

# He'eia National Estuarine Research Reserve

*Ko'olaupoko, O'ahu, Hawai'i*

## He'eia NERR Communiqué

### September 6, 2018

### Re: Estuary Restoration

This communiqué is issued by the He'eia National Estuarine Research Reserve (NERR) to convey information regarding restoration activities in the He'eia estuary. The goal of the project is to restore a wetland, altered by invasive alien species, to a more natural and productive landscape—one that provides habitat for native species and food for local communities through management as a traditional Hawaiian *ahupua'a*. The current mangrove removal projects are key to the success of this restoration, and are designed to both restore natural fresh water flow to the stream system, and promote native species regeneration. All necessary permits for this restoration project have been obtained, and scientific monitoring has demonstrated that mangrove removal above the bridge has *not* resulted in either increased siltation or coral dieback on nearby reefs.

Below, we put forth 1) the project vision and mission, 2) scientific, scholarly, and traditional understanding of the history of He'eia, and 3) the collaborative research (Federal, State, University, NGO) that is ongoing to monitor the environment and assess the efficacy of restoration efforts.

### Summary of Points

- The estuary of He'eia is currently undergoing restoration by a collaborative effort involving the community, Federal agencies, State agencies, University of Hawai'i, and NGOs.
- Through the designation of He'eia as a National Estuarine Research Reserve, the environment is being monitored to determine the efficacy of restoration efforts towards a vision of a natural and productive ecosystem as managed in the traditional Hawaiian *ahupua'a* system.
- Restoration efforts (replacement of invasive species with natives and restoring the *lo'i* and the fishpond) follows extensive community outreach process that led to the NERR designation and the overwhelming support of the community expressed for removing invasive mangrove, and has already resulted in the return of endangered native birds, such as 'Ae'o, and native fish.
- Florida mangroves are an invasive species in Hawai'i, and are detrimental to the native ecosystem by facilitating the persistence of non-native fauna and significantly altering the flow of water and sediment layer.
- The wood from removed trees is being provided at no cost to cultural practitioners and community development projects.

## He'eia NERR

The He'eia National Estuarine Research Reserve (NERR) was designated in 2017 following more than a decade of effort by the community, and is founded on recommendations derived from the 1992 Kāne'ohe Bay Master Plan<sup>1</sup>. It is a collaboration between Federal, State, and various site partners including private landowners and non-governmental organizations (see below for a complete list of site partners). The Reserve includes 1,385 total acres of terrestrial, wetland, and aquatic habitats. The vision of He'eia NERR is to create a resilient estuary and coastal watershed where both human and natural communities thrive. The mission of He'eia NERR—set by the community through an intensive public engagement process—is to practice and promote stewardship of coasts and estuaries through innovative research, education, and training using a place-based system of management guided by traditional Hawaiian practices and knowledge passed on through *kūpuna* (elders). The biological and cultural integrity of the *ahupua'a* of He'eia will be restored to create an *'āina momona* (abundance) legacy for future generations. The *ahupua'a* of He'eia will be a global example of thriving and resilient social-ecological communities<sup>2</sup>.

## Historical ecology of the He'eia estuary

Historical ecology can provide important perspective of the natural history in any given area, and can be used to inform contemporary restoration efforts.

- **Pre-human era:** About 10,000 years ago after the beginning of the Holocene, geologic and erosional forces began creating the estuary in the area that is now known as He'eia. By the mid-Holocene, this was an open-canopy area that was also biologically diverse — abundant with various native sedges, now-endangered waterfowl, such as *koloa* (duck), *'alae 'ula* (mudhen), *'alae ke'oke'o* (coot), *'ae'o* (stilt), and native fishes, such as the *'ama'ama* (mullet), *'o'opu* (gobies), *āholehole* (flagtails), among many others.
- **The Hawaiian era:** Starting at least 1,500 years ago, indigenous *kānaka maoli* began managing the landscape to stabilize and sustainably increase ecosystem services. This was done by expanding highly productive ecotones, such as riparian areas and estuaries, and establishing the *ahupua'a* system. These practices essentially increased the habitat for key resource species such as native waterfowl and both marine and freshwater fishes, while concurrently creating habitat for key sources of complex carbohydrates such as *kalo*. Land management practices prevented topsoil loss, and increased both species richness and the availability of freshwater while also supporting rich coral reef ecosystems and nearshore fisheries, such that a population roughly equivalent to that in the area today lived sustainably off the land with no detectable decline of coral reef health<sup>3</sup>.

