
**The Rhoades School**  
**Gr. 7**

**Ariana Samady**  
**The Rhoades School**  
**Gr. 7**



*Documenting Native Fauna in Aquatic Suburban Settings*

**AWARDS:**

*Association for Women in Science - Winner*  
*Nature Needs SD - Winner*  
*CSEF Qualified*

Ponds are vital sources of biodiversity and habitat for native species and are critical in reducing the effects of human impacts and the widespread loss of wetland habitats in Southern California. In our project we aimed to discover if there was a correlation between the percentage of native flora and the presence of native fauna in a suburban aquatic setting. Our hypothesis was that the number of native animals within this pond area, would be positively correlated with the concentration of native plants.

We documented the native flora and fauna within two aquatic habitats inside a developed area in the midst of a residential neighborhood. We divided the large, suburban wetland habitat into ten 10,400 square meter plots by finding the GPS coordinate boundaries of each area. Then we approximated the percentage of native flora coverage within each of the sections. We then mapped the presence of the native species we observed within our sectors.

We observed more than 30 species of native animals and documented their GPS coordinates. Using these coordinates we mapped them into their corresponding 10,400 square meter sections. The percentage of native flora within each plot never exceeded 40%.

There was a weak correlation between the percentage of native flora in an area and the number of native fauna documented in that same section. The species we observed seemed to slightly favor native plants, but were also readily utilizing, perching upon, and dwelling within nonnative flora.



**Project ID: 635**  
**Junior Division**  
**Earth and Environmental Sciences**

**Emilio Castaneda Martinez**  
**Chula Vista Middle School**  
**Gr. 8**



*Is There Total Dissolved Solids in Our Drinking Water?*

**AWARDS:**

*San Diego County Water Authority - Junior Division 3rd Place*

The purpose of this experiment was to see if there are Total Dissolved Solids in our drinking water in the parts of San Diego. The experimental question was "what Total Dissolved Solids are in the drinking water of San Diego." The hypothesis was if the water that is tested is tap/drinking water then little to no Total Dissolved Solids will be found because drinking water is often filtered or cleaned before being sold in places such as stores or be connected to a water fountain system. To conduct this experiment, the person doing the experiment collected different water samples from different water fountains that are in the San Diego area, then the person tested the water with a Total Dissolved Solid/Parts Per Million stick to see the amount of TDS is in the water. They also put test strips in the water to identify the specific form/type of the Total Dissolved Solids in the water. The result of the experiment showed that most samples of water that were tested had high levels of Total Dissolved Solids, also most water fountains that were tested contained Total Dissolved Solids, only a few were actually clean or mostly clean. The hypothesis was refuted because the water samples that were collected and tested contained a high amount of Total Dissolved Solids, and not few or no Total Dissolved Solids, just like the hypothesis stated. The data from the experiment could help people by letting them learn more about the current water quality around their area.



**Project ID: 636**  
**Junior Division**  
**Earth and Environmental Sciences**

**Steven Chen**  
**Pacific Trails Middle School**  
**Gr. 8**



*Synthesizing Living Materials for Coral Reef Regeneration*

**AWARDS:**

***Grand Award – Junior Division Life Sciences***

***The General Atomics Sciences Foundation Science Award - Junior Division***

***Ricoh USA - Winner***

***Torrey Pines Docent Society - Junior Division 1st Place***

***CSEF Qualified***

***Thermo Fisher Scientific Junior Innovators Challenge Nominee***

The objective of the project is to fabricate a living construct that contains live cells to help coral reef restoration. A distinctive advantage of the living construct is that it is entirely composed of a biocompatible hydrogel, which holds cells in its pores and allows them to grow.

The first step to build the construct was to design the shape according to coral structures found in nature. Using TinkerCAD, I designed two types of constructs, modeled after Favia and Stylophora coral polyps. Next, I prepared a hyaluronic acid (HA) hydrogel solution containing live brown algae cells, which live in symbiosis with coral cells in nature. It was necessary to encapsulate the algae cells into the construct to enable coral growth. The next step was to print out the constructs using a 3D printer. I optimized the printing parameters to fabricate the polyps. Finally, the finished polyps were moved into a cell culture medium (mimicking sea water) and left to grow for several days, during which I would measure the cell viability of the polyp by a fluorescent microscope. I also used an Optical Coherence Tomography scan to produce a 3-dimensional view of cell growth in the construct.

The results showed that over 2 weeks, the cell density increased by 95.55% in the Favia construct and 83.85% in the Stylophora construct. Both types of polyp constructs were indeed capable of supporting cell growth. These are exciting and promising results towards future work for coral reef regeneration.



