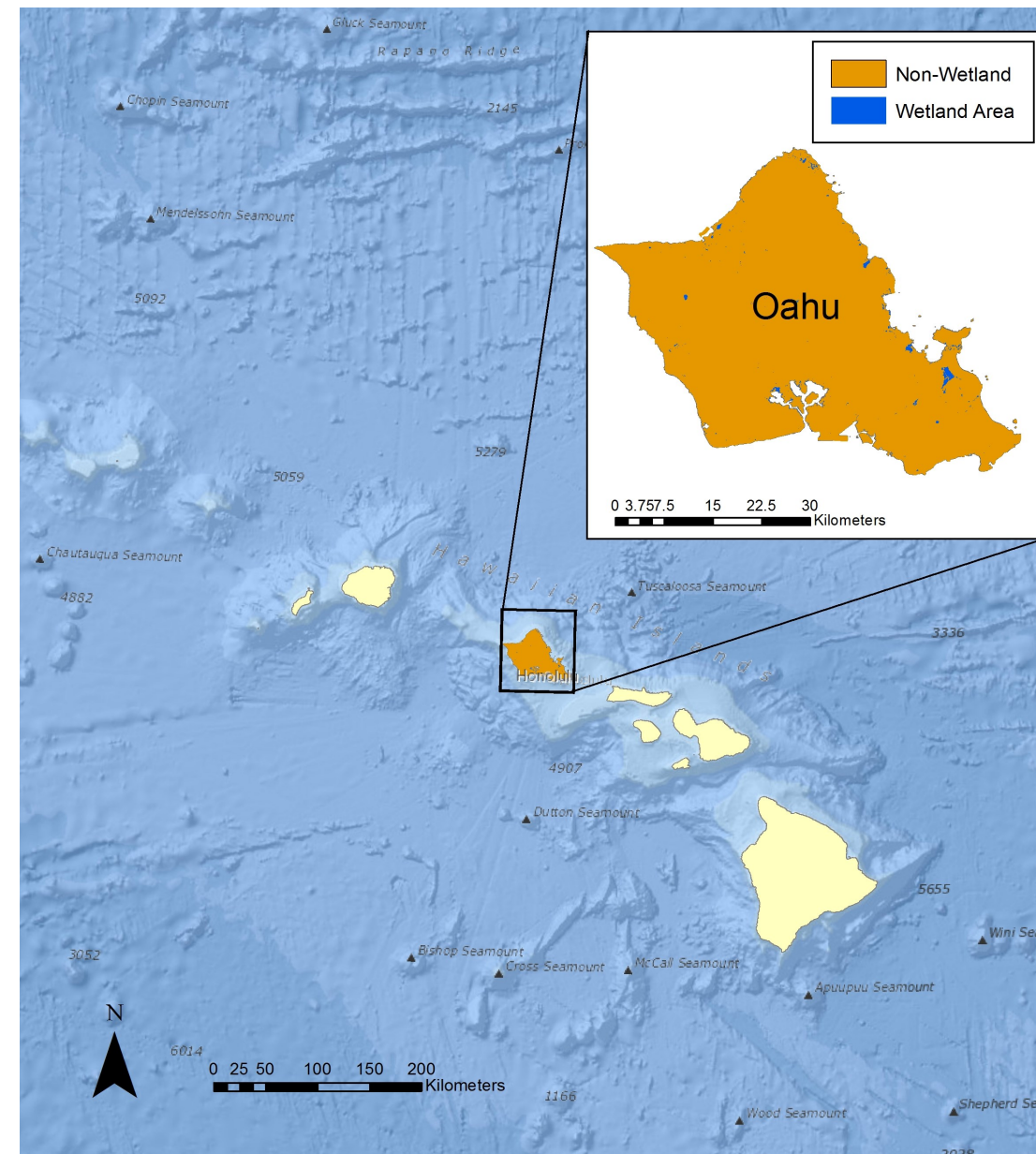


Local Extinction Vulnerability Analysis of the Hawaiian Gallinule

Background

Oahu, the most populous island of Hawaii, has been subject to increasing habitat loss and degradation since human development. This habitat loss comes at the cost of incredibly high extinction rates for its native species, many of which are endemic to the state. The wetlands of Oahu have seen an especially high rate of loss and fragmentation, putting local populations at greater risk to local extinction. In order to maintain the remaining populations of these endemic species, it is vital to know which habitat and landscape factors are affecting their distribution the most.

