



**East Molokai Watershed Partnership**  
**2030 Management Action Plan**  
Fiscal Years 2021-2030 (July 2020-June 2030)



The East Molokai Watershed Partnership  
Coordinated by The Nature Conservancy Molokai Program  
May 15, 2020



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## I. Executive Summary

The East Molokai Watershed Partnership (EMoWP) **2030 Management Action Plan** (2030 Plan) reports on past management accomplishments and projects future management strategies, actions and costs for Fiscal Years 2021 to 2030. The 2030 plan is prepared by The Nature Conservancy's Molokai Program, which also coordinates the EMoWP. The East Molokai Watershed Partnership was made formal through a *Memorandum Of Understanding* (MOU) that was signed by fourteen partners in 1999 and later amended in 2003. In 2013, the EMoWP expanded to the "East Slope" with the initial signing of nine new landowner partners. The plan is guided by the decree of the EMoWP MOU.

### A. **Mission** as stated in the EMoWP MOU, 2003 (*Appendix 7*)

- ❖ WHEREAS, East Moloka'i's native ecosystems are important to the water resources for the island of Moloka'i; and
- ❖ WHEREAS, active management is needed to maintain a healthy watershed in order to sustain the future quality and quantity of Moloka'i's water supply; and
- ❖ WHEREAS, active management of these watersheds would also benefit Hawai'i's native flora and fauna; and
- ❖ WHEREAS, the Hawaiian concept of the ahupua'a acknowledges that all parts of a watershed, from the mountains to the sea, are interconnected, and that activities carried out in one portion of a watershed can affect the rest of the watershed; and
- ❖ WHEREAS, active management of the East Moloka'i watershed is also important to the programs of each of the PARTNERS; and
- ❖ WHEREAS, the lands managed by some of the PARTNERS share common boundaries; and
- ❖ WHEREAS, many of the threats to the forested watershed, such as feral ungulates, fire, insects, diseases, and invasive non-native plants, occur across these common boundaries; and
- ❖ WHEREAS, significant economic and staffing advantages will accrue to the PARTNERS if the management of these threats is shared; and
- ❖ WHEREAS, effective management is best achieved through the coordinated actions of all major landowners in the watershed.

NOW, THEREFORE, the PARTNERS hereby agree in principle as follows:

1. To develop jointly, where appropriate, watershed management plans for areas within the East Moloka'i Watershed Partnership, **that will document resource values and identify priority watershed management objectives and strategies** within the areas included in the Partnership.

## **B. Landowner Partners – See Maps on pages 9-12**

### **South Slope – Managed directly by TNC**

**The Kapualei Ranch** is 1,680 acres comprised of a series of steep gulches and ridges. The steep gulches and ridges culminate at the highest peak on Molokai, Kamakou (4974'). The upper montane mesic and wet forest systems of Kapualei remain largely intact and are about 630 acres. The Kapualei Ranch is owned by the Austin Estate. A botanical survey was conducted in 2002 and the plant checklist is attached (See Appendix 6).

**The Kamalō Ahupua'a** is approximately 3,500 acres. Kamalō's most prominent feature is the Kamalō gulch, ruggedly beautiful and the location of the famous waterfalls--Hina, Haha and Mo'oloa. The approximately 700 acre upper montane mesic and wet forest systems are similar to Kapualei. Kamalō is owned by Kamehemeha Schools.

**Kawela Plantation's** "Common lands" is the single largest parcel of the EMoWP at 5,500 acres. At one time, the Molokai Ranch owned about 90% of the Kawela Ahupua'a. The Kawela Ahupua'a has very similar natural community types to Kamalō and Kapualei.

In ancient times, Kawela was once a thriving village. With the rich near shore reefs and abundant springs, Kawela was able to support an entire community, from royalty to commoners. Molokai's main city of refuge (Pu'uhonua) is located at Kawela. Catherine Summers' 'Molokai, A Site Survey' points out that there were other inland ponds in the area like Uluanui which functioned as wetlands, similar to Kākahai'a Pond, a US Fish & Wildlife Refuge at the coast.

In 1981, Hawai'i State Senator Wadsworth Yee developed the 5,930 acre Kawela Plantation using the "ahupua'a" model. With two hundred ten, 2-acre agricultural lots, in the lower elevation, the upper 5,500 acres of the property are designated "common lands." Approximately half of the 210 lots have homes on them. Each lot owner enjoys common ownership and access to the "common lands," which are used primarily for hunting and hiking and make up the Kawela Plantation Homeowner's Association (KPHA). A private water system with five wells serves the Plantation.

**Kamakou Preserve** is approximately 2,700 acres and was established through a perpetual conservation easement in 1983, between The Nature Conservancy and the landowner (Molokai Ranch). The easement allows the Conservancy to protect the intact watershed, comprised of native Hawaiian montane wet and mesic forest systems, while the Ranch retains its surface water rights. The Pēpē'ōpae and Pu'u Ali'i bogs are unique vegetation types occurring within the forest systems of Kamakou. The Kamakou Preserve is funded through the State's Natural Area Partnership Programs (NAPP), a 2:1 matching grant. The NAPP grant also allows Conservancy staff to work outside the Preserve's boundaries to remove threats in adjacent lands that will affect the Preserve's native resources. The Preserve is considered part of the State designated Molokai Forest Reserve and access is open to the public.

### **East Slope land Partners – Managed directly by TNC**



**The Thacker Corporation** owns approximately 200 acres of the **Ka'amola Ahupua'a**. Ka'amola is a low elevation ahupua'a with 33 acres above the Forest Reserve boundary line. The mauka lands in the ahupua'a support some mesic native forest, but, more importantly, connect native forests in the adjacent ahupua'a of Pua'ahala and Keawanui.

**The Keawanui Ahupua'a** at approximately 600 acres, is owned by Kamehameha Schools - a founding partner of the EMoWP. The restored Keawanui Fishpond, taken care of by 'Aina Momona, is located in the ahupua'a, makai of the highway. Approximately 192 acres exist above the Forest Reserve boundary line, a majority of which is covered in wet and mesic native forest.

**The West 'Ohi'a Ahupua'a** is noted for its steep valley walls. Roughly 170 acres of the ahupua'a are above the Forest Reserve boundary line. These mauka lands are owned by the Pedro family. A number of rare plant species were found during ground surveys in the area, which is a trend that is anticipated to continue for the East Slope.

**The Pua'ahala Ahupua'a, East 'Ohi'a Ahupua'a, 'Ualapu'e Ahupua'a, Pūko'o Ahupua'a, Honouliwai Ahupua'a, and Keopukaloa Ahupua'a** are partially or fully owned by the State of Hawai'i. Above the Forest Reserve boundary line, these parcels, with the exception of Keopukaloa, are part of the State designated Molokai Forest Reserve and are under the authority of the State's Division of Forestry and Wildlife (DOFAW). Keopukaloa is under the authority of the State's Department of Land Management. The DOFAW-managed portions of Pua'ahala Ahupua'a, East 'Ohi'a ahupua'a and 'Ualapu'e ahupua'a are within the Pāku'i Unit.

The many steep ridges and valleys of the **Manawai Ahupua'a** culminate in Pāku'i Peak, the highest point in the East Slope and namesake of the Pāku'i Unit. Manawai is also noted for the exceptional complex of heiau located in the lower elevations of the ahupua'a near the highway. Vernon Suzuki owns 508 acres of Manawai, which includes all mauka lands containing native habitats.

**Kalua'aha Ranch** contains approximately 700 acres above the Forest Reserve boundary line. These mauka lands of Kalua'aha represent the eastern boundary of the Pāku'i Unit and consist largely of native wet montane and lowland mesic forest. The Dunnam Family owns and manages Kalua'aha Ranch and are working toward a Conservation Easement with Molokai Land Trust to protect these native resources in Kalua'aha.

**The Mapulehu and Puna'ula Ahupua'a** are principally owned by 'Ilima Molokai Limited Partnership. The large ahupua'a of Mapulehu in addition to the smaller, adjacent 'Ili of Puna'ula total 1,159 acres above the Forest Reserve boundary line. Together these parcels represent the largest land holding in the East Slope. While the Mapulehu Valley floor has been heavily impacted and consists mainly of non-native vegetation, the valley walls and upper ridges have not been as heavily impacted.

**The Honomuni Ahupua'a** is approximately 763 acres with roughly 400 acres above the Forest Reserve boundary line. The native ecosystems in Honomuni consist of mesic and wet forest, largely concentrated between 1,400 to 2,500 ft. elevations rather than near the summit. The adjacent ahupua'a of Kawaikapu, Kainalu and Pūniu'ōhua follow this same forest pattern, which

is likely a result of increased browsing by feral ungulates near the summit where the terrain is less steep and divided. The Ambrose Hutchison Estate owns these Honomuni lands and 100 acres above the Forest Reserve boundary line in the adjacent ahupua'a of Kawaikapu.

**The Molokai Land Trust** owns approximately 200 acres of the **Kawaikapu Ahupua'a**, directly below the Ambrose Hutchison Estate's Kawaikapu parcel. The mission of the Molokai Land Trust is to protect and restore the land's natural and cultural resources of Molokai, and to perpetuate the unique Native Hawaiian traditions and character of the island for the benefit of the future generations of all Molokai, particularly Native Hawaiians.

**The Kainalu and Pūniu'ōhua Ahupua'a** account for approximately 470 acres above the Forest Reserve boundary line. The mid to upper reaches of Kainalu contain native wet forest and two perennial stream systems. These mauka ahupua'a lands are owned by the Dunbar family.

### **North Slope – Managed by multiple partners**

**Kalaupapa National Historical Park (KNHP)** is located on the north central coast of the Island of Molokai, encompassing approximately 10,700 acres. The land portion of the park consists of 8,700 acres and includes a relatively flat peninsula, three deeply carved valleys (Waihānau, Wai'ale'ia, and Waikolu), steep cliffs (pali), and a strip of land along the rim of the cliffs. The park boundaries also stretch 0.25 miles offshore to include roughly 2,000 acres of water, as well as the islets of Huelo and 'Ōkala. Elevation throughout the park varies greatly, ranging from sea level to more than 4,222 feet above sea level. Most of the park is managed through formal cooperative agreements with various federal and state agencies, as well as private entities.

The North Shore Cliffs on Molokai is a National Natural Landmark established in 1972 - a federal designation identifying and encouraging preservation of pristine examples of ecological and geological resources representing the nation's natural heritage.