- **The Territorial era:** The abolishment of traditional resource management practices and the imposition of continentally-based resource management philosophies led to rapid deforestation, urbanization, increased erosion, dredging, public wastewater and declines in water quality and availability. Solutions to these problems were put forth, such as introducing non-native trees like albizia, mangroves, and others to stabilize the sediments and coastal environment. However, time has revealed that these solutions were short-sighted. Many of them have become invasive in that they displace native species, and they further facilitate the spread of other invasive species, thus leading to a net decrease in ecosystem services. What was once a rich native estuarine area, that supported a thriving human community for more than a millennium, deteriorated rapidly (1930s to 1960s) as a result of human impacts and the introduction of alien species<sup>3</sup>. Fishing from He'eia bridge over the estuary stopped around the 1940s because the habitat had been altered so much that it was no longer suitable for native resource fish.
- **Late 20th Century:** Monotypic stands of invasive mangrove have displaced native fishes and waterfowl, and facilitated the establishment of other invasive species such as tilapia, mosquitofish, and the cattle egret. The density of the mangrove has also contributed to drastically degraded water quality. By holding leaf litter and reducing flow, the mangrove stands release anoxic (oxygen depleted) water into Kāne'ohe Bay. This impedes watershed connectivity, which is a critical factor for many native species that spend a portion of their life cycle in estuaries. The inland estuary has become silt-saturated, and no longer prevents the loss of topsoil into Kāne'ohe Bay, nor is it used as a nursery for native fishes and birds.
- **Current:** Ongoing efforts of invasive species removal and restoration of the *lo'i* and He'eia fishpond have resulted in the first record of nesting by the endangered *koloa* and 'ae'o (Hawaiian stilt) in He'eia in living memory. The fishpond restoration continues, and now maintains populations of 'ama'ama (mullet), *moi* (threadfin), and other resource fishes.



*"He'eia Viaduct"  
1922. Depicts  
active agriculture  
prior to the  
establishment of  
mangrove (photo  
source unknown).*

## Mangrove as an invasive species in Hawai'i

Florida mangrove (*Rhizophora mangle*) was introduced to Hawai'i in 1902<sup>4</sup>. Prior to mangrove introduction, marine vascular plants were absent in Hawai'i<sup>5</sup>. While mangroves are a critical nursery habitat in other locations, such as Florida, they are detrimental to the native ecosystem in Hawai'i. These mangroves have become an 'invasive species,' which means that it is spreading in such a way that it displaces native species, and it negatively affects native habitat in a significant way<sup>6,7</sup>.

In Hawai'i, mangroves:

- Spread quickly and grow rapidly, thus altering native coastal and estuarine habitat.
- Facilitate the persistence of non-native fauna in Hawai'i by pushing out native species<sup>6</sup>
  - Its dense growth and habitat-altering nature effectively blocks the upstream migration of 'ama'ama (mullet) and āholehole (flagtails), and does not provide nursery habitat for native fish or birds in Hawai'i.
  - Substantially alter benthic (sediment surface) community structure for decades even after removal, with a significant change in the species present and reduction of infaunal prey species that previously provided a variety of ecosystem services (food for fish and birds, detrital decomposition, etc.)<sup>8</sup>.
- Slow the flow of water through the wetland, trap leaves in their root systems, and changes sediment composition (finer grain sizes and higher organic content). The stagnant environment results in slower decomposition processes, producing a putrid smell and anoxic (oxygen depleted) conditions inhospitable to most aquatic vertebrates and native invertebrates. The mud looks black because of the accumulation of organic matter and lack of oxygen, and most native species avoid streams with such conditions.
- Cause significant damage and speed the destruction of ancient Hawaiian sites (such as Native Hawaiian fishponds), and cultural landscapes.

