Optimal Green Infrastructure

Reducing Stormwater Runoff Pollution in Maunalua Bay, O'ahu, Hawai'i

Spring 2022

Elmera Azadpour, Genevieve Chiong, Kristin Gill, Lauren Skube, Catherine Takata
Faculty Advisor: Dr. Samantha Stevenson, Bren School of Environmental Science & Management, UCSB
Client: Mālama Maunalua

ENVIRONMENTAL PROBLEM

Before Western settlement, Native Hawaiians carefully managed the resources of the Maunalua Bay region in O'ahu, Hawai'i. Since the mid-1950's, development has had significant negative impacts on the Maunalua Bay ecosystem. Accelerated growth in the region has led to expansion of roads, parking lots, and roofs. These impervious surfaces quickly carry stormwater runoff directly into the ocean. Pollution from the urban environment is transported to the sea along with the rain, negatively impacting marine life and the health of community members who rely on the Bay for recreation and fishing. The Hawai'i Department of Health (DOH) has declared Maunalua Bay an impaired water body for recreation due to high bacteria levels, suspended solids, and nutrients.

RESULTS

1

We created 8 hydrologic models for the watersheds of Maunalua Bay, using the EPA's Storm Water Management Model.

These reproducible, climate-adaptive models will help identify stormwater runoff hotspots and ideal locations for green infrastructure placement across the region.

2

If chosen appropriately, green infrastructure can effectively reduce stormwater runoff flowing into the Bay.

Rain barrels and rain gardens capture runoff at low cost and maintenance requirements. However, they are less effective than green roofs and permeable pavement which have greater stormwater capture ability.

3

Green infrastructure can remain effective in the face of climate change through 2050.

We found that climate change is not projected to have an impact on the magnitude of *extreme* storm events in the near future, indicating that green infrastructure that is effective today will remain effective.

UC SANTA BARBARA
Bren School of Environmental Science & Management

mālama maunalua

DIPAOLA foundation

BACKGROUND

Located on the southeastern shore of O'ahu, Hawai'i, the 28 sq. mi. Maunalua Bay region has nine surrounding *āpana*, or watersheds, that drain water from the land into Maunalua Bay. These *āpana* include Wailupe, Kuli'ou'ou, Hahaione, Kamilo Iki, Kamilo Nui, Niu, Portlock, Waialae Iki, and Waialae Nui. Each watershed can be divided into subcatchments, or smaller flow areas within watersheds, where the water may drain to stormwater infrastructure or a neighboring subcatchment.

CULTURAL SIGNIFICANCE & PROJECT IMPACT

Community members, especially fishers and *kupuna*, or elders, who depend upon a healthy Bay for their livelihoods and cultural practices, will significantly benefit from research focused on land-based sources of pollution entering Maunalua Bay. The combined efforts of this project and Mālama Maunalua will aid the City and County of Honolulu in the future management of the watersheds feeding Maunalua Bay. The climate change projections used in this study could prove helpful for the Honolulu Office of Climate Change, Sustainability, and Resilience and stakeholders concerned about climate change risk and mitigation.

APPROACH & LIMITATIONS

The lack of available precipitation and stream gauge data in the Maunalua Bay region has hindered the calibration of hydrologic models of the area.

Simulations indicate that green infrastructure constructed at a large scale can significantly reduce stormwater runoff from a given location (Figure 1). This analysis serves as the starting point for green infrastructure recommendations for the Maunalua Bay region.

We utilized O'ahu projected precipitation data to quantify simulated differences in stormwater flow across subcatchments in the Wailupe watershed under extreme climate change scaled conditions.

a

b

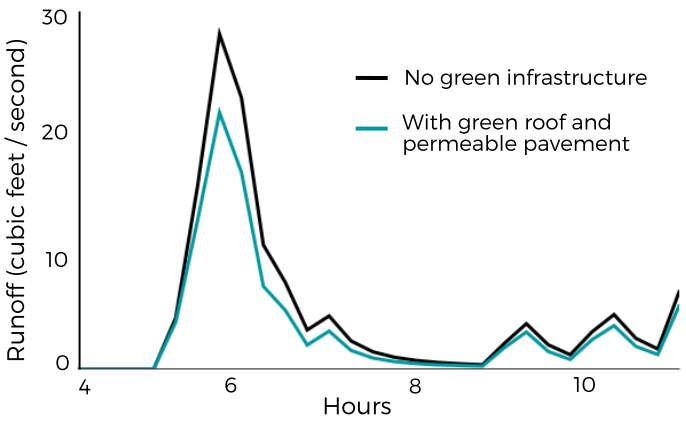

*Figure 1. (**a**) Theoretical green roofing and permeable pavement scaled to infrastructure at Aina Haina shopping center. (**b**) Modeled runoff reduction at the subcatchment level after green roof and permeable pavement implementation (blue line) compared to normal (black line) at Aina Haina shopping center.*

UC SANTA BARBARA
Bren School of Environmental Science & Management

mālama maunalua

DIPAOLA foundation