Kalaupapa NHP takes the lead on managing lower elevation park lands on the Kalaupapa Peninsula, Kūka'iwa'a, and adjoining valleys. Low elevation management targets include remnant summer-deciduous dry forest considered the only remaining windward coast example of this community left in the State. The coastal spray zone on the northeast shore of the peninsula is known as the best example of this vegetation type in the State. Restoration activities include the removal of weeds and the reintroduction of threatened or endangered plants. KNHP manages higher elevation forested lands primarily by assisting partners to achieve management goals held in common and defined in this document. Activities such as animal control, weed control, and fence construction take place within the 1,330 acre Pu'u Ali'i Natural Area Reserve within the park, and also beyond the park boundaries on partnership lands. Within the Parks rainforest, dry forest, coastal spray vegetation, and marine resources, Kalaupapa NHP includes over 30 threatened or endangered plants, insects, birds and other terrestrial or marine wildlife. These natural resources are monitored using protocols designed to measure the "pulse" of the ecosystems encompassing important communities and populations of rare plants, wildlife, and insects. Protocols include: vegetation mapping, plant community monitoring, early detection of weeds, stream and water quality monitoring, marine benthic monitoring, marine

fish community monitoring, and others. The eastern end of the park contains the park's sole perennial stream, Waikolu Stream. The stream provides habitat for all five native Hawaiian amphidromous fish, with high densities of Hawaiian stream gobies and continued presence of the stream snail, *Neritina granosa* or hīhīwai, now uncommon or absent from most streams in Hawaii due to overfishing or other causes. The park's 2,000 offshore acres contain important marine and terrestrial resources. The water quality of this area is very high and supports a varied fish and wildlife population including sea turtles, cetaceans, and the Hawaiian monk seal.

The Pu'u Ali'i Natural Area Reserve (NAR) is managed by the State of Hawai'i DLNR, Division of Forestry and Wildlife, Native Ecosystems Protection and Management (NEPM) according to Hawaii Administrative Rules (HAR) Title 13, Chapter 209;

The Molokai Forest Reserve is managed by the State of Hawai'i DLNR, DOFAW. Management of this system is guided by HAR Chapter 104 and Hawaii Revised Statutes (HRS) Chapter 183; The two islets (Huelo and 'Ōkala) off the coast of Kalaupapa NHP are designated as State Seabird Sanctuaries, owned by DOFAW, but co-managed by NPS. HAR Title 13, Chapter 125 protects wildlife and plants and restricts human activities in seabird sanctuaries; The 234 acre Pālā'au State Park provides a scenic overview of Kalaupapa NHP. This area is administered by the State of Hawai'i DLNR, Division of State Parks (Division of State Parks 2008).

**Pu'u Ali'i NAR** - This Division of Forestry and Wildlife/NEPM reserve, is located in the mountains of northern Molokai. It is a wet summit plateau incorporating 1,300 acres of wet forests, mixed fern and shrub montane cliff communities, wet shrublands, and Hawaiian intermittent stream communities. Pu'u Ali'i reserve lies between Pelekunu and Waikolu Valleys. It is an important part of the Molokai watershed and contains forest bird habitat, houses 10 native animals, seven of which are rare and 157 plant taxa, of which at least 37 are rare species.

**Oloku'i NAR** – The Oloku'i NAR of the Division of Forestry and Wildlife/NEPM encompasses 1,620 acres of an isolated, cloud-shrouded mountain plateau with slopes extending down to sea cliffs. The reserve is one of the few areas left undisturbed by feral ungulates. It is an isolated plateau set between two of Molokai's largest and most undisturbed stream systems. Helicopter surveys continue to confirm that the plateau of Oloku'i remains one of the few rain forest areas in the state still free from feral ungulates. NEPM staff continue to visit Oloku'i and confirm it is still exceptionally intact, with examples of native communities and essential forest bird habitat. They have also reported the presence of rare snails, insects and vegetation. Oloku'i houses 150 native plant species, 33 rare, and contains at least nine animal taxa, six considered rare.

**Molokai State Forest Reserve (Wailau Section)** at approximately 5,770 acres, was included in the 1912 proclamation of the Molokai Forest Reserve. This parcel is owned and managed by the State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), Maui Branch. This section of the forest reserve, which encompasses Wailau Valley is bordered by DOFAW's Oloku'i NAR and The Nature Conservancy's Pelekunu Preserve to the west and Pu'u O Hōkū Ranch to the east. The upper reaches of Wailau Valley are primarily comprised of intact native forests and plans to manage these upper reaches for zero tolerance of ungulates are being proposed. DOFAW is conducting ongoing control work within the lower portions of Wailau Valley for weed species such as *Clidemia hirta*, Kahili Ginger, African Tulip and Australian

tree fern. Public access to Wailau Valley is limited to small marine crafts (north shore) and foot traffic (south shore) due to its remote location.

**Pelekunu Preserve** was purchased in 1986 by The Nature Conservancy from a number of private land owners (primarily Molokai Ranch Ltd.) This 5,759-acre Preserve in the Northeast sector of Molokai encompasses the majority of Pelekunu Valley and also the adjacent Waiaho‘okalo Valley. Pelekunu Preserve contains one of Hawai‘i’s best and last remaining intact, perennial stream ecosystems. The Preserve is bordered by four other managed natural areas: state-owned Pu‘u Ali‘i and Oloku‘i Natural Area Reserves (NARs), and the Wailau Forest Reserve; Kalaupapa National Historic Park; and the Conservancy’s Kamakou Preserve (Map 4). These managed areas protect more than 22,000 acres of contiguous ecosystems that range from sea level to 4,970 feet in elevation. The topography of Pelekunu Preserve is spectacular, with 3,000-foot valley walls dissected by a series of convoluted streams and ridges. This isolated Preserve has no roads and only a few rough trails.

Pelekunu Stream systems are characterized by the presence of native diadromous species whose life cycle requires an oceanic phase. The stream and its tributaries contain a variety of native aquatic insects and healthy populations of four native gobioid fish species (collectively referred to as ‘o‘opu) and one hardy native Sleeper fish, ‘o‘opu ‘owau (*Eleotris sandwicensis*) that is not a true goby. The freshwater mollusk hīhiwai (*Neritina granosa*) and other native invertebrates including the shrimp ‘ōpae kala‘ole (*Atyoida bisulcata*), and the native prawn ‘ōpae ‘oeha‘a (*Macrobrachium grandimanus*) are found in the streams as well.

