OHA STRATEGIC ALIGNMENT

Mo‘omeheu ‘Āina

Ke Ahupua‘a o Mākua IV
The Land Division of Mākua IV

Mahele IV: Ka Wā ‘Ānō (Part IV: The Present Time)

FIGURE 1. . *Nā Kao o Mākua.* Akana (2022)

In 1964, the State of Hawai‘i’s Board of Land and Natural Resources leased Mākua to the U.S. Government for a 65-year term. That lease is set to expire in 2029. In the meantime, the Army is preparing to renew its lease. It must prepare an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) of 1969 which it agreed to do in 2001. Advocacy groups such as Earthjustice and Mālama Mākua are also preparing their own statements and actions in opposition of the renewal.

Native Flora and Fauna

Obata and Warschauer (1972, pp. 2-16) found rare and endangered species of flora in Mākua: 163 plants were endemic, 32 were indigenous, five were introduced by Polynesians (e.g. kukui), and 139 plants introduced after 1778. Of the endemic species, 22 were listed as Endangered and Threatened Wildlife and Plants (Fed. Regis. 1976).

The grassland habitat of Mākua was found to be suitable for pueo (Hawaiian owl) should they populate the valley again (E.I.A. Dept. of Army, 1976). Pueo are diurnal creatures that nest on the ground unlike the barn owl that are nocturnal and nest in tree hollows, cliffs, and buildings. As result of their nesting habits, pueo eggs and young are highly susceptible to predators such as rats, mongooses, cats, and dogs. However, it is probably the noise from the bombs and other munitions that drove pueo away when military training occurred.

SUGGESTED CITATION:
Akana, K. (2022). Ke ahupua‘a o Mākua IV: Ka wā o nā mākua. Office of Hawaiian Affairs Research Program.

OFFICE OF HAWAIIAN AFFAIRS

In a 1975 survey of ʻelepaio (flycatcher) in Mākua, 3,343 of them were sighted. The most populated area on Oʻahu was the Waiʻanae Mountains with a total of 5,857. In the 1900s, the population of ʻelepaio in Mākua dropped to 19. By 2012, 77 were spotted, an increase of over 305% over two decades of military inactivity (Vanderwerf et al., 2011, p. 605).

FIGURE 2. ʻElepaio. Digital sketch of photo by Eric Vanderwerf.

Older surveys of Mākua revealed the presence of kāhuli (land shells) at the top of Kaʻala, the highest elevation on Oʻahu at the head of the valley. Bishop Museum malacologist, Dr. Yoshio Kondo wrote:

> The whole valley [Makua Valley] was lantana and guava overrun by cattle. This was in September 1941, before World War II. McCandless had a ranch there for many years.
>
> We were looking for the remains of the native forest, but were not hopeful. We concluded that if we went up some of the canyons on the right of the valley, we'd find something, and it turned out that we did find a grove of kukui trees and a small cave (about 12 to 15 feet deep).
>
> Under the bark of the kukui trees at eye level were *Portulina dubia*. Under rocks at the mouth of the cave were *Endodonta sp. Portulina dubia* was rare at that time, and by now may have completely disappeared. *Endodanta* was difficult to find, and that's why we were so pleased to find them. (In Kelly & Quintal, 1977, p. 104)

The State of Hawaiʻi's Snail Extinction Prevention Program (SEPP) coordinates with the Department of Land and Natural Resources, U.S. Fish and Wildlife Service, the Oʻahu Army Natural Resources Program, UH Mānoa, and Bishop Museum to prevent the extinction of native snails. It manages a captive-breeding laboratory and five predator-free environments on Oʻahu of which four are located in the Waiʻanae Mountains. At one of these sites in the Waiʻanae Mountains, 30 ground-dwelling snails of the *Amastridae spirizona* species were introduced in 2015. Two years later, the population tripled (Tani, 2017, p. 2). SEPP coordinator David Sicho noted that "the snails inside [the enclosures] have survived and thrived, while the snails outside are all gone" (p. 9).