In this project, I analyze the vulnerability to local extinction of the Hawaiian Gallinule (*Gallinula galeata sandvicensis*), an endemic, endangered species of waterbird on the island of Oahu. In the face of increasing habitat loss, the gallinule's population has seen a serious decline since pre-settlement, making it all the more vulnerable to extinction. In order to effectively conserve this ecologically and culturally important species, we must realize which populations are most at risk in order to prioritize wetland management. Furthermore, understanding which landscape factors are the most detrimental to species' success can help to illuminate the most sustainable methods of further development.



Wetland area on Oahu, Hawaii

Methods

The factors chosen to include in the analysis have all been known to either remediate or hinder a population's persistence. 1. Close proximity to roads puts these birds at risk of getting hit by cars, something that often occurs on one wetland abutting a major street. 2. Close proximity to urban development puts the population at long-term risk of habitat loss due to expanding urbanization. 3. Current population is one of the most telling predictors, as low populations are more vulnerable to extinction due to stochastic factors. 4. Proximity to other occupied wetlands allows for the repopulation of ponds and a larger genetic pool. 5. The management status of a particular wetland tells us how well the habitat is managed for invasive species, human disturbance, and predator control.

Individual factor layers were created using a combination of personal data collected in Oahu and existing land use and land cover data. To create an initial layer of the occupied ponds, GPS points were geocoded and then drawn into polygons. This layer was then filled with pond-specific population and management data. The factors used in analysis and the weight of each is displayed in Table 1.