*Dense mangrove invading into the mouth of He'eia stream, 2018. (F. Reppun)*



## Traditional and customary practice

“Traditional and customary practice” is a right of native Hawaiians that is protected by both the State Constitution and precedent-setting case law upheld by the Supreme Court. “*Mālama ‘āina*” (caring for the land) is one of the traditional and customary practices that is recognized by the courts. Restoration of native ecosystems and cultural landscapes by native Hawaiians is supported by the State of Hawai‘i in fulfillment of its obligation to honor the traditional and customary practice of *mālama ‘āina*, such as through efforts to restore native wetlands and the associated ecosystem services.

Invasive species, such as mangroves, are noted to interfere and/or inhibit traditional and customary practice. As such, the removal of invasive species is widely regarded as an appropriate practice within the context of *mālama ‘āina*.



*He'eia Fishpond in 1928 (left) showing an open agricultural area with the bridge over the stream mouth on the left side of the pond, and in 2000 (right) with dense mangrove along the bridge, stream mouth, and pond walls (© 1928, 2000 DigitalGlobe, Inc.)*

## Scientific Research

There are several collaborative monitoring efforts that are being conducted by Federal, State, NGO, and University of Hawai'i partners to understand the short-, medium-, and long-term effects of the restoration efforts currently underway. The data that are gathered will determine whether this current action results in a net improvement of the ecosystem or not, and will inform future restoration efforts in He'eia and throughout Hawai'i.

- He'eia National Estuarine Research Reserve
  - System-Wide Monitoring Program (SWMP) evaluates nutrients and water quality
  
- Hawai'i Institute of Marine Biology (HIMB)
  - Sediment accumulation on nearshore reefs and its impact on coral reef biodiversity
  - Surveys of coastal fishery species and evaluation of coral cover and bleaching
  
- University of Hawai'i at Mānoa
  - Ecosystem services provided by restoration of *lo'i kalo* (taro fields)
  - Surveys of microbial activity and biogeochemical cycles in the wetland
  - Nutrient dynamics and movement of water from the wetland through the fishpond and out onto the nearshore environment
  
- Division of Aquatic Resources (State Department of Land and Natural Resources)
  - Surveys of fishes and coral cover in the area to monitor the health of the ecosystem prior to restoration, during the removal of mangroves, and post-removal during planting of native species
  
- State Department of Health
  - Long-term monitoring of water quality at the mouth of He'eia stream
  
- The Nature Conservancy
  - Monitoring of water quality and sediment transport from upland sources through the *lo'i* and into the fishpond

## Partners

Various partners are collaboratively working on and supporting restoration efforts in the He'eia estuary, including:

- He'eia National Estuarine Research Reserve (NOAA, University of Hawai'i at Mānoa)
- Hawai'i Institute of Marine Biology (University of Hawai'i at Mānoa)
- Hawai'i Sea Grant (University of Hawai'i at Mānoa)
- Department of Land and Natural Resources (State of Hawai'i)
- Hawai'i Community Development Authority (State of Hawai'i)
- Ko'olaupoko Hawaiian Civic Club (NGO)
- Ko'olau Foundation (NGO)
- The Nature Conservancy Hawai'i (NGO)
- Kāko'o 'Ōiwi (NGO)
- Paepae o He'eia (NGO)
- And countless community members, leaders, *kūpuna* (elders), and enthusiastic volunteers

For questions about efforts to restore the estuary of He'eia or about associated monitoring/research, please contact Dr. Kawika Winter ([kawikaw@hawaii.edu](mailto:kawikaw@hawaii.edu)), Reserve Manager at He'eia National Estuarine Research Reserve; and Dr. Rob Toonen ([rjtoonen@gmail.com](mailto:rjtoonen@gmail.com)), researcher at the Hawai'i Institute of Marine Biology.

## References

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