Mālama Mākua

Mālama Mākua describes itself on its website as "a Kanaka Maoli-led non-profit organization with a mission to bring about the return of sacred Mākua from US military for culturally appropriate use.

https://www.malamamakua.org/

FIGURE 3. Mālama Mākua elder and cultural practitioner Leandra Wai conducting a ceremony

It was not until 1998 that any environmental assessments were considered for Mākua. That year, Earthjustice, on behalf of Mālama Mākua, compelled the military to conduct a review of their impacts to Mākua under the National Environmental Policy Act (NEPA) of 1969, whose basic policy is to assure that all branches of government give proper consideration to the environment prior to undertaking any major federal action that significantly affects the environment. Earthjustice also took action against the Army to enforce the Endangered Species Act. Training stopped in 1999 until the Army conducted an environmental review of the impacts of military training under NEPA. In an initial 2000 environmental assessment, the Army claimed no harm was done but withdrew the report. Evidently, part of the report included findings by the U.S. Wildlife and Fisheries Service that listed 29 species that were "likely to be jeopardized" by military impacts (Earthjustice, 2014). Earthjustice brought another lawsuit on behalf of Mālama Mākua, which challenged the Army's failure to conduct the comprehensive review of environmental and cultural impacts. The State of Hawaiʻi District Court allowed a preliminary injunction against the Army, which prevented live-fire training.

In 2001, the Army settled and agreed to cease live-fire training at Mākua while it completed its Environmental Impact Statement (EIS) under NEPA. In the agreement, the Army would address existing and potential impacts to the unique biological resources of Mākua Military Reservation as well as potential soil, air, ground water, and surface water contamination associated with livefire training (Earthjustice, 2001). To date, the Environmental Impact Statement has not yet been completed by the Army.

Fire

FIGURE 4. July 24, 2010 fire at Mākua.

The fire burned 486 acres and impacted three endangered plant species: the Chamaesyce celastroides, or akoko; the Nototrichium humile, or kului; and the Melanthera tenuifolia, or nehe (Gardin, 2019).

The Environmental Impact Assessment (EIA) of 1976 found that fires in Mākua were set intentionally to create fire breaks or to clear areas for roads, firing positions, and a helicopter landing pad. Unintentional fires were set by explosives and tracers (p. 9). According to State of Hawai'i District Forester Herbert H. Kikukawa "the problem of fires in Makua Valley is the fact that the Army has practically no fire control measures, except reliance on suspending firing during high fire danger" (Kikukawa memo, 1976, Nov. 19,). In addition, several factors increased fire risk, such as minimal rainfall and the growth of highly flammable grasses introduced for grazing. The steep terrain also encouraged flames to climb while making fires impossible to fight. Kikukawa commented to a news reporter:

Five years ago those ridges [in Mākua and Kahanahāiki] were forested, much like what is on the forest reserve side...Now, the grass is working its way up the valley each time there is a fire and creates fuses for bigger fires to come. (Bakutis, 1976)

TABLE 1. Fire damage in Mākua.

Fire Incidents	Acres Burned
August 1970	1,525 acres
November 1974	270 acres
December 1974	53 acres
March 1975	370 acres
June 1975	95 acres, Keawa'ula
July 2010	486 acres

As fires spread, so do the invasive, flammable grasses that further threaten native flora. Obata and Warschauer (1975) found that the March 1975 fire spread quickly because of the flammable molasses grass but that the presence of kukui and waiawī trees slowed the fire down. As a result, the forestry division suggested, in addition to a firebreak road, that kukui, waiawī, and other hardy Hawaiian plants such as 'ūlei, 'ākia, 'a'ali'i, and ko'oko'olau be planted as they are not as flammable and will help to stop erosion (Obata report, 1975 Aug. 26; Lamoureus et al., 1975). Earlier, Smith (1922) had also suggested "replanting the highly flammable molasses grass with Native trees and shrubs; and taking readings and stationing stand-by firefighting equipment on high danger days"(p. 20).

In the 1970s, helicopters continued to fire rockets into the upper areas of Mākua. Stray rockets, as well as the type of fuse called the "lucky gray crystal," were especially likely to cause fires. In January and February 1977, the Army bulldozed the valley to make a firebreak, which began near the highway, proceeded up into Ko'iahi Gulch, then turned in towards the central valley where the military training area was. Unfortunately, full-grown trees of the upper forest were mowed down, and the streambed and several historic sites were destroyed (Kelly & Quintal, 1977, pp. 101-102).

Goats

In addition to cattle that were introduced by early ranchers in the mid 1800s, goats and pigs have threatened and greatly reduced the native ecosystem of Mākua. They graze and forage on almost any type of vegetation, including native grasses, shrubs, and small trees, which often leads to overgrazing and other impacts to the ecosystem (Campbell and Donlan, 2005). These impacts include the loss of biodiversity, erosion, and colonization by non-indigenous weeds, which ignite easily and widen the range for invasive species.

The goats of Mākua, in particular, have adapted more easily as they have "a very efficient digestive system, a low metabolic rate, and can tolerate arid environments which allows them to thrive in habitats unsuitable for many other animals" (Silanikove, 2000 , as cited in Burt & Jokiel, 2011). Goats can also be found in steep terrain, further threatening rare and endangered plants who have no natural defenses against herbivores (Vitousek, 1988; Primack, 1992; Paulay, 1994).

