

A Multi-Faceted Approach to Leveraging Community Science Applications for REEU Summer Environmental Research

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Introduction or Background

Using free citizen science smartphone applications and wearable technology can be a meaningful way to conduct environmental research that can inform environmental policy. The REEU summer program serves as a model program that can enable students and mentors to successfully conduct impactful citizen science projects. In this section, we provide a brief background of 2 citizen science projects conducted during the 2024 REEU summer program.

- (1) *Waste Tracking Study:* Unfortunately, litter is found in every continent of the globe. According to a study done in 2020 by the organization Keep America Beautiful, “There are nearly 50 billion pieces of litter along U.S roadways and waterways.” (*End litter*, 2023.) In an effort to directly tackle this issue on the Cal State LA campus, we decided to track waste by using the citizen science mobile application, Marine Debris Tracker. By identifying, pinning and tracking the waste, we can highlight litter hotspots and access strategies to manage the issue.
- (2) *Vector-Borne Disease Study:* The spread of mosquitoes, which are vessels for vector-borne diseases, is among one of the many repercussions of climate change that is affecting the state of California. According to the pest control company Orkin, Los Angeles is ranked as “the top mosquito city” for the past three years. (*California Dreaming: Los Angeles leads Nation in Mosquito Complaints according to Orkin’s 2024 Top Mosquito Cities List*, 2024) Mosquito’s carry viruses such as Zika, West Niles Virus, St. Louis encephalitis, Dengue, Chikungunya, and are detrimental to public health. The county of San Diego states that mosquitoes can lay their eggs in as little as quarter inch of water; therefore, any source of stagnant water poses a risk to the spread of vector-borne diseases (*Mosquito-Borne Diseases*, n.d.). To identify stagnant water sources across Cal State LA, we used the mosquito Habitat Mapper mobile application.

Purpose and Objectives

The purpose of this multi-faceted study was to demonstrate the utility and potential impact of using free citizen science smartphone applications and wearable/usable physical technology (outside of a wet laboratory) in the collection of environmental data. Our main objective for both studies was to use environmental citizen science smartphone applications to collect data that can inform policy. We hope this research encourages further research in the

field of environmental citizen science with the hope that more community members will be able to collect data on environmental endpoints that pertain to their own communities.

Methods or Procedures

In this section, we provide the methods for both of our citizen science studies conducted during the 2024 REEU summer program.

(1) *Waste Tracking Study*: Using the National Geographic smartphone application, *Marine Debris Tracker*, waste around campus was geotagged and classified according to its material content and use. That data was then extracted, analyzed, and compared to global data, to compare littering patterns across the world. Recommendations are then made to campus administrators on what best waste policies to implement based on this study.

(2) *Vector-Borne Disease Study*: Using the citizen science smartphone app, *Mosquito Habitat Mapper*, we combed through the entire Cal State LA campus to identify and geotag concerning stagnant bodies of water. That data was then analyzed, and recommendations were then made to campus administrators on what best vector-borne disease prevention policies to implement based on this study.

Results

In this section, we provide the results for each of our citizen science studies conducted during the 2024 REEU summer program.

(1) *Waste Tracking Study*: Here are the results that organizations uploaded worldwide on the same days that litter was tracked on campus, along with our results. As you can see, plastic is the biggest percentage of waste tracked in both charts. Paper/ Lumber is the second most tracked item and the third most tracked item was cloth, whereas the worldwide data shows metal. Here is data showing the top 5 items worldwide compared to our data. Our first most tracked item was single use plastic. Something significant to note is that cigarettes, mostly found along the stairs leading to campus from south village, were our third most tracked item as well as in the world data.

(2) *Vector-Borne Disease Study*: After searching the entirety of the campus, we found 3 areas of concern. Our first area of concern was an untreated hot tub, which contained dead mosquitos and larva. Our second area of concern was a container in the garden of wellbeing, which did not have a drain to stop water from accumulating. Our third and last area of concern was a puddle next to the track field, which had not evaporated. This study was intended to show how easy it is for mosquitoes to harbor homes, including on campus. Educating the population is critical to reducing the spread of vector- borne diseases.

Conclusions and Recommendations

In this section, we provide conclusions and recommendations that emerged from each of our citizen science studies conducted during the 2024 REEU summer program.

(1) *Waste Tracking Study*: Leveraging the benefits of using community science smartphone applications, we successfully raised awareness of waste issues on campus as a function of environmental health. Our study provides actionable recommendations for our campus administration stakeholders to help improve environmental health on campus.

(2) *Vector-Borne Disease Study*: Our study was also successful in having the administration drain a major stagnant source of water, thus reducing vector-borne disease risk

on campus. This recommendation, which was made while the study was taking place, has already been successfully adopted by the university administration overseeing this body of water. We are confident this will help reduce the potential transmission of vector-borne disease on campus.

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