



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Ashwin Sivakumar	Project Number S0921
Project Title Studying Avian Biodiversity Changes after Wetland Restoration: A Novel Approach via Remote Sensing and Citizen Science	
<p style="text-align: center;">Abstract</p> <p>Objectives Wetlands, extremely important as wildlife habitats, are under severe threat in the United States. Preservation and restoration of wetland habitats is therefore critical for improving the health and diversity of wildlife populations. This study aimed to assess the effectiveness of a wetland restoration project at Fernhill Wetlands, Oregon by developing a low-cost, novel, and reusable technique combining remote sensing satellite imagery and geospatial climate data and performing quantitative correlations to citizen science bird observations from Cornell University's eBird database.</p> <p>Methods 254 LANDSAT-8 and 230 SENTINEL-2 satellite images and PRISM climate datasets from 2013-2018 were imported and processed in the cloud using Google Earth Engine. From these data, quantitative indices for vegetation, water area, and climate were calculated for the pre- and post-restoration periods. Quantitative correlations were then established in R between these indices and 146,457 observations in the eBird observation dataset. Finally, supervised classification was used to obtain clarity on land, vegetation, and water changes at Fernhill.</p> <p>Results Several terrestrial species and deep-water diving ducks correlated well with vegetation and water indices, as expected. Shorebirds, marsh birds and other species at the water's edge showed subtler and sometimes unexpected reactions to habitat change, effects that were not visible with conventional analyses. Particularly notable were the dabbling ducks that showed no correlation to the expected indices, and this was later shown to be due to compensating effects from different species within the group that reacted differently to the habitat change.</p> <p>Conclusions The new technique showed that the habitat restoration had a positive impact on several species as hypothesized. It was also effective in highlighting unexpected signals and relationships not obvious in previous studies, prompting further analysis. The results also implied that subtle feeding or other behavioral differences among species, even within the same category, could significantly influence their response to habitat change. This technique is low in cost due to the use of free, publicly available datasets and cloud computing resources and has drawn interest from ecologists. The methodology is reusable and allows for powerful and effective ongoing monitoring of wetland habitats.</p>	
Summary Statement I developed a low-cost, novel, and reusable methodology combining LANDSAT, SENTINEL, PRISM, and eBird datasets for the first time to do a quantitative study of the effect of wetland habitat restoration on the biodiversity of avian fauna.	
Help Received I got advice on publicly-available satellite data options from Mr. Benjamin Holt of NASA JPL. I got background information on Fernhill Wetlands and information on a prior study conducted at the site from Mr. Jared Kinnear of Clean Water Services and Mr. Joe Liebezeit of Portland Audubon.	