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Surface Flow Measurements in the Ballona Wetlands Freshwater Marsh

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Abstract

The Ballona Wetlands Freshwater Marsh is a 26-acre constructed wetland located in coastal Los Angeles, CA. The Marsh serves an important ecological function of capturing and filtering runoff from the surrounding urbanized area before it enters the Ballona Wetlands Ecological Reserve. Mosquito populations in the Marsh are monitored by Los Angeles County Vector Control to prevent public health risks. Knowledge of the areas in the Marsh with the least water movement, an indication of the highest probability of mosquito breeding, may help to maximize the efficiency with which the control is being exercised. Additionally, knowledge of the marsh hydrology will assist in further research done in the area. To address this need, the study used flotation devices and GPS tracking units to collect information on surface water velocity and an electronic temperature gauge to measure water temperature in the Ballona Wetlands Freshwater Marsh. The velocity measurements of the water at different points in the Marsh were combined to create a vector field layered over a satellite map of the marsh to clearly show where water flow is fastest and slowest. This map can facilitate further examination of mosquito concentrations in the Marsh, as well as improve the knowledge of the Marsh's hydrological characteristics. This research on surface flow is a crucial first step in establishing the entire Ballona Freshwater Marsh Ecosystem Monitoring Program, and the collected data will be useful for a variety of purposes.

Introduction

The Ballona Wetlands Conservancy currently monitors the Ballona Freshwater Marsh to track animal populations such as fish and birds, and cuts back vegetation in certain areas. Reducing the amount of vegetation, including reeds, reduces the areas in which mosquitoes can lay eggs because they lay their eggs in stagnant water, especially in reedy areas. This study approached the marsh with the hypothesis that wide open spaces would have more surface water movement than more crowded spaces near the banks and among the reeds.

Methods

The study placed 6 iGotU GPS trackers that recorded location and time at intervals of 1 second in individual plastic containers, which were cleaned-out tapioca tubs. Sand was added to the bottom of the tubs in order to weight the containers such that the lid sat 1 cm above the water line when placed in standing water.

The study used a boat that the Ballona Wetlands Conservancy keeps to manage the marsh to travel throughout the marsh and deploy and recover the trackers. The data from the trackers was then uploaded to software called @trip PC, which was transferred to Google Earth Pro which allowed for time stamps and distance measurements.

Data

The study collected 37 usable data tracker paths. These paths were then analyzed with distance between points and times to calculate velocities from them. The velocities were calculated to make the vector field to show water movement. An example of the paths collected is shown below (Figure 1). Overall, the trackers moved less than a centimeter a second, but were faster in the afternoon when wind speeds increased compared to the morning. The temperature of the water ranged from 19 to 22 °C, and was noticeably warmer in areas of stagnant water.

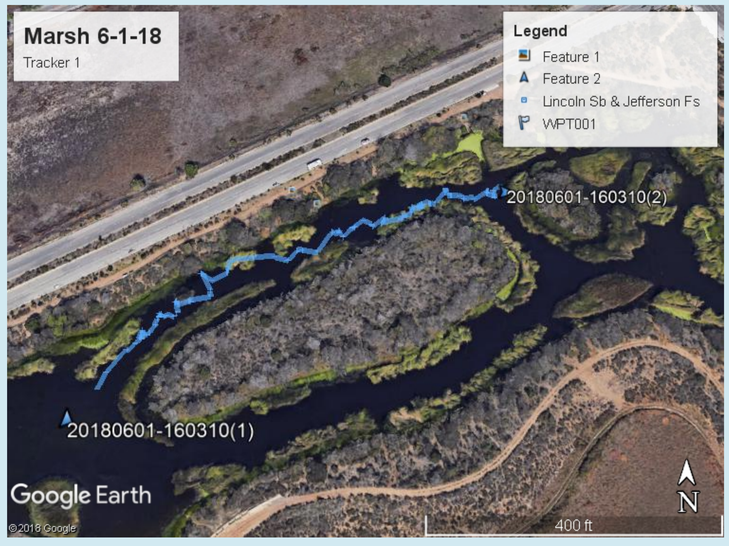

Figure 1: data tracker path

Results

The study obtained a map from the Ballona Wetlands Conservancy which created the image through satellite data in order to have a highly accurate picture of the Ballona Freshwater Marsh. Grid lines were added to the map with width and height corresponding to around 100 feet square to give perspective and delineate where arrows for surface water flow would be inserted (Figure 2). The arrows represent areas where the surface water flow was highest in the marsh, and the x marks represent where water flow was stagnant or essentially not moving.

Figure 2: surface water flow map

Discussion

The results support the hypothesis that the open spaces have more surface water flow than areas close to banks and reeds in the marsh. The vector field map was sent to the Ballona Wetlands Conservancy to show where cutting back vegetation could be useful and informing Vector Control to ensure that mosquitoes do not proliferate and spread vector-borne diseases. The surface water flow is simply one aspect of the marsh's hydrology, and further studies about depth and composition of the marsh would add to the Ballona Freshwater Marsh Ecosystem Monitoring Program.

Acknowledgements

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Ballona Wetlands Conservancy