To deal with the feral goat problem, the O'ahu Army Natural Resource Program (OANRP) was assigned the task to remove the animals. For a two-year period from December 1995 to February 1997, local hunters, contracted by the U.S. Department of Agriculture Wildlife Services, eliminated the goats. Aerial hunting was introduced in the 2000s

and found to be effective in targeting goats in terrain unreachable by the ground hunters. In addition, snares were placed in steep areas (Burt & Jokiel, 2011, p. 281). In terms of efficiency (man hours spent per goat), snaring proved to be most efficient as a snare worked 24-hours. Snares were also cost effective in controlling feral pigs (p. 283).

Transects were established to monitor the goats' patterns of movement along trails and signs left behind (e.g., scat). In addition, Judas goats were outfitted with transmitters to give away the location of goatherds. Unfortunately, this method did not work as the domesticated goats got herded and shot, snared, or escaped. The steep terrain made verification difficult too. While the eradication efforts were ongoing, a fence was constructed to isolate goat populations and prevent migrations into Mākua Military Reservation.

Rodents

Introduced non-native rats, like the invasive goats and pigs, have had pronounced effects on the flora and fauna of Mākua. Shiels et al. (2014) found that "In contemporary Hawaii, rats (probably *R. rattus*), not pigs or mice, were found to rapidly remove *Pritchardia affinis* and *P. hillebrandii* fruits (> 50% removed within 6 days; > 80% within 22 days) from the forest floor" (p. 4). To address the rat problem, the United States Army at Mākua Military Reservation is required to stabilize endangered species per the Biological Opinions (2007-2208) issued by the U.S. Fish and Wildlife Service and locally, by the O'ahu Army Natural Resource Program (OANRP). In Mākua, the OANRP has been eradicating rodents since 1995 using snap traps, automatic traps, physical barriers and diphacinone rodenticide, the only rodenticide approved for conservation areas.

The importance and effectiveness of stabilization efforts was demonstrated at the OANRP site on the ridge separating ʻŌhikilolo and Mākua, where a large stand of loulu palm (*Pritchardia kaale*), whose nuts are especially attractive to hungry rodents, was revitalized. The juvenile loulu population rose from 0 to 1,600 once goats were removed and rat suppression was in place.

In isolated forests, such as those at the Mākua Military Reservation, black rats and Pacific rats are known to prey on native species (Shiels et al., 2013) including endangered birds (VanderWerf, et al. 2001), snails like the kāhuli (Hadfield et. al., 1993), and plants (Pender et al., 2013). The Mākua forests are mesic forests known to have the most diverse ecosystems in Hawaiʻi (Shiels et al., 2019, p. 226). OANRP efforts to suppress rodents are especially important because the more dominant black rat was found to be especially damaging to native forests (Shiels et al., 2014).

FIGURE 5. *ʻŌhikilolo and Mākua ridge. OANRP treatment site.*

The OANRP began a study on the effectiveness of various treatments of rodent suppression on Dec. 9, 2015. The study took place on the ʻŌhikilolo Ridge overlooking Mākua. A control site, Kapuna, was used to study the effects of no treatment. The study was to determine if two treatments were effective at suppressing commensal rat and mouse activity: (1) rat trapping using Victor snap tarps and A24s; and (2) hand broadcasting of Diphacinone-50, a conservation rodenticide.

Tracking-tunnels were all placed on the same day to monitor rodent activity at the treatment site and at Kapuna. At the treatment site, rodent presence was calculated at an average of 5.6% over period of a year. At Kapuna, the reference site, the average presence was 87.4%. The conservation rodenticide had no effect on the rodent population but did reduce the mouse population for 1.3 months (Shiels, 2019, p. 231). Rat trapping year round was not effective, however, in Kahanahāiki.

Slugs

FIGURE 6. Lowland mesic forest. Source: http://www.hawaiiecoregionplan.info/LMsystem.html

Slugs are not native to Hawai'i, however, over a dozen slug species are now established (Cowie 1997, 1999). Joe and Daelher (2008, p. 245) reviewed Rare Plant Recovery Plans issued by the U.S. Fish and Wildlife Service for Hawai'i and found that slugs were threats, or potential threats to 59 rare plant species. The two researchers conducted a study to assess the impact of slugs on the growth of two endangered plant species *Cyanea superba* or hāhā and *Schiedea obovata*; one non-endangered native species (*Nestegis sandwicensis*); and two invasive plant species (*Psidium cattleianum* or strawberry guava and *Cildemia hirta* or miconia). They hypothesized that the non-native slugs would have the largest impact on endangered species such as hāhā, a lobelia or *Schiedea obovate* (no known Hawaiian name).