**Project ID: 637**  
**Junior Division**  
**Earth and Environmental Sciences**

**Ian Martinez**  
**Chula Vista Middle School**  
**Gr. 8**



### *Can Biodegradable Hydrogels Help Soil Retain Moisture?*

The purpose of this experiment was to mix amounts of hydrogel solution with soil to see if this could help soil retain moisture. The experimental question was, does mixing biodegradable hydrogels help soil retain moisture? The hypothesis was, if biodegradable hydrogels are mixed with soil then the soil will retain more moisture because hydrogels are an absorbent jelly-like substance, meaning that the hydrogels will absorb some water that is infiltrating the soil and release the water once the hydrogel biodegrades. To conduct this experiment, cups with hydrogel solution made from citric acid, beef gelatin and water were mixed with soil, water was added to the cups and a small bowl was added to analyze how much water infiltrated the cup through the drainage holes. The result of the experiment showed that the cups with 10g of the hydrogel solution provided the most negative results, as the average amount of water that infiltrated the soil was 220.1 mL after two minutes, the group with the most positive results was the group with 40 g of the hydrogel solution mixed with the soil, in this group, an average of only 114.5 mL of water was able to infiltrate the soil after two minutes. The hypothesis was supported because, when hydrogel solution was mixed with soil, less water infiltrated the soil. The contribution this experiment established was, once more hydrogel solution was mixed with soil, the soil retained more moisture, this could help during droughts because there is less available water.



**Project ID: 638**  
**Junior Division**  
**Earth and Environmental Sciences**

**Omar Musse**  
**Bright Horizon Academy**  
**Gr. 8**



*Solar-Powered Saline Water Purification System*

**AWARDS:**

*American Academy of Pediatrics Climate Change and Health Committee - Junior Division 1st Place*

The objective of this project is to design and construct a solar-powered system to purify saline water, making it suitable for consumption or agricultural use.

It is hypothesized that, when reflective materials are used and integrated with solar panels, the system will efficiently desalinate saline water, resulting in purified water with reduced salt content.

To create a solar still, I began by assembling a transparent cover and glass bowl. Three bowls were labeled accordingly: one for seawater, one for tap water, and the third for purified water. Each bowl was lined with absorbent material, and a small cup was placed inside each bowl to collect dripping water. Solar panels were installed near the still to harness sunlight. The solar still operated under sunlight, collecting purified water daily for five days. Regular testing with a kit recorded salinity levels. Adjustments were noted along with their effects on performance. Water quality before and after desalination was compared daily. System performance was monitored for changes in efficiency or reliability. The process was repeated four times for accuracy.

Results showed significant improvements in pH levels and reductions in metal concentrations, particularly in seawater. However, while there were notable decreases in iron and lead levels, copper content increased drastically in tap water after purification. These findings suggest the effectiveness of the solar still in purifying water. These findings show us the potential of solar stills as a sustainable and efficient method for water purification.





**Project ID: 639**  
**Junior Division**  
**Earth and Environmental Sciences**

**Uma Onwuchekwa**  
**De Portola Middle School**  
**Gr. 8**



### *The Effects of Rock Tumbling Methods on Gemstone Smoothness*

This experiment analyzed how the two main rock-tumbling methods affect the smoothness of certain gemstones. The gemstones selected for this experiment were Dalmation Jasper, Lapis Lazuli, Rose Crystal, Red Jasper, Black Obsidian, Green Aventurine, and Amethyst. The first method was a standard 4-step grit consisting of coarse grit, medium grit, pre-polish, and polish grit. The second method was a 2-step process of medium and pre-polish grit. Both methods took eight days for one trial to be completed, and a total of three trials were performed for both methods; the experiment took 48 days to complete (6 weeks and 6 days). The data for the smoothness score was determined through the creating a smoothness scale from 1-10 and using reference points (1 equaling sand, 5 equaling silt, and 10 equaling glass) to compare each rock to them with physical touch. At the end of the tumultuous experiment, the conclusion observed was that the first method of rock tumbling was more effective than the second with an increased smoothness score of 0.06. Despite this, it appears that neither method is superior to the other in terms of effectiveness.