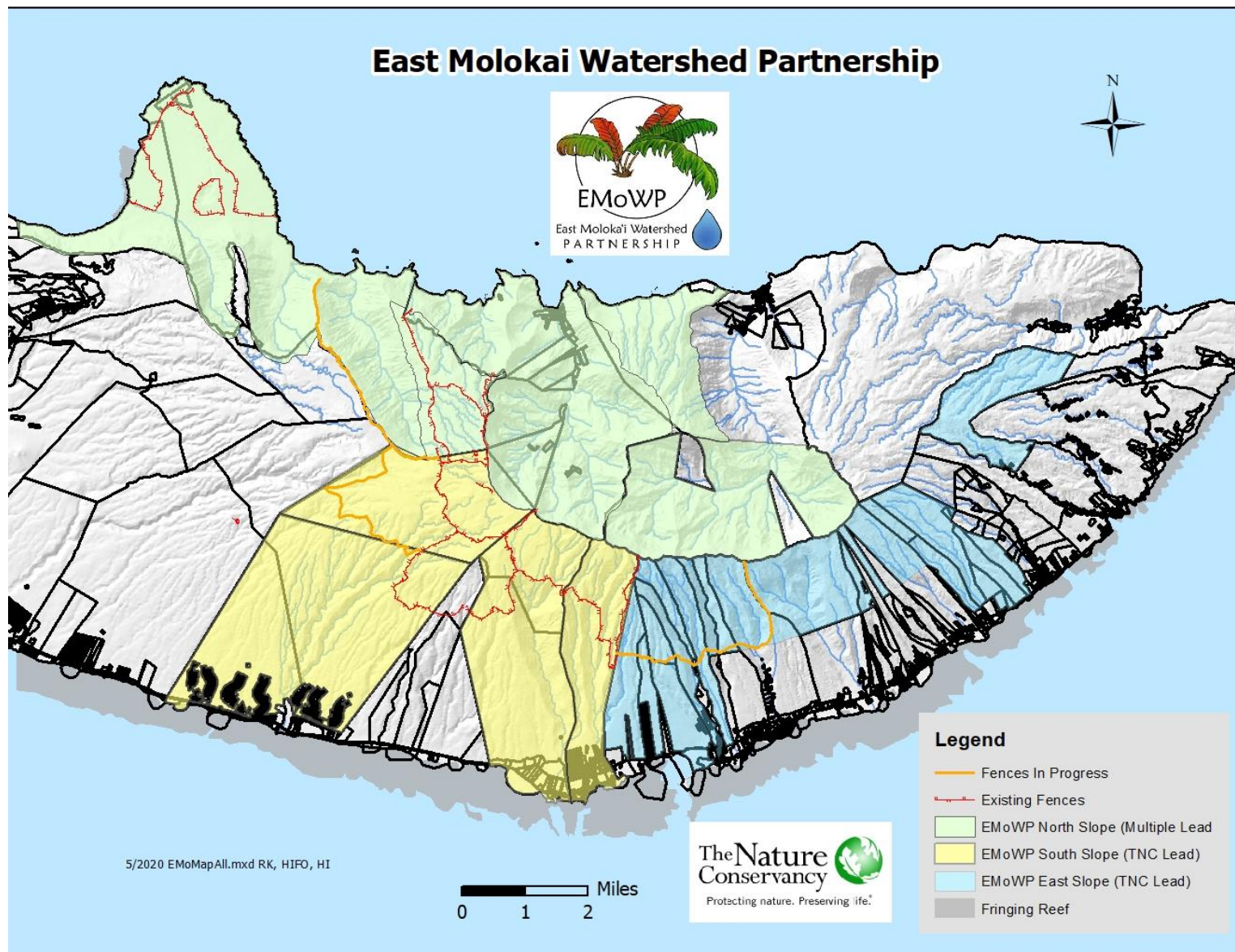


Figure 1-East Molokai Watershed Partnership Map



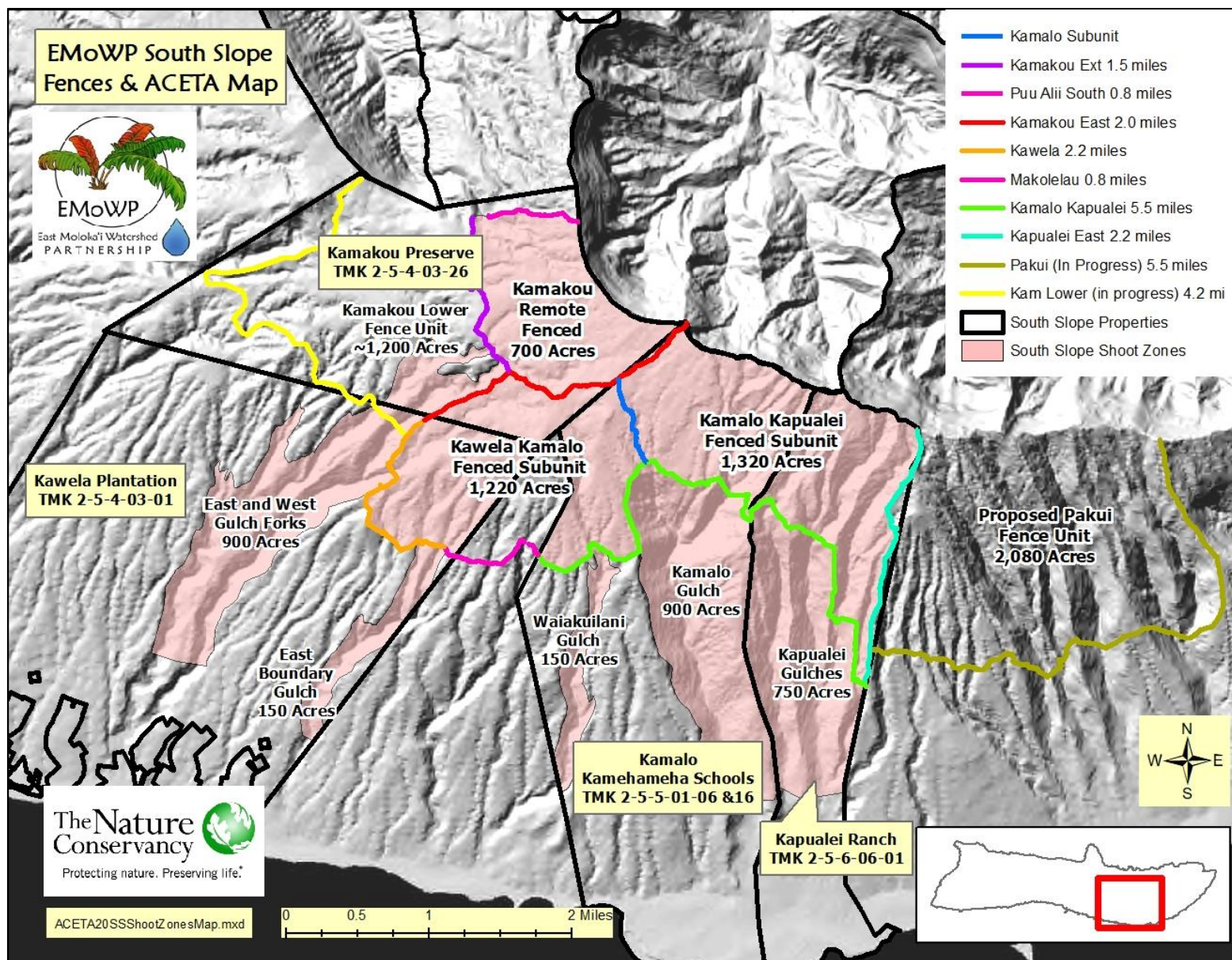
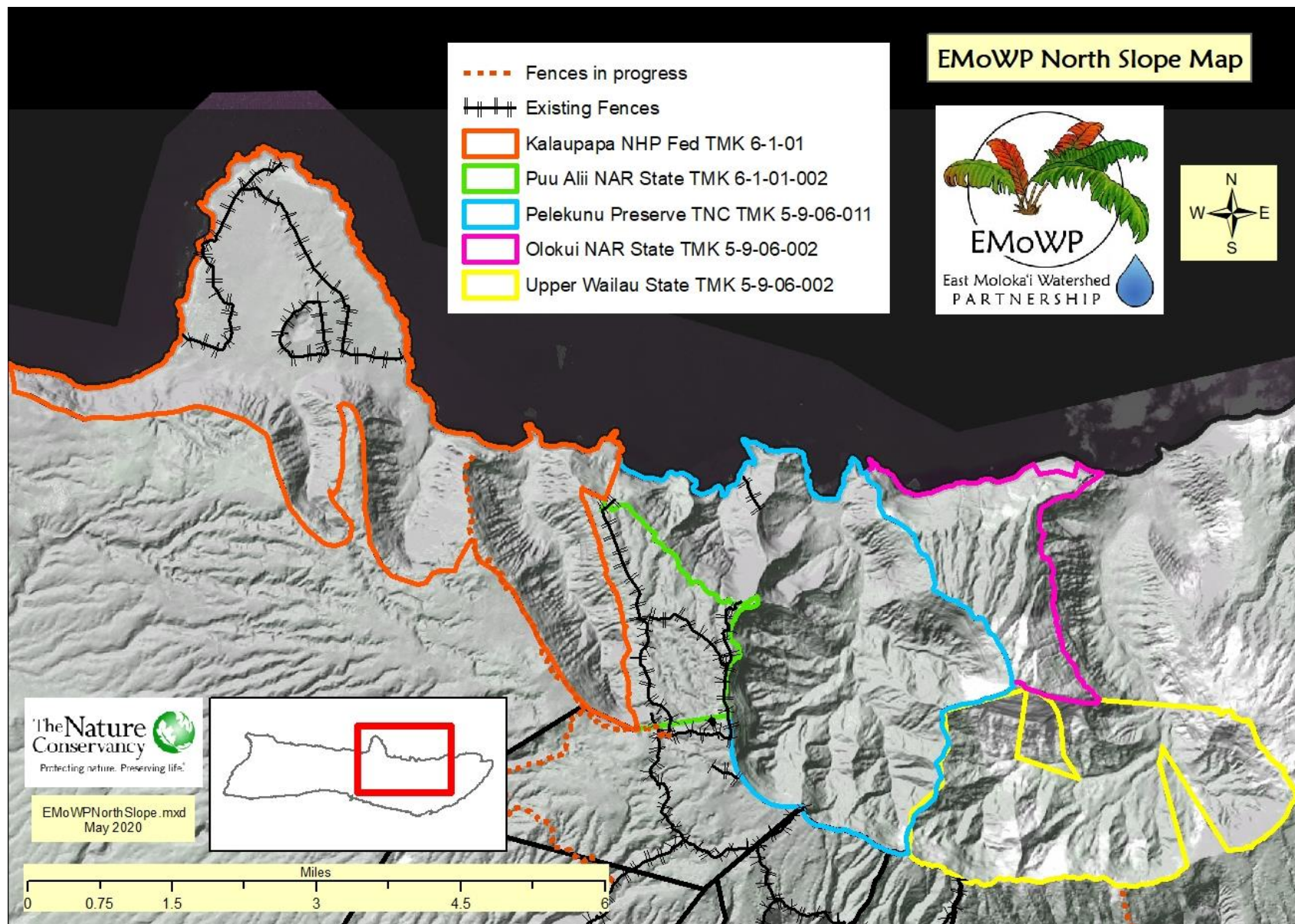


Figure 2- South Slope Fences and ACETA Map







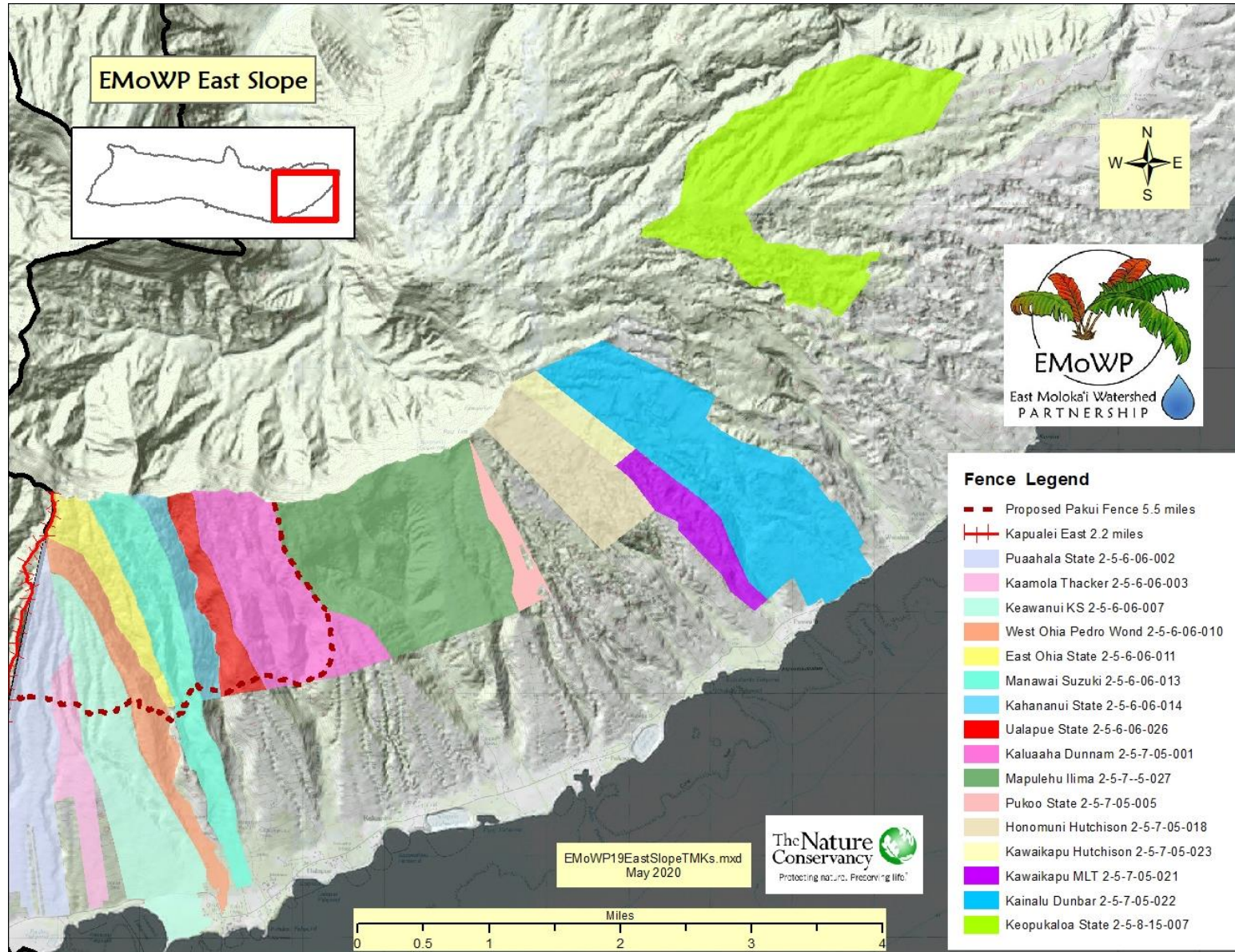
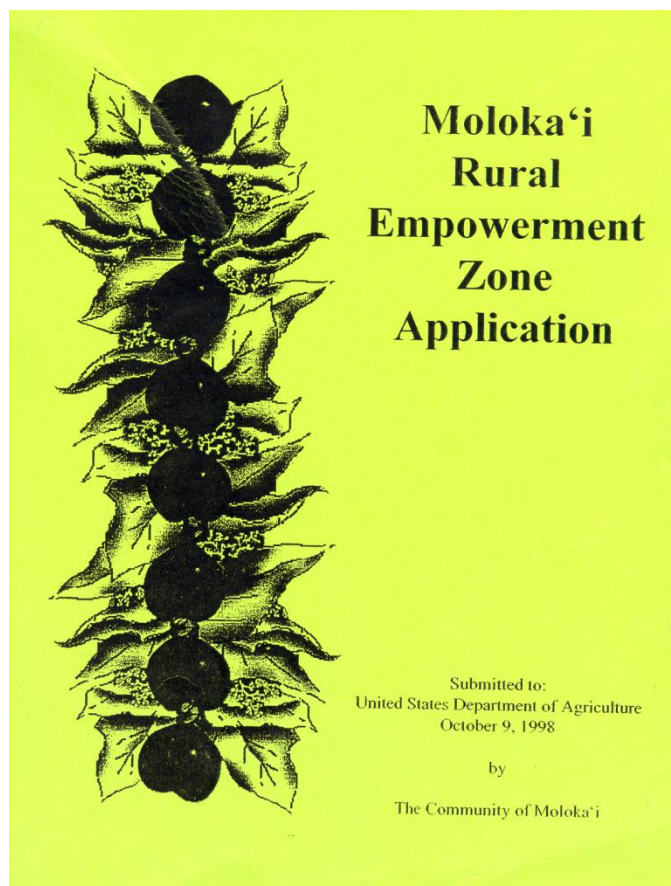