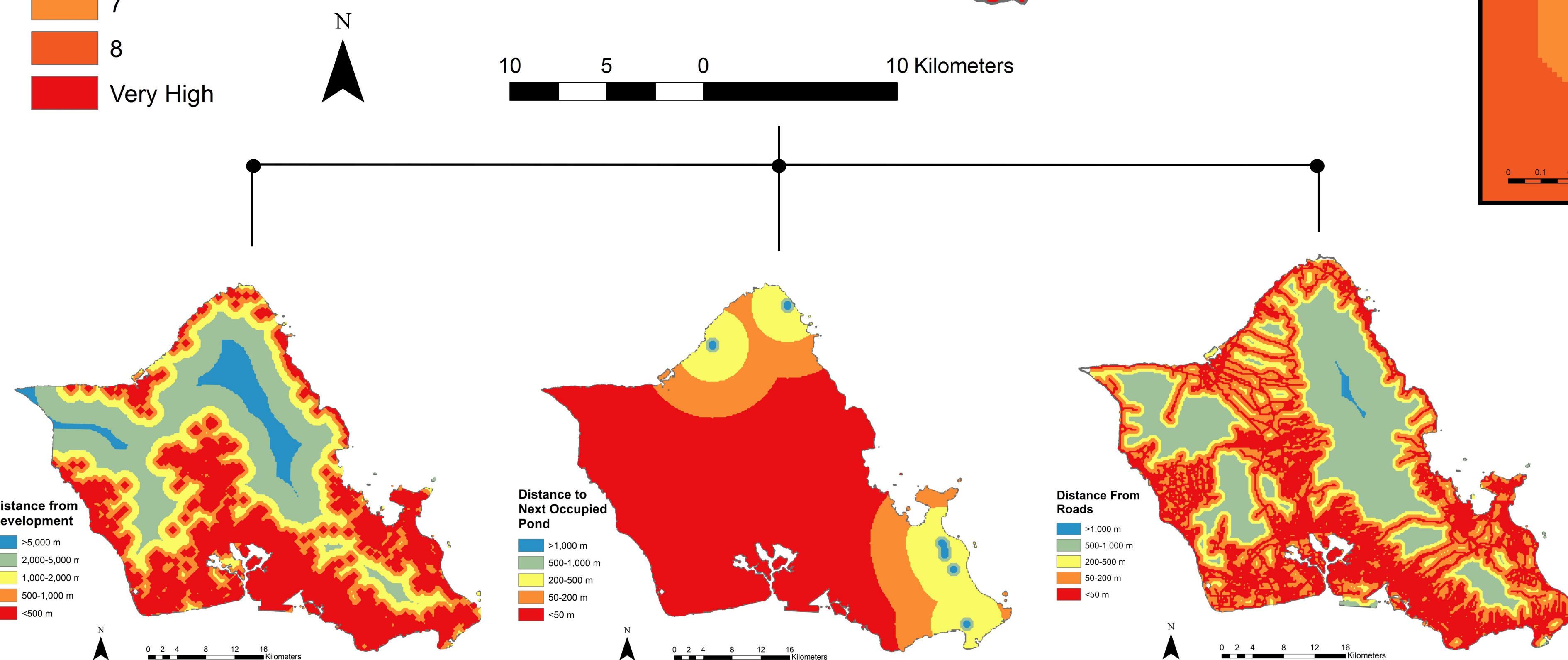
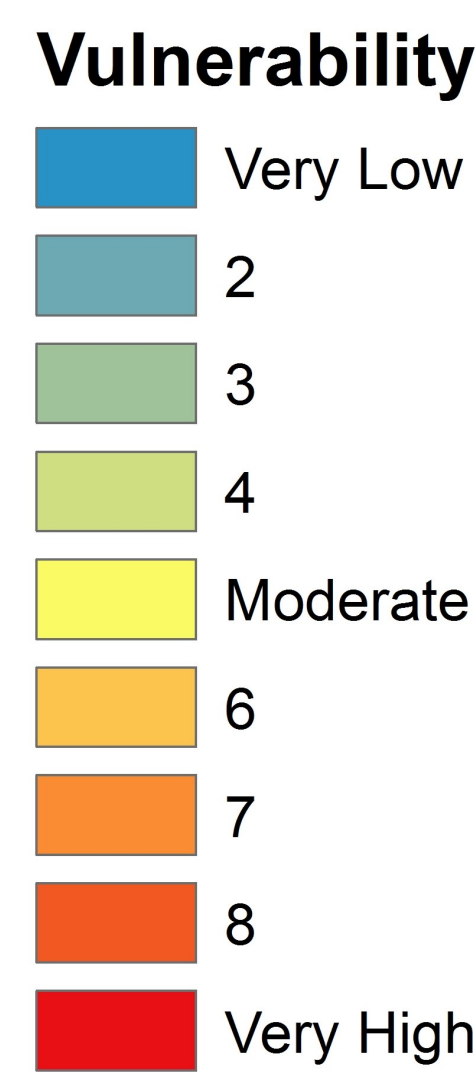
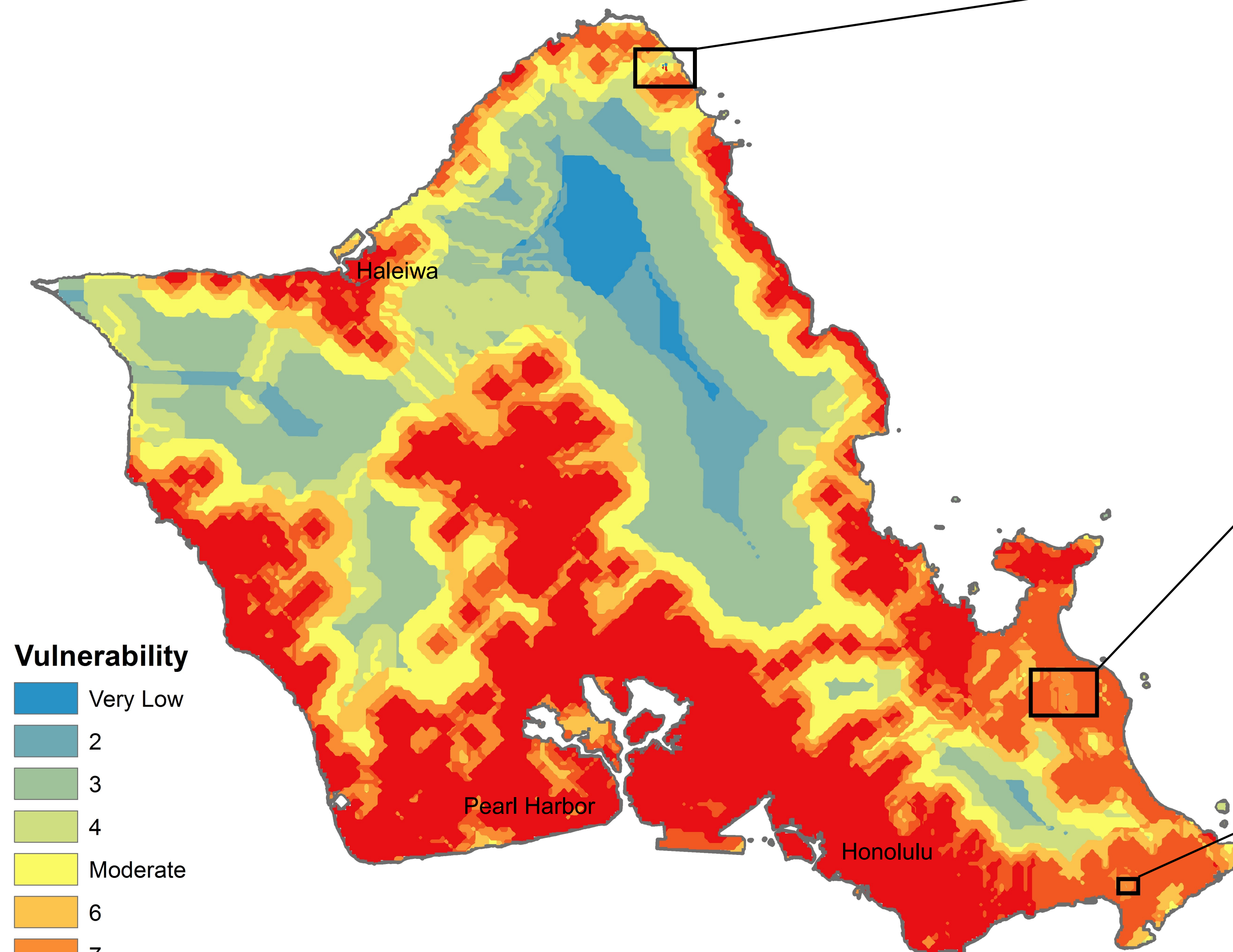
Factor (weight)	5 = Most Vulnerable to Local Extinction	4	3	2	1 = Least Vulnerable to Extinction
Distance from Road (15%)	<50 m	50-200 m	200-500 m	500-1,000 m	>1,000 m
Distance from Urban Development (30%)	<500 m	500-1,000 m	1,000-2,000 m	2,000-5,000 m	>5,000 m
Distance to Nearest Occupied Wetland (10%)	>10,000 m	5,000-10,000 m	1,000-5,000 m	500-1,000 m	<500 m
Management Status (20%)	Public, little to no management	Public, some management	Limited access, some management	Private, some management	Private, well managed
Wetland Population (25%)	<3	3-5	6-9	10-12	>12