**Project ID: 640**  
**Junior Division**  
**Earth and Environmental Sciences**

**Medha Ravi**  
**The Rhoades School**  
**Gr. 8**



*Quantifying Heat Emissions from Alternatives to Synthetic Grass*

**AWARDS:**

*Association for Women Geoscientists - Winner*

*Society of Women Engineers - San Diego County Section - Junior Division 3rd Place*

Synthetic turf has been cause for concern due to its potential to contribute PFAs ( forever chemicals) and micro-plastics to the environment. In water-scarce Southern California, artificial turf was introduced as a water-conservative alternative to grass. Recent concerns about plastic pollution caused by artificial turf and a proposal to ban it will lead to seeking alternatives. My project attempts to find the most climate-friendly alternative by quantifying and comparing heat emissions of six alternative ground covers. I predicted emissions from native California cordgrass might be lower than other ground covers.

I used a FLIR i7 professional grade infrared camera to document the temperatures and heat emissions produced by commercial grass, California cordgrass, artificial turf, mulch, gravel, and rock. I took multiple measurements of each ground cover exposed to direct sunlight, shade or at night for a total of 500 measurements.

Average temperatures in direct sunlight varied according to the ground cover with California cordgrass exhibiting a 40% average lower temperature than other ground covers in the sun. Artificial turf and mulch recorded the highest average temperatures, . California cordgrass temperatures were also more stable, exhibiting the lowest average variability.

Overall the findings supported my hypothesis that cordgrass would exhibit lower average temperatures in direct sunlight than other alternatives. Although California cordgrass is famous as a wetland ground cover, California cord grass also thrives in a non-saline environment and is drought tolerant. I would recommend California cord grass as a viable option for home landscaping in Southern California.



**Project ID: 641**  
**Junior Division**  
**Earth and Environmental Sciences**

**Andres Roa Albarracin**  
**St. Mary Star of the Sea School**  
**Gr. 8**



### *Global Warming in Relation to Hurricanes*

Purpose of the Investigation: Hurricanes, tropical storms, and tropical depressions pose a variety of threats to people and property. Each tropical storm system can bring a variety of unique, life-threatening hazards to a given location. Global warming is causing hurricanes to become deadlier, more common, and more intense.

Procedure: After creating a google sheet, I performed an online search of Atlantic hurricanes from 2009-2022 mostly from the National Oceanic and Atmospheric Administration (NOAA) website. I used the data of Name, Year, Peak Category, Direct Deaths, Sea surface temperature (SST), Minimum central pressure, Maximum intensity, Peak storm surge, and Peak rainfall. I inserted the information into a google sheet. I used the "insert chart" feature from google sheets to make graphs to show correlation between data.

Results: A total of 105 Atlantic hurricanes from 2009 to 2022 were analyzed. The data showed a positive trend in the number of direct deaths comparing 2009-2015 vs 2016-2022 ( $p$  value=0.023). The data also showed a positive trend in the number of category 4 and 5 hurricanes comparing 2009-2015 vs 2016-2022 (8 vs 19) with a  $p$  value=0.051. There was no statistically significant findings after adjusting for available sea surface temperature data ( $p$ =0.71).  
Conclusion: I conclude that the historical Atlantic hurricane data showed an upward trend in the intensity of the hurricanes and direct deaths in between 2009-2022. The upward trend was not significant enough to prove that global warming is causing hurricanes to become deadlier, more common or more intense. More research is needed.



**Project ID: 642**  
**Junior Division**  
**Earth and Environmental Sciences**

**Amelie Roy**  
**San Diego French American School**  
**Gr. 7**



*The Acid Rain Avenger: Mod-Podge® to the Rescue!*

**AWARDS:**

*American Academy of Pediatrics Climate Change and Health Committee - Honorable Mention*

The experiment evaluated the impact of acid rain on various construction materials and the effectiveness of protective coatings to reduce corrosion. It involved simulating acid rain and assessing the corrosion effects on both coated and uncoated materials such as nails, screws, copper wires, wood, limestone, aluminum, and plastic. 10 pieces of each material were chosen for a total of 70. Mod-Podge®, a polymer sealant with a pH under 5, was applied to half of these materials. A diluted sulfuric acid solution with a pH of 4 was used to mimic acid rain conditions. After two weeks of exposure, the uncoated wood showed mold growth and an average weight gain of 1.98 grams (over 10.34 grams) or approximately 19.31% caused by moisture absorption, while the coated wood showed an average gain of 0.71 grams (over 10.61 grams) or 6.72% and no mold, showing that the sealant worked. However, the uncoated limestone gained an average of 0.14 grams (over 14.18 grams) or 1.07%, likely due to calcium sulfate formation from corrosion, while the coated limestone lost -0.07 grams (over 19.31 grams) or -0.34% due to the reaction with the sealant's acidity, which released water and carbon dioxide. The experiment shows that a universal non-reactive sealant suitable for all materials would be beneficial, especially for older buildings where the material composition could be unknown.