The study took place in the Kahanahāiki Management Unit (KMU). Joe and Daehler (2008) noted the absence of goats and pigs due to the construction of fences mentioned earlier in this section. They also noted the presence of rat traps as mentioned in Shiels et. al (2019, 2014, 2013) and the use of rodenticide seasonally in KMU (Akau et al., 2006). These invasive species have threatened other native species throughout Mākua.

Hāhā and *Schiedea obvata* seedlings for the experiment came from Lyons Arboretum in Mānoa, and the other species were found in the KMU area. At the end of the experimental period, the two endangered species had high survival rates in slug-excluded areas but the highest final mortality rates for seedlings in slug-exposed areas (Joe & Daehler, 2008, p. 251). Thus, the hypothesis that the endangered and endemic species are more vulnerable to slug damage was found to be true. The implications of the study are relevant for rare plant restoration efforts in that "outdated seedlings that are unrotected from slug predation may suffer from high mortality" (p. 253).

FIGURE 7. Hāhā *(Cynea superba).*

FIGURE 8. Kāhuli. A digital sketch of photo by David Sicho.

FIGURE 9. *Schiedea obovate*

Cultural Access

In addition to the 2001 agreement by the Army to complete an EIS, there was a stipulation granting daytime access of cultural practitioners to Mākua Military Reservation a minimum of two days a month for cultural purposes and a minimum of two times a year to camp overnight for cultural observances.

In 2016, Earthjustice took the U.S. Army back to court for violating the cultural access rights agreed to in the 2001 settlement (*Mālama Mākua v. Rumsfield*, 2001). Mālama Mākua had been accessing those rights until 2014 when the Army cut off access due to a need for a National Historic Preservation Act Memorandum of Agreement (MOA) to continue grass cutting leading to cultural sites so that unexploded ordnance could be avoided. The MOA was obtained in 2015 but access not allowed to resume. The 2001 agreement provided for redress if the Army did not honor its obligations to provide access to the cultural sites (Earthjustice, 2016).

According to the latest agreement, the Army must "also look into removing ordnance from two other cultural sites, a process that could take up to three years" (Lovell, 2018). The Army requested three years because it may not know where the locations of unexploded ordnance might be.

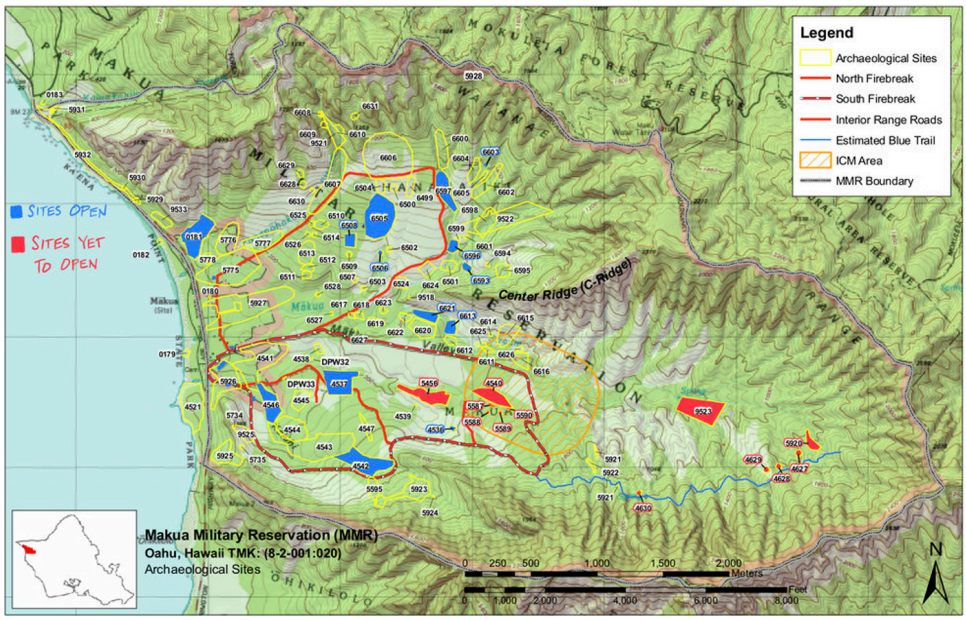

FIGURE 10. Mākua sites open (in blue) to public for cultural access.

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