Figure 4- EMoWP East Slope Map

## C. Goals

1. Achieve Zero Tolerance (ZT) ungulate detection for all fenced units.
2. Propose and complete new fence projects to protect native forest systems.
3. Achieve 15% or less ungulate detection in predominantly native systems in unfenced units.
4. Continue ACETA Missions to maintain low goat populations and to increase vegetation cover in the middle elevation, denuded steep slope in designated areas.
5. Conduct priority weed detection and elimination in priority areas.
6. Support MoMISC to prevent, detect and eliminate incipient, invasive plant and animal species that may threaten the EMoWP landscape.
7. Support MoPEP or other rare plant restoration efforts to protect and enhance Molokai's rarest native plants from extinction.
8. Conduct regular threat and viability monitoring to summarize progress and continue or adjust management programs as needed to increase efficacy.
9. Support research that has conservation benefits (eg. USGS Ridge to Reef).
10. Facilitate fire pre-suppression and suppression activities that prevent and protect the EMoWP landscape from wildland fire (eg. Molokai Fire Task Force).
11. Conduct community outreach activities to enhance awareness, strengthen support and engage the Molokai community in EMoWP management actions.
12. Support/Facilitate the development of management plans and actions adjacent to the EMoWP priority areas that enhance the efforts of the EMoWP (e.g. Kawela Plantation Watershed Management Plan, Traditional and Customary Practices Report for Mana'e, Moloka'i).
13. Complete key acquisitions.

## II. Background



In 1998, the Conservancy proposed the Kamalō/Kapualei Watershed Project, which was voted as the top priority project by the Moloka'i Community for the USDA's Moloka'i Rural Empowerment Zone Application's strategic plan. The "EZ" application was awarded a ten year Moloka'i "Enterprise Community" (EC) designation in January of 1999. In November 1999, the EC played an instrumental role in the formation of EMoWP and became the first "community group" to formally sign into a Hawai'i Watershed Partnership. The Kamalō/Kapualei Watershed Project was subsequently awarded a \$100,000 grant for the project. The grant helped leverage an additional \$200,000 from Federal, State, County and private funds, and was used to build a 5.5 mile fence below the forest edge above the denuded landscape of Kamalō and Kapualei. The fence was completed in March of 2001 and the landscape above the fence showed immediate vegetation improvement, because

large goat herds no longer had free access to the higher elevation native forest systems. The funds also enabled the EMoWP to begin animal and weed control on private lands of the partnership.

In 2003, the MOU was amended to add Kawela Plantation, the single largest land holding, to the EMoWP. The current North Slope partners also signed into the EMoWP in 1999, making the EMoWP the first watershed partnership in the State to manage a coast to coast, north to south profile. In an effort to protect the remaining native forest of East Molokai, nine new landowners totaling 17 new watershed areas, were signed to the EMoWP and collectively called the "East Slope" in August of 2013. The 2013 Draft East Slope Watershed Start-Up Management Plan initially helped guide management strategies for the East Slope. Since 2013, the input gathered from stakeholders has been incorporated into EMoWP planning efforts, including this plan. The top priority for the East Slope is the native forests atop the ahupua'a of Pua'ahala to Kalua'aha, also called the Pāku'i Unit. Management actions for the Pāku'i Unit will take several years to implement and feedback from stakeholders has been supportive of an incremental approach, therefore, this plan doesn't pursue immediate action steps for areas east of the Pāku'i Unit.



## A. Native Biological Resources (Appendices 1-6)

From the Kamakou Preserve to Kalua‘aha, there are two major vegetation types that still exist in relatively healthy condition: montane wet forest and montane mesic forest and shrublands. Other vegetation community types, although greatly impacted, also include lowland dry forest and shrublands and lowland mesic forest and shrublands. In all of the land parcels, most of the rare taxa occurrences exist above 800 m elevation (2,624 ft) and within the above mentioned vegetation systems. There are 32 federally listed endangered plant species, five candidates for listing and 10 species of concern in the EMoWP areas. With only 15% of Molokai’s native terrestrial ecosystems remaining, the protection of these forest systems is vital to the health of these rare species as well as the Molokai community.



1) The **montane wet forest systems** that extend from Kamakou to Kalua‘aha are considered among the best remaining native Hawaiian forests in Hawai‘i.

These forest systems contain important habitat for rare plants, forest birds, tree snails and other native invertebrates.



2) The **montane mesic forest and shrubland systems** contain a diversity of taxa and represent a transition zone between the very wet and very dry systems. The lower elevational edge of these forest types has been impacted severely by wildland fires and feral animals.

3) Both the **lowland mesic and dry forest systems** were once very diverse and characterized by canopy ranging in height from 2 to 20 m tall. Now these systems are severely degraded and

confined to a few individuals or small patches in gulch bottoms and cliffs.



4) Historically, **lowland dry forest and shrubland systems** contained the greatest diversity of plant species, including trees, shrubs, woody lianas, and ferns.

5) **Perennial streams** are best expressed on the North Slope of the EMoWP. Wailau and Pelekunu are both Hawaiian continuous perennial streams that contain no diversions, and the entire stream flows continuously from the mountain to the ocean, with a healthy upper watershed at the source. These two streams are known as some of the best remaining streams in Hawai'i, containing the full complement of native stream species that have persisted to the present time. The native species which occur there, such as the hīhīwai, a native mollusk, native shrimp such as the 'ōpae and 'ōpae 'oeha'a, and the freshwater fish collectively called 'o'opu (families *Gobioidae* and *Eleotridae*) have a two-part life cycle (one part ocean, one part stream) that require these continuous streams so these species can reproduce.



Above: Hīhīwai (*Neritina granosa*), an endemic mollusk that thrives in fast moving, high-quality Hawaiian continuous streams. Photo by Kanoe Morishige, Sept 2013.



Above right: 'O'opu alamo'o (*Lentipes concolor*), an endemic fish that occurs in the upper reaches of high-quality Hawaiian continuous streams. Photo Sept 2009 by Russell Amimoto



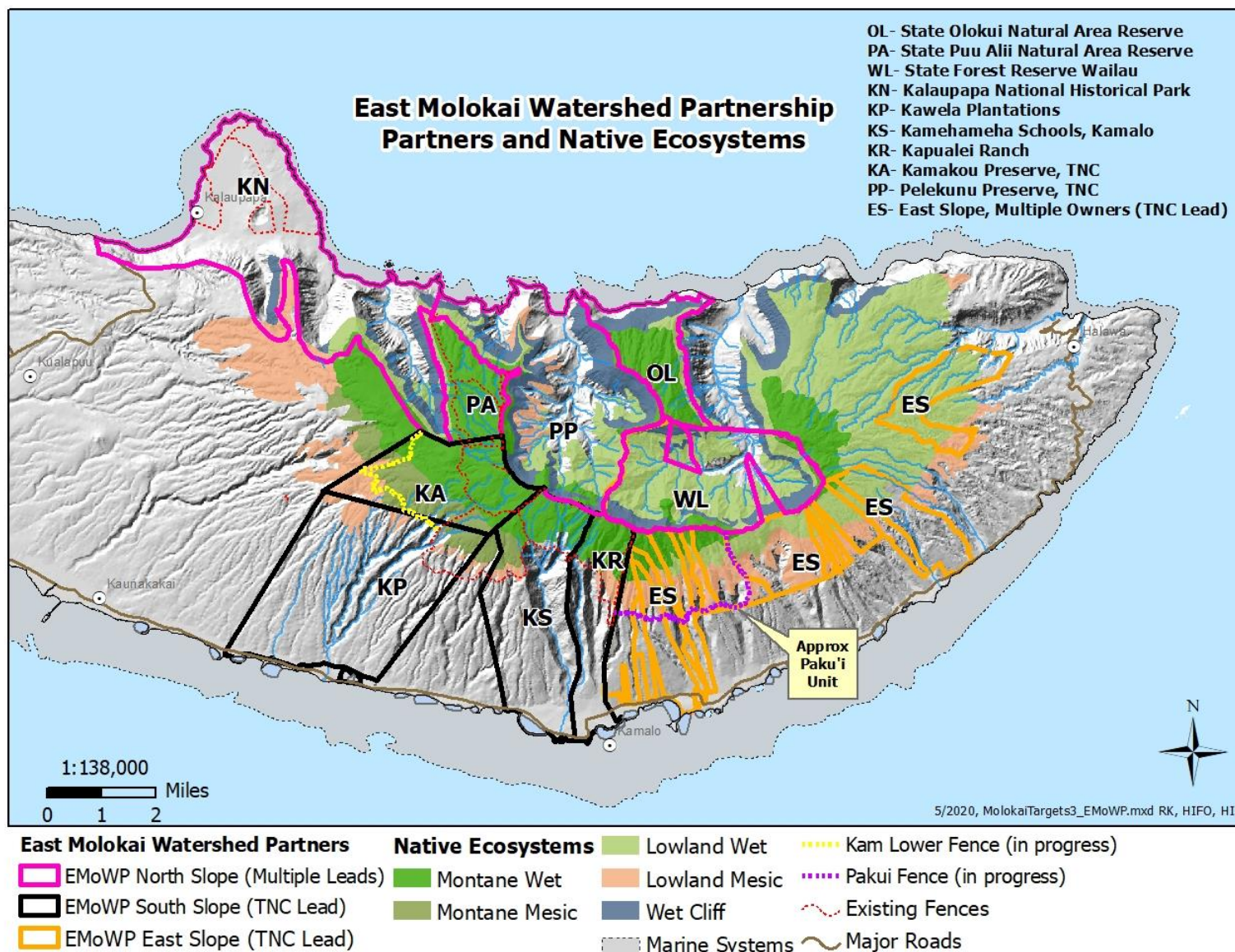
Middle Right: The 'O'opu Nōpili, (*Sicyopterus stimpsoni*) an herbivorous endemic fish, seen here feeding on stream algae. Known only from high-quality Hawaiian streams, it has been renowned since ancient times from Wailau and Pelekunu. Photo by Kanoe Morishige, Sept 2013.

Right. Stream monitoring takes place every two years to assess the abundance and distribution of aquatic macrofauna such as those species above. Photo lower left by Ed Misaki, 2001, lower right by Russell Amimoto, Sept 2009.





Figure 5- Native Ecosystems of East Molokai (Map)



**6) The Molokai South shore fringing reef tract** extends for approximately 30 miles and is known as the longest continuous fringing reef tract in the nation. According to the 2007 U.S. Geological Survey study “*Coral Reefs of Molokai at Risk*”, sediment runoff at study sites results mainly from overgrazing of the adjacent slopes by feral goats. The USGS initiated a mapping study of the Molokai fringing reef in 1999 and made their report public in 2007 (see below). USGS lead scientist Michael E. Fields has indicated that while the outer reef and reef crest is still very healthy and intact, the inner reef is being severely degraded by sedimentation. In the adjacent slopes of east Molokai from Kapualei to Kawela, seasonal rainstorms erode the denuded landscape and deposit tons of sediment onto the fringing reef tract. Sediments are re-suspended on a daily basis as the predominant trade winds stir up the inner reef areas. Many of these findings have recently been made public in USGS’s report: “*The Coral Reef of South Molokai, Hawai‘i; Portrait of a Sediment-Threatened Fringing Reef*: (2008, U.S. Geological Survey Scientific Investigations Report 2007-5101, 180 p., <http://pubs.usgs.gov/sir/2007/5101/>].

In 2008, USGS began the Kawela Ridge to Reef studies that included measuring erosion, vegetation cover and intermittent stream flow on a two-acre site in Kawela. Concurrently, the EMoWP began to reduce goat populations in the area. The USGS 2013 summary from their study site showed that from 2009 to 2013, erosion decreased 10-fold per annum and vegetation cover increased from 1% to over 70%. Furthermore, sedimentation at the site in 2009 was 6 tons per year and now down to less than 2 tons per year. Actual 2009-11 stream gauge shows that the Kawela stream pours an average of over 6,000 tons of sediment from the entire Kawela watershed into the adjacent shoreline and reefs, with a high of over 16,000 tons in 2011!



View from the upper native watershed looking down on the denuded middle zone and the adjoining fringing reef

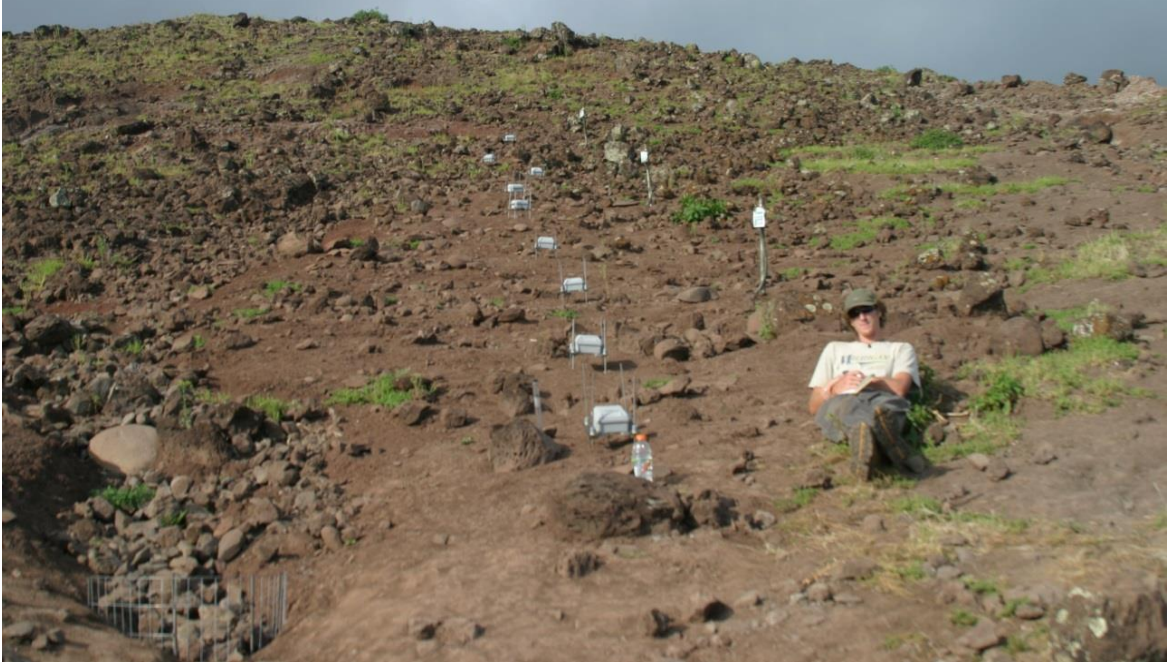


Molokai South Shore "Longest, continuous, fringing" reef tract in the U.S.





USGS Kawela Site 1 Unfenced – May 2007 Vegetation Cover 1%

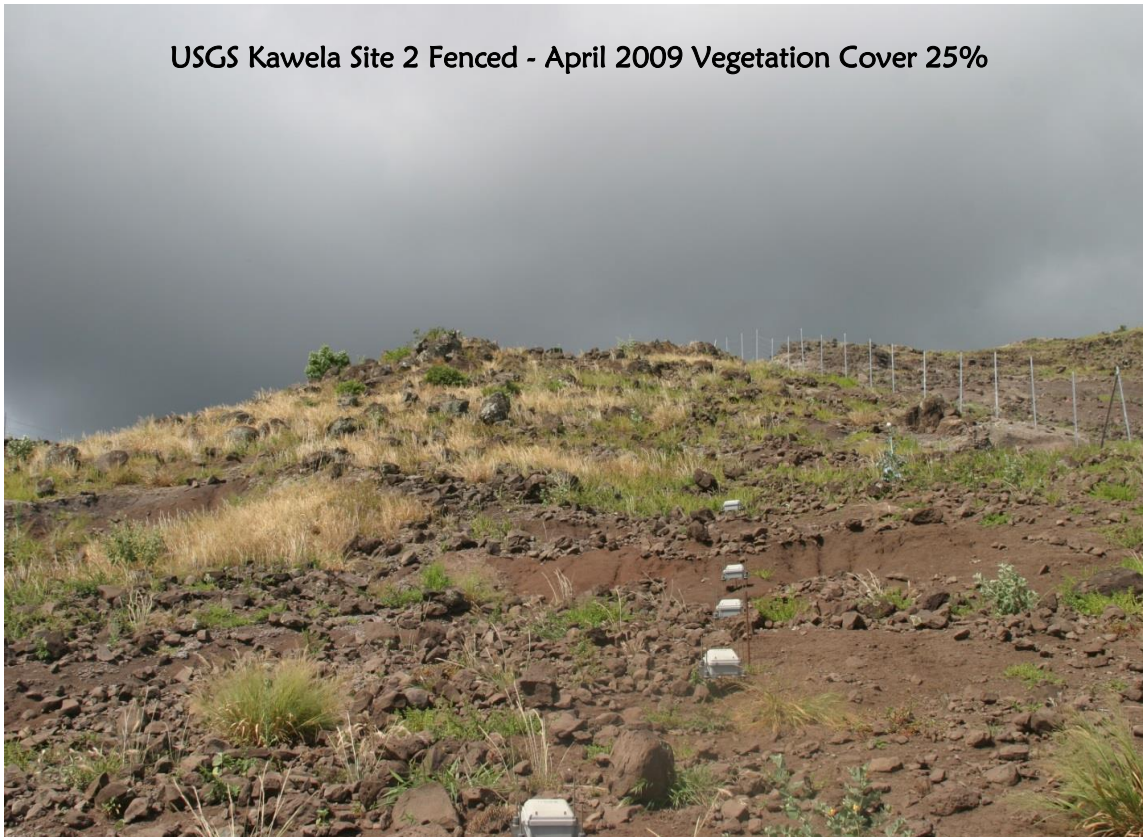


USGS Kawela Site 1 Unfenced -February 2014, Vegetation Cover over 75%





USGS Kawela Site 2 Fenced - April 2009 Vegetation Cover 25%



USGS Kawela Site 2 Fenced—February 2014 Vegetation Cover over 55%



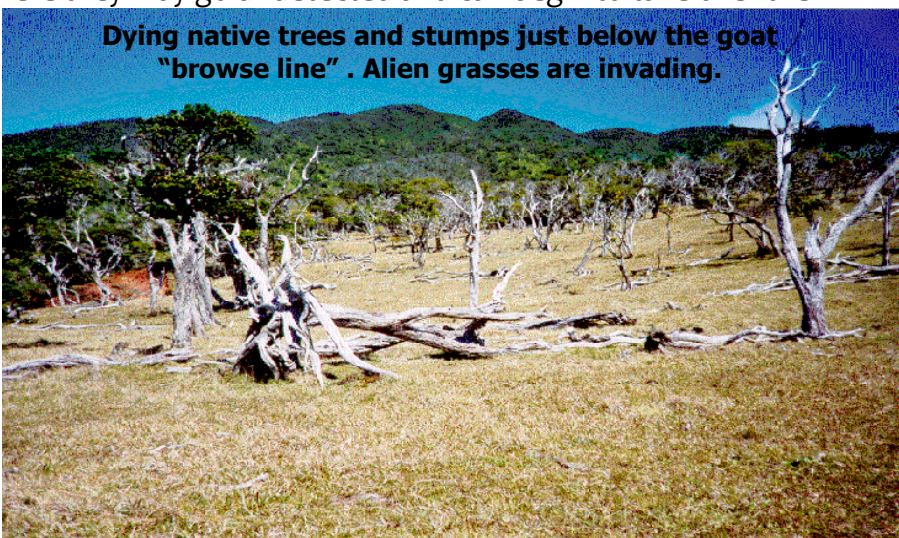


## B. Degradation of the Landscape

The montane wet and mesic forest systems of Molokai, generally above 3,000 feet elevation, remain relatively intact. However, feral ungulates (hooved animals) and invasive weeds are present and pose a significant threat to the viability of these forest systems. Feral ungulates are known to impact the native vegetation by grazing, trampling and spreading weed seeds.

1) **Feral pigs** are found at all elevations and they easily adapt to the wettest and highest elevations of the native forests. Feral pigs consume great quantities of the native tree ferns, their preferred starch source in the wet forest. They also seek worms, their primary protein source, by digging up the understory vegetation exposing the underlying organic and soil layers to runoff. These open areas present an ideal site for successful invasive weed germination and establishment. Feral pigs are known to move between areas with fruit bearing invasive weeds and more intact forest areas. Fruit from weeds, such as strawberry guava are consumed and transported to remote areas where they may go undetected and can begin to take over the forest.

2) **Feral goats** are the primary reason for the degradation of the rugged “middle zone” (500’– 2,500’ elevation). Goats roam in large numbers, are free from natural predators and inhabit the steepest terrain as their safe haven. Consequently, they denude the landscape, which results in massive erosion and diminishes the



water-carrying capacity of the watershed (USGS 2013). Every summer when the climate is extremely hot and dry the large goat herds migrate to the upper montane mesic and wet forests where they graze at the forest edge or “browse line”.



The browse line is a remnant dying forest, as evidenced by a mix of native dead tree stumps and invading alien grasses. Below these dying forest grasslands, the landscape becomes a sea of red dirt and gray rock. In the East Slope, a herd of about 20 goats was recently observed in Keawanui. Residents of ‘Aha‘ino have also observed a similar-sized herd of goats in their ahupua‘a.

3) **Feral Axis deer** also pose a threat. Axis deer are very elusive and thus



will be hard to manage should they become established in the upper forest systems. Currently, they are found primarily in the lower elevation areas from the coastline to about 1000' elevation, which are mainly covered with alien kiawe forest and grasslands. Hunting pressure and cattle have likely helped to establish deer populations in upper elevations especially in the East Slope areas.

4) In the past, **feral cattle** significantly impacted Molokai's native forest systems and are one of the reasons why the lower dry shrubland and forest systems are non-existent today. The last feral cattle were removed from the land in the 1970's, and they are therefore no longer a threat to the native forest systems of Molokai.

5) **Invasive weeds** are non-native, habitat-modifying plants known to displace native vegetation, alter natural habitat conditions and create monocultures. Invasive weeds generally invade from areas that have been altered by ungulates and humans, generally from the lower elevations. Invasive weed seeds are spread mostly by being transported internally (consumption) or externally (fur, tires, shoes, etc.) by humans, feral animals, birds, and wind. Control efforts of invasive weeds will focus in the most intact areas first with the highest priority being in the montane wet forest and cliff ecosystems. These ecosystems remain relatively intact with little to no presence of invasive weeds due to the remote, steep terrain and dense vegetation, which keeps human and feral ungulate activity low (i.e. Oloku'i, Pu'u Ali'i, Kamakou, Kamalō, Kapualei, and Pāku'i). The adjacent intact mesic forest and shrubland ecosystems are being impacted by higher levels of feral ungulates and human activity, and hence more invasive weeds are present. Invasive weeds and other non-native vegetation dominate a majority of the landscape below 3,000' elevation in the South and North Slope where the lowland forest and shrubland ecosystems are almost non-existent. Additionally, much of the North Slope valley floors are dominated by invasive weeds such as *Clidemia hirta*. The East Slope, however, still has intact native lowland mesic forest and shrublands that extend below the 3000' elevation with the most intact existing in the Pāku'i Unit. The levels of invasive weed presence are sporadic in the East Slope, particularly from Mapulehu to Keopukaloa, due to being heavily impacted initially by cattle, then later and into the present by deer, pigs, and invasive weeds such as *Tibouchina herbacea*. (See Maps, "Known Weed Extents", p. 31-33).

6) **Fire** is a major threat to the entire watershed and forest systems especially the drier south slope areas, where in 1988, 1991, and 1998 fires consumed more than 10,000 acres each. These wildland fires impact much of the mid-elevation slopes and have resulted in massive erosion during the winter rains. Fire displaces native vegetation, as fire-adapted non-native vegetation quickly takes over burned areas. Molasses grass is a good example of a non-native grass that is fire-adapted and recovers quickly after a fire. Molasses grass reclaims the nutrients from the burned areas, and quickly turns the burned areas into a sea of grass that blankets out native regeneration and is more vulnerable to repeat fires.



Almost all wildfires on Molokai are due to human-related activities. The Molokai Fire Task Force (MFTF) was formed in 2003 with the intention of providing collaboration with the two main wildland fire authorities – Maui County Fire Department and the State Division of Forestry and Wildlife Maui District. The MFTF meets quarterly and provides valuable information, important resources and needed collaboration to the fire authorities.

7) **Climate change** has the potential to substantially affect East Molokai's watersheds by altering the abundance and frequency of rainfall in the area. The demand for water among residential and agricultural users on the island is already high and the possibility of reduced rainfall would further exacerbate water resource limitations. Rare species, which generally lack the genetic diversity necessary to adapt quickly to changes in precipitation, humidity, and temperature that result from local (and global) climate change, may be particularly threatened. Deforestation is also known to alter rainfall patterns, where impacted areas are found to be comparatively cloud free. Landscape scale habitat shifts from native forest systems to weedy shrublands and grasslands would reduce cloud cover and, consequently, rainfall along the East Molokai mountain range.

### III. EMoWP Management Strategies and Actions

#### A. Feral Animal Control--fencing, hunting, & aerial shooting.

**1. Fencing (help to achieve Goal 1 and 4)** the 5.5 mile Kamalō/Kapuālei contour fence was completed in 2001 to prevent the intrusion of feral goats into the upper native forest systems in those areas. In 2006, the Kamakou East boundary fence was extended by an additional 2.5 miles to protect the upper eastern parts of the Kawela common lands. In 2008, a half mile section of the Makolelau property was fenced, closing off the bottom section of the Kamalō to Kapuālei contour fence. Since the construction of 2.2 miles of fence along Kapuālei's eastern boundary in December 2012, the original Kamalō/Kapuālei fence unit is now a closed unit from Kawela to Kapuālei (2,500 acres); a mesh "subunit" fence was completed in 2017, dividing the unit roughly in half. In 2014, the upper section of Kamakou Preserve was fenced and is also now a closed unit, now referred to as the "Kamakou Remote" fenced unit (700 acres).

The top priority fence unit for construction is the East Slope's Pāku'i Unit (See EMoWP South Slope Map 2). The Pāku'i Unit contains the most continuous, intact sections of native forest remaining in the East Slope. Located near the center of the island, close to Kamakou peak, the Pāku'i Unit is made up of public and private land, ranging from 1,300 ft to 4,380 ft elevation (Pāku'i Peak), and totaling approximately 2,080 acres. The unit includes the mauka sections of the ahupua'a of Pua'ahala, Ka'amola, Keawanui, West 'Ōhi'a, East 'Ōhi'a, Manawai, Kahananui, 'Ualapu'e, and Kalua'aha (Map 3- EMoWP East Slope). The unit's southern boundary, which ranges in elevation from approximately 1,300-1,700 ft., extends from Kua Gulch on the west to the western ridge of Mapulehu Valley on the east. An eastern boundary fence along Kalua'aha Ranch's eastern boundary line would work with strategic fencing near the East Molokai summit crest to enclose the unit. The unit abuts the Kamalō/Kapuālei fence unit and would share its western boundary fence in Kapuālei.

Waiahookalo fence is a roughly ½ mile long strategic fence in the small valley northwest of Pelekunu proper on Molokai's rugged north shore. Together with the Waikolu rim fence (under construction), this strategic fence would prevent any entry of feral goats, pigs and deer into Waikolu as well as prevent the eastward movement of ungulates into Pelekunu valley proper.

Next fences:

Kamakou Lower Fence, at ~4½ miles in length, would connect to the Waikolu Rim fence and the Kawela Fence, and protect almost 75% of Kamakou Preserve's remaining unfenced lands on the south slope, which includes good to very good quality mesic forest and shrubland.

Kawela Gulch Fence. The steep walls of Kawela Gulch where hunters cannot safely access are home to excessive numbers of feral goats, responsible for much erosion along this region of Molokai's south slope. A fence surrounding that gulch would prevent additional

animals from populating the gulch, and aid animal reduction efforts within it, restoring stream quality and reducing sediment load on the reef.

#### Other Future Fences

Kapualei/Pua‘ahala Lower Extension Fence. This fenceline would be extended below the current Kapualei fence and on the boundary of Kapualei and Puaahala to help reduce east west animal movements.

Pelekunu – DOFAW and TNC is looking at the possibility of fencing the upper section of Pelekunu valley which will help protect the upper valley, Oloku‘i and Pu‘u Ali‘i NAR.

Mapulehu – The EMoWP and the landowner will look into the feasibility of fencing the upper section of the valley.

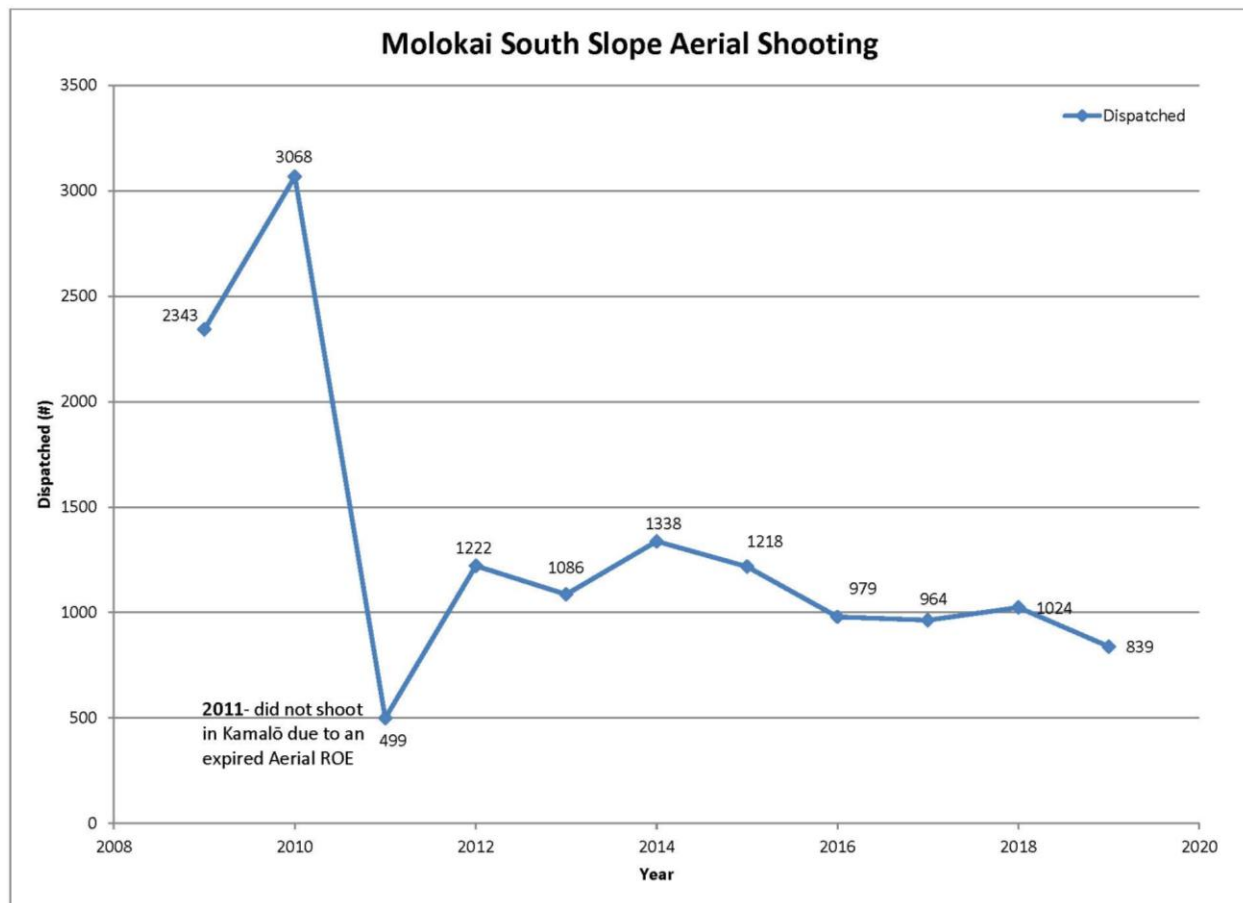
Pu‘u O Hōkū – Pu‘u O Hōkū contains the largest watershed area in East Molokai, including the headwaters of most perennial streams. A comprehensive look into fencing parts or all of the watershed should be considered.

Other areas will be considered for fencing should landowners bring forth fencing proposals.

**2. Conduct Hunt Sweeps with dogs (help to achieve Goal 1 and 2)** - hunt sweeps deploy a one hunter one dog team with at least two teams. The teams usually take a top-down approach and systematically “sweep” an area by taking parallel tracks. This technique was shown to TNC in 2007 Prohunt project. The Garmin GPS Astro dog collars revolutionized the hunt sweep technique. Spot hunts are rifle hunts/ without dogs and usually conducted in unfenced units to reduce deer and goat populations and to pressure these ungulates to lower elevations out of native forest areas. The spot hunts may be deployed in the unfenced areas of Kamakou Preserve.

**3. Conduct Aerial Shooting (help to achieve Goal 1, 2 &3) – aerial shooting** is the most effective method to control animals in steep gulches and cliff faces that are unsafe to ground hunt and is particularly effective when used in conjunction with fencing. On the North Slope, aerial shooting has helped stop feral animals from moving higher up into intact forest areas like the Oloku‘i NAR. The State DOFAW, an EMoWP partner, by law is the only entity that can conduct aerial shooting on private lands. Aerial shooting also is conducted in the fenced units of the South Slope and has been effective in the open canopy areas. Aerial shooting is one of the tools needed to reach zero tolerance in fenced units. A “two tablet” system is employed in the helicopter- one mounted tablet computer is used by the pilot for navigation of permitted shoot zones and a second tablet is used by the spotter to record all animal dispatches.

Figure 6- ACETA Graph



#### Management Actions:

- Complete construction and animal removal of the Waiahookalo fence by FY 2021.
- Complete construction and animal removal of the Pāku'i fence by FY 2024.
- Complete construction and animal removal of the Kamakou Lower fence by FY 2025.
- Begin and or complete construction of the Kawela Gulch fence by 2028.
- Plan and seek funding for the upper Pelekunu fence
- Develop list and timetable for future fences-Kapualei Pua'ahala lower extension fence, Mapulehu fence, Pu'u O Hōkū fence and others as needed.
- Conduct fence surveys, maintenance, and repairs on all EMoWP fences.
- Maintain ZT in the Kamakou Remote Fence unit.
- Achieve and maintain ZT in the Kawela Kamalo fenced subunit.
- Achieve and maintain ZT in the Kamalo Kapualei fenced subunit.
- Deploy ground hunts as needed in unfenced areas.
- Complete annual aerial shooting plan as required by DOFAW.
- Support DOFAW with aerial shooting protocol and procedures
- Support DOFAW with implementation costs and logistics.
- Conduct aerial shooting (ACETA Mission) in priority permitted units.
- Document and map all animal control activities.

**Kamalō fence 3 months after construction. Pūkiawe is able to sprout again!**





**Pāku'i Fence Unit**  
5.5 Miles, 2080 Acres

Mapulehu West Rim Fence Section 1.0 mile

Kapualei to Mapulehu Fence Section - 4.5 miles

**Legend:**

- Proposed Step Overs
- Fenceline (under construction)
- Kapualei Fence
- Natural Barrier (Cliffs)
- Tax Map Key

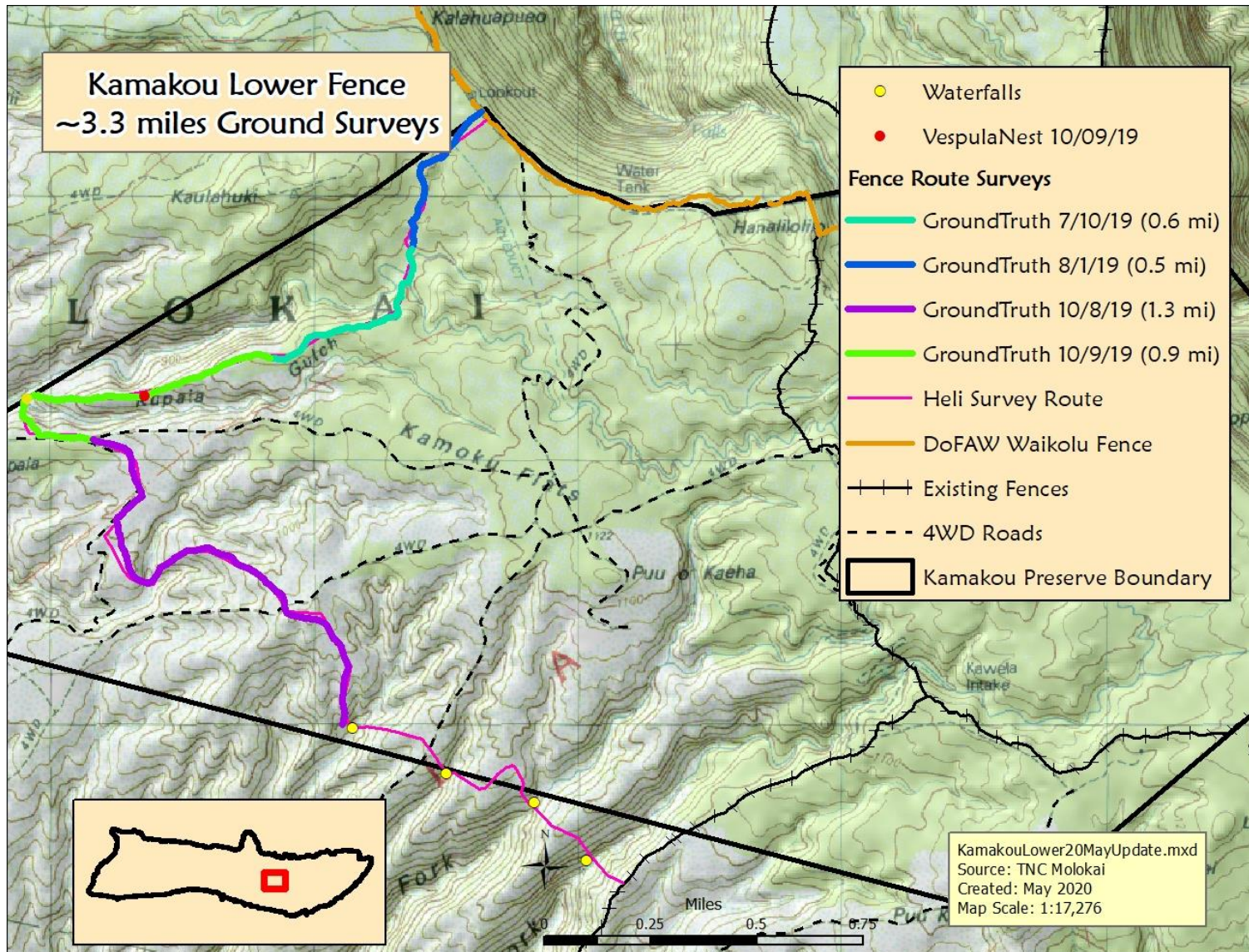
#	Landowner(s)	TMK
1a	State of Hawaii	5-6-06-002
2	Thacker Corp.	5-6-06-003
3	Kamehameha Schools	5-6-06-007; 5-6-06-025
4	Pedro and Wond	5-6-06-010
1b	State of Hawaii	5-6-06-011; 5-6-06-018
5	Vernon Suzuki	5-6-06-013
1c	State of Hawaii	5-6-06-014
1d	State of Hawaii	5-6-06-026
6	Dunnam Trusts	5-7-05-001

Island of Molokai

0 0.25 0.5 1 Miles



Figure 8- Kamakou Lower Fence Map



**B. Weed Control** focuses on removing invasive weeds from the intact native forest ecosystems and preventing new invasive species from impacting them.

**Weed control efforts will be guided by the following management priorities and strategies:**

- **Intact Forest Systems are Priority** - Eliminating priority weed species in the Montane Wet Forest is a high priority because it is the most intact conservation target in the EMoWP. Furthermore, montane wet forest that are completely “fenced” and protected from ungulates will be the highest priority due to the native forests’ ability to heal itself after the threats are removed (i.e., passive restoration) and prevent further invasion from invasive weed species. Eliminating or suppressing priority weed species in the adjacent native forests is our second priority. These areas will act as a buffer to keep weed populations from spreading into the Montane Wet Forest.
- **Top-Down Approach** – This strategy is to prevent the spread of invasive weeds into the intact forest systems. Removal efforts will begin in the most intact area first, usually at the higher elevations, and then work downwards to lower elevations where invasive weed presence increases. Routes and helicopter landing zones with the least amount of invasive weed presence (cleanest) will be utilized to access the intact forest. Workers will follow “Weed Prevention Protocols” to ensure field gear is decontaminated before entering an intact forest system.
- **Outside-In** - This strategy is to start control work from the outer extent of a known weed population and work inwards toward the core. The core will change very little while outliers have the potential to increase the perimeter of the weed occurrence.
- **Weed Prioritization Criteria:**

The “sum” of the following criteria determines the priority rank of a weed species. The criteria below will be collectively considered to determine if a weed species rank as a low or high priority.

  - a. **Intactness - Current condition of the conservation target(s)**

The ultimate goal of native Hawaiian forest managers is to keep intact systems from being invaded and to remove threats from areas that are being impacted. Any weed would rank high if it begins to invade an intact forest system. A weed would also rank high if it occurs inside or near an intact forest system.
  - b. **Invasiveness - Level of impact (Disruptive Potential)**

It is critical to know the level of invasiveness of a weed and its potential impact on an intact ecosystem. These are typically intrinsic to the weed itself, and attributes of a highly invasive weed can include: environmental versatility, habitat-modifying behavior, allelopathy, ability to form single-species stands, germination without disturbance, prolific seed production, multiple means of reproductivity, multiple dispersal methods, short time to maturity, an enduring seedbank, shade tolerance, and fire tolerance. The more attributes an invasive weed has, the higher it will rank.
  - c. **Occurrences - Current extent of species**

The extent and distribution of a weed species is important to determine if management of the weed is feasible. If a weed occurs in a high priority area, it is



given high priority. If its presence is already extensive and widespread, it will be ranked low. A weed that is recently introduced and/or a weed that has only a few occurrences will rank high.

d. **Feasibility of Control - Treatment Method(s) and Resources Available**

A weed will rank higher if there are proven and effective ways to dispatch it. Resources available will also be factored in. For example, if a weed doesn't require multiple retreatments (high investment of staff time) to be eliminated, it is more feasible to remove and may receive a higher priority.

1. **Eliminate priority weed species throughout the intact montane wet forests (help to achieve Goal 5 & 6).**

**Management Actions:**

- Complete quarterly ground surveys and removal in the South Slope fenced units of Kamakou and Kamalō/Kapualei.
- Begin mapping, prioritizing and eliminating weed populations in the East Slope's Pāku'i Unit.
- Support weed control efforts in the North Slope's Pu'u Ali'i and Oloku'i NARS.
- Annually assess the need to conduct aerial surveys to detect new weed occurrences.



2. **Eliminate priority weed species in forest systems adjacent to the intact montane wet forests (help to achieve Goal 5 & 6).**

**Management Actions:**

- Complete monthly ground surveys and removal in the South Slope (i.e. Kamakou Unfenced, Kawela, Makolelau, and Southwest Kamalō).
- Continue to monitor and eliminate incipient weed species (e.g. African Tulip) in the North Slope Pelekunu Preserve.
- Support incipient weed control efforts (e.g. Mexican poppy) in the Kalaupapa National Historical Park.



- Support and assist with incipient weed control efforts (e.g. Australian tree fern, African Tulip, Kahili Ginger) in the North Slope conservation areas.
  - Support and assist with incipient weed control efforts in the State Forest Reserves adjacent to the EMoWP
  - Begin identifying priority weed species in the East Slope outside of the Pāku'i Unit.
  - Annually assess the need to conduct aerial surveys to detect new weed occurrences.
3. **Prevention through partnering with the Molokai/Maui Invasive Species Committee (MoMISC: help to achieve Goal 5 & 6).**

**Management Actions:**

- Assist MoMISC with island-wide early detection surveys (e.g. Miconia aerial survey).
- Assist MoMISC with dramatically reducing or eliminating Target Species that will impact the native forest systems [e.g. Australian tree fern (*Cyathea cooperi*), mule's foot fern (*Angiopteris evecta*), gorse (*Ulex europaeus*), rubber vine (*Cryptostegia madagascariensis*), Barbados gooseberry (*Pereskia aculeata*), Mexican Poppy (*Argemone mexicana*), fireweed (*Senecio madagascariensis*), kākili ginger (*Hedychium gardnerianum*)].

4. **Develop strategies, plan and timetable for Kamakou pine plantation removal.**

In the 1930's areas denuded from years of animal grazing were planted across Molokai's south slope with tree species like pines to curb ongoing erosion there. Planting efforts continued through the 1970's. While erosion was reduced, pines are a non-native and invasive group of species that greatly increase the fire threat to the Hawaiian landscapes, particularly in mesic to dry systems. A plan to develop a timetable and determine feasibility of pine plantations and their outliers in Kamakou will be developed.

5. **Track the State of Hawai'i Department of Agriculture's progress in identifying successful biocontrol agents for habitat-modifying weeds that are difficult to control (e.g. *Tibouchina herbacea*, Kahili ginger, *Clidemia hirta* to help to achieve Goal 5 & 6).**

**Management Actions:**

- Assist State partners with monitoring efforts for bio-control agents released on State land.
- If needed, be prepared to seek in-house approval to make release a top priority as soon as a successful biocontrol agent is identified and documented.

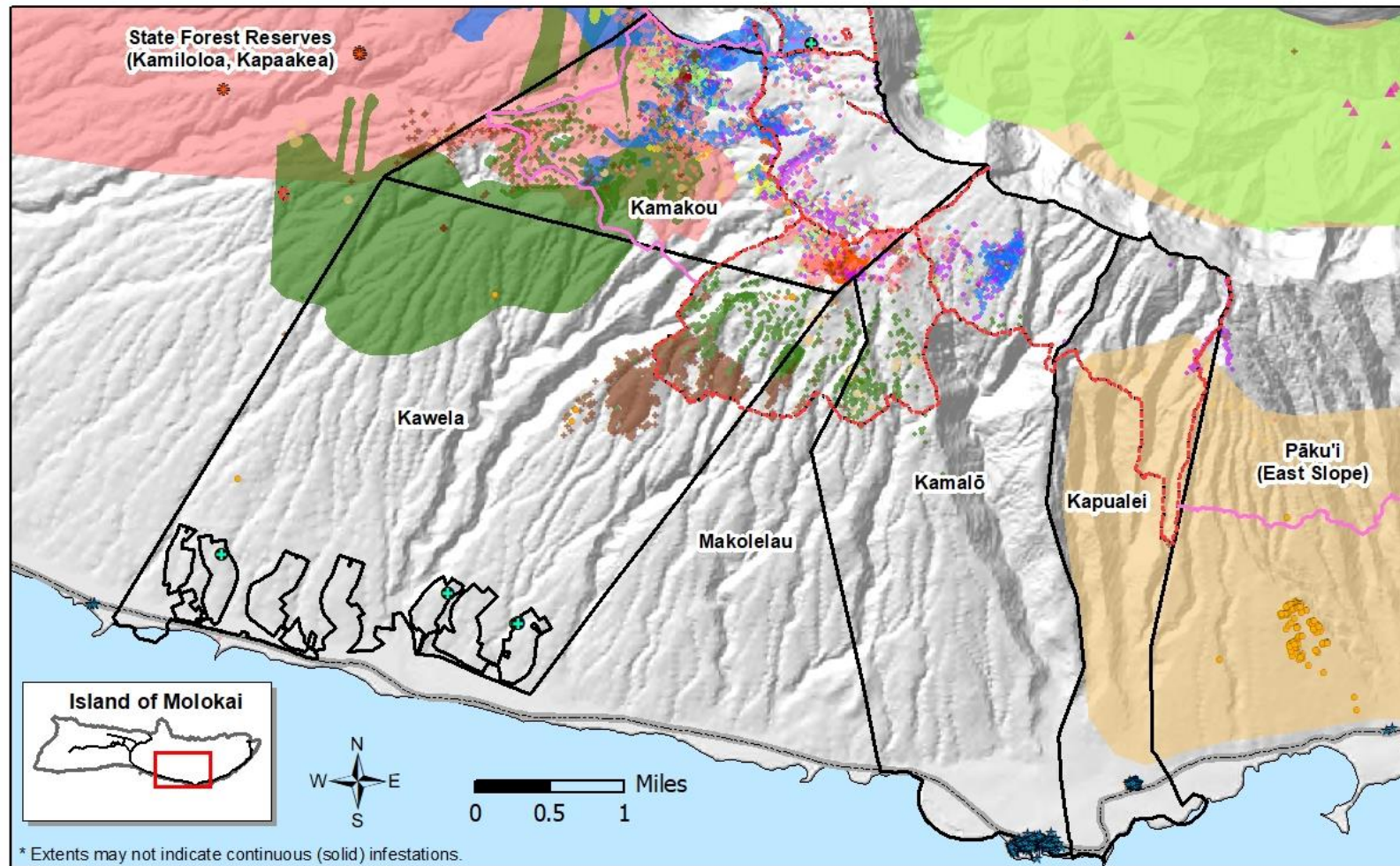




GPS technology is used in all weed sweeps to track crew progress and map weed locations.

*Figure 9- EMoWP South Slope Weed Map*

## Known Weed Extents and Locations in the EMoWP South Slope\*