Table 1. The factors, and their weights, used in local extinction vulnerability analysis

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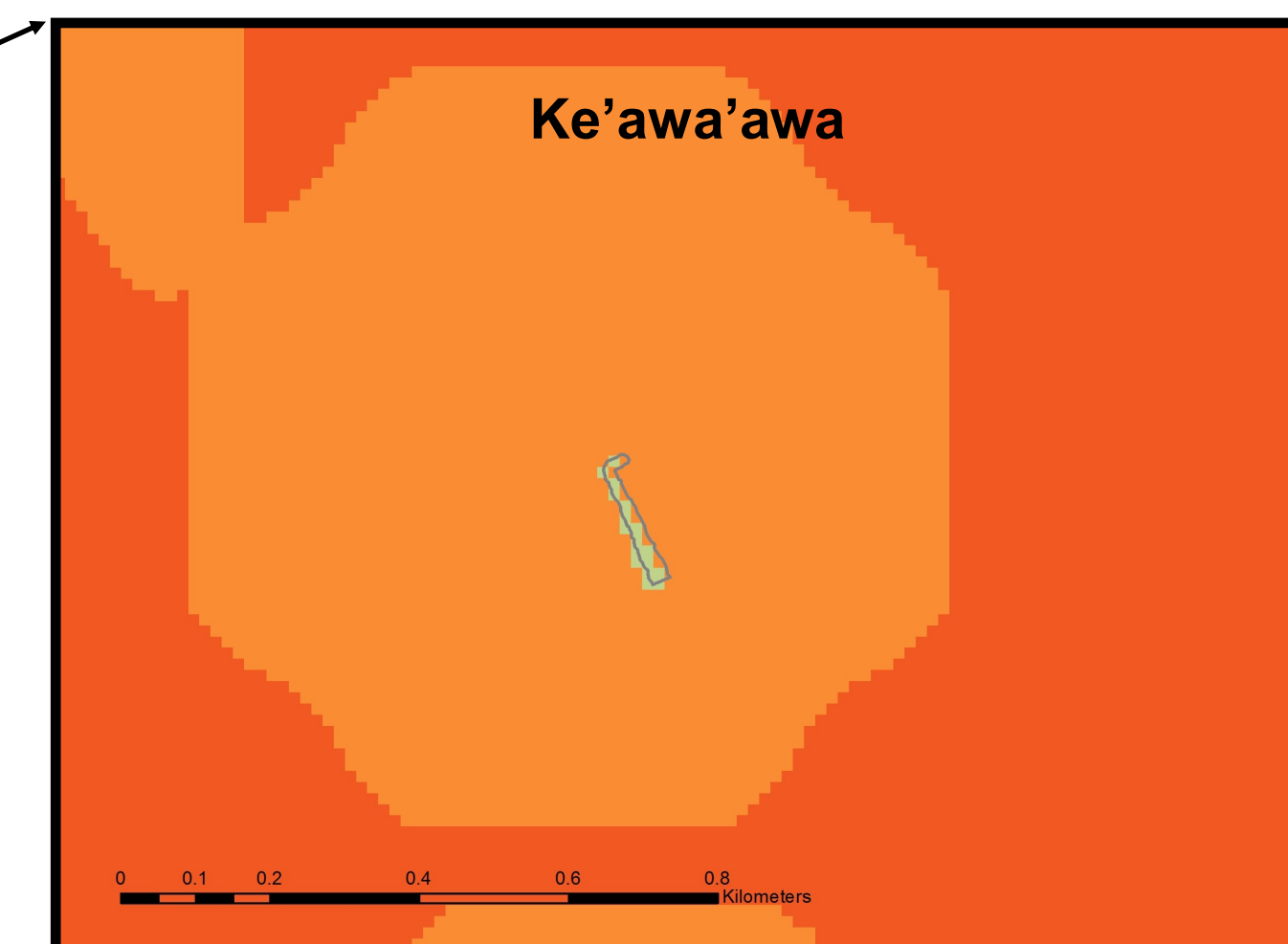
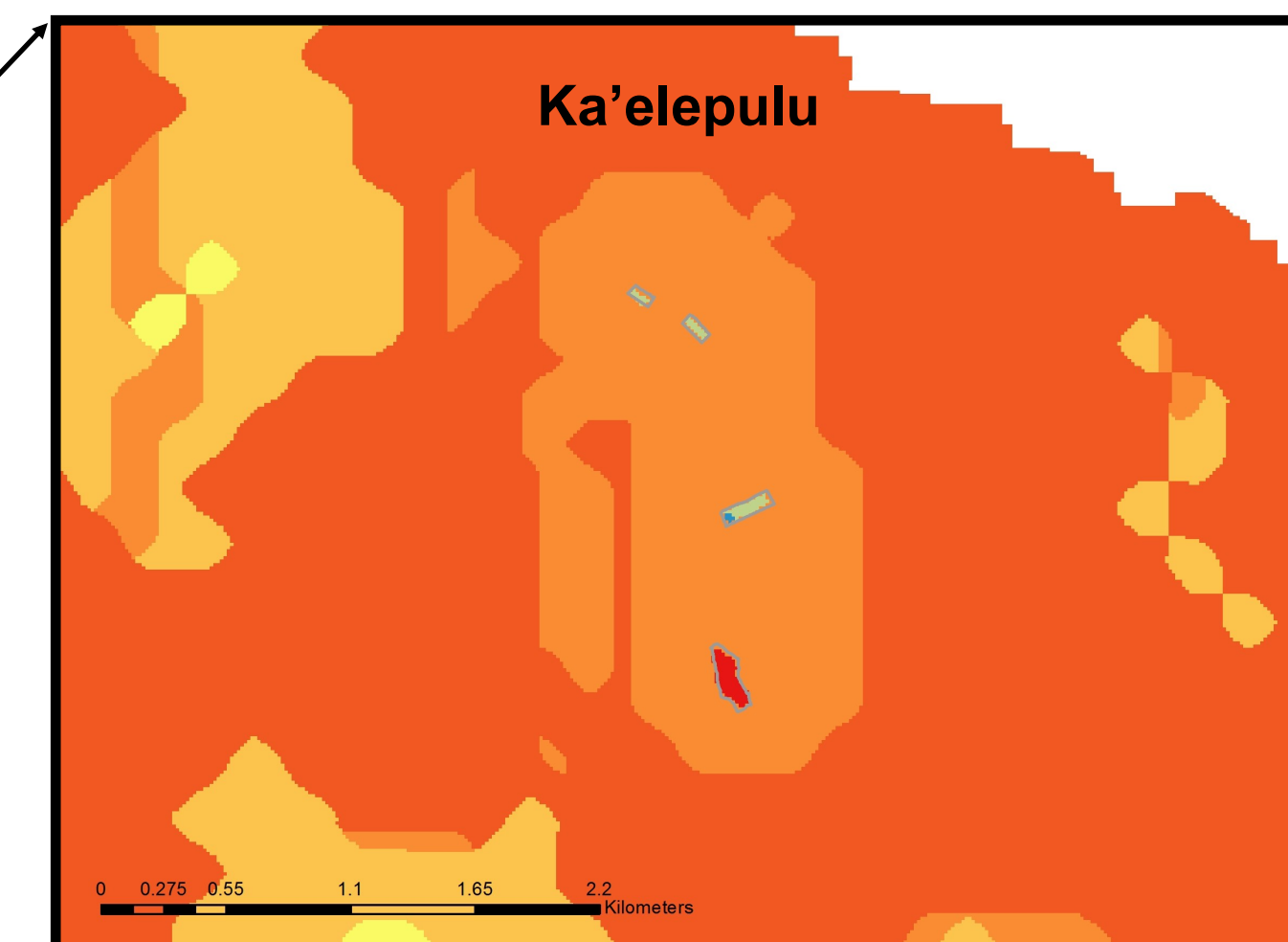
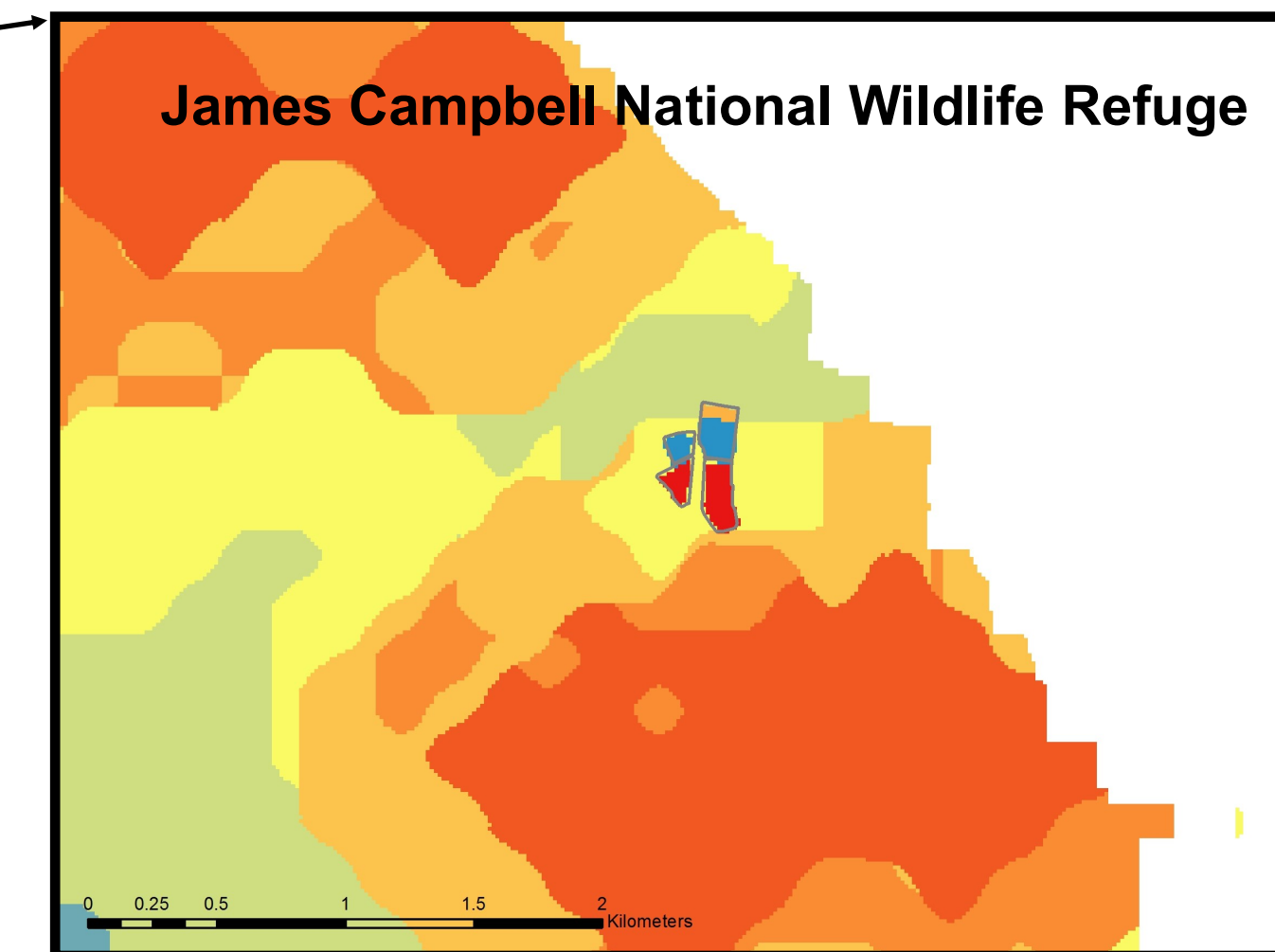
Results

This analysis revealed areas of vulnerability on the island of Oahu. From the final analysis we see that certain ponds are more at risk of local extinction than others. For instance, a pond in Ka'elepulu is highly vulnerable to local extinction, most likely due to its extreme proximity to roads and a major commercial development. The areas of most concern, unsurprisingly, are near major cities. The entire southern region of Oahu, where Honolulu and Pearl Harbor are, are subject to the highest vulnerability of local extinction where wetlands exist.



Conclusions

Overall, more data needs to be collected in order to accurately and effectively analyze the vulnerability of wetlands to local extinction of Hawaiian Gallinules. I only used data from 14 ponds, which is not a proper sample size for analysis. In further analyses, it would be valuable to include more habitat-level factors, such as vegetation type, presence of predators, etc. However, this analysis did illuminate areas of concern for management on Oahu.



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Sources: ESRI, US Census Bureau 2015, NOAA 2015, Tufts GIS

Projection: NAD1983 StatePlane Hawaii 1