**Project ID: 643**  
**Junior Division**  
**Earth and Environmental Sciences**

**Aminah Siddiqui**  
**Bright Horizon Academy**  
**Gr. 8**



*Affordable Water Filtration for Developing Countries*

**AWARDS:**

***San Diego County Water Authority - Junior Division 1st Place***  
***WaterReuse Association - San Diego Society - Winner***  
***CSEF Qualified***

This project aims to create a water bottle with three layers designed to filter out large and small particles while removing heavy metals through Chelation. The project will test various natural materials to determine the most effective ones from each layer. The objective of this project is to develop a simple yet efficient water filter for underdeveloped countries. It is hypothesized that sand is most efficient in filtering larger particles, seashells are adequate for heavy metal filtration, and rice husks are optimal for smaller particles.

To test this hypothesis, rainwater was tested before and after filtration to measure conductivity, pH, turbidity, and the concentrations of heavy metals. 1.25 ml of both lead and copper were added to all 50 cups, except the control. Materials such as sand, charcoal, gravel, shells, rice husks, coconut coir, parsley, cilantro, and magnets were used to test which material filters each layer most effectively. After the three materials from each layer were chosen, they were used together in a filter to test the filtration levels of pH, conductivity, turbidity, and heavy metals.

While the hypothesis was proven partially correct, the study found a more effective method of filtration using sand, coconut, and parsley. Using these materials the conductivity of the filtered water increased by 89% while lead and copper levels decreased by 90% and 51% respectively.

This presents a viable approach for achieving the goals of this project, an affordable solution for water filtration in developing countries.



**Project ID: 644**  
**Junior Division**  
**Earth and Environmental Sciences**

**Siri Tipirneni**  
**Carmel Valley Middle School**  
**Gr. 8**



*Native Water-Efficient Indoor Living Walls: Mitigating Air Quality, Heat Challenges in Cities*

**AWARDS:**

*BIA Cares - Junior Division 3rd Place*

Globally, over 50% of the world's population live in urban areas where land previously home to native plants are developed into buildings. This massive urbanization has brought up environmental concerns in cities due to the the increase in temperature, air pollution and water scarcity.

Problem Statement: Explore sustainable practices by understanding the effectiveness of using native, drought tolerant plants in an indoor living wall to help reduce temperature and increase air quality while showcasing water conservation.

Hypothesis: I hypothesize that an indoor living wall, using native drought tolerant plants like the Chalk Dudleya, Yellow Eyed Grass and the Cape Sebastian, can positively impact indoor micro climates. This project focuses on the coastal San Diego region.

Procedure: Set up a living wall 76.2 x 101.6 cm with 20 of the native plants listed above and a control wall with no plants. Documented temperature, carbon dioxide (CO<sub>2</sub>), humidity and formaldehyde (HCHO) levels morning, afternoon and evening for 21 days for both the living wall and the control wall. Watered the plants with 59.15 milliliters of water every week.

Result: The results show a consistent temperature reduction of 0.25F-0.75F, an increase of 5-9% humidity and a reduction of CO<sub>2</sub> by 70-100 PPM when comparing results between a living wall and control wall. This proves my hypothesis regarding the positive impact of this living wall on indoor micro climates. The HCHO levels did not show any difference needing further research on adding native plants into the wall that specifically target those HCHO levels.



**Project ID: 645**  
**Junior Division**  
**Earth and Environmental Sciences**

**Matthew Yang**  
**The Cambridge School High School**  
**Gr. 7**



*Finding an Optimal Strategy to Separate Oil and Water in Our Oceans from Oil Spills*

After an oil spill, there are many ways to clean it up. I will be experimenting on water oil that has been taken from skimmers. There are two methods I tested: siphoning method and filtering method. I used a coffee filter for my filter and after 3 tests, I found the result to average at about 93.3% of the oil was able to be extracted while the other 6.7% made it through. This process averaged to take around 1 minute if the filter was left to fully run its course. In contrast, the siphoning method was able to extract 99.9% of the oil (small traces were poured out with water) after 3 tests. The siphoning method, once the water was fully settled, was much faster than the filter because the water is simply poured out. The average amount of time it took was ~8 seconds but this could change depending if a second pour was wanted. However, the siphoning method left 12% of the water behind because if the siphon poured again, oil would come out. This percentage is fixed however and the amount of water left would not change from varying amounts of oil water so it's not a very big problem. Therefore I concluded that the siphoning method was faster because it would be able to remove the oil with only traces escaping and its speed was much more efficient. It's possible that with this method the water could be released back to the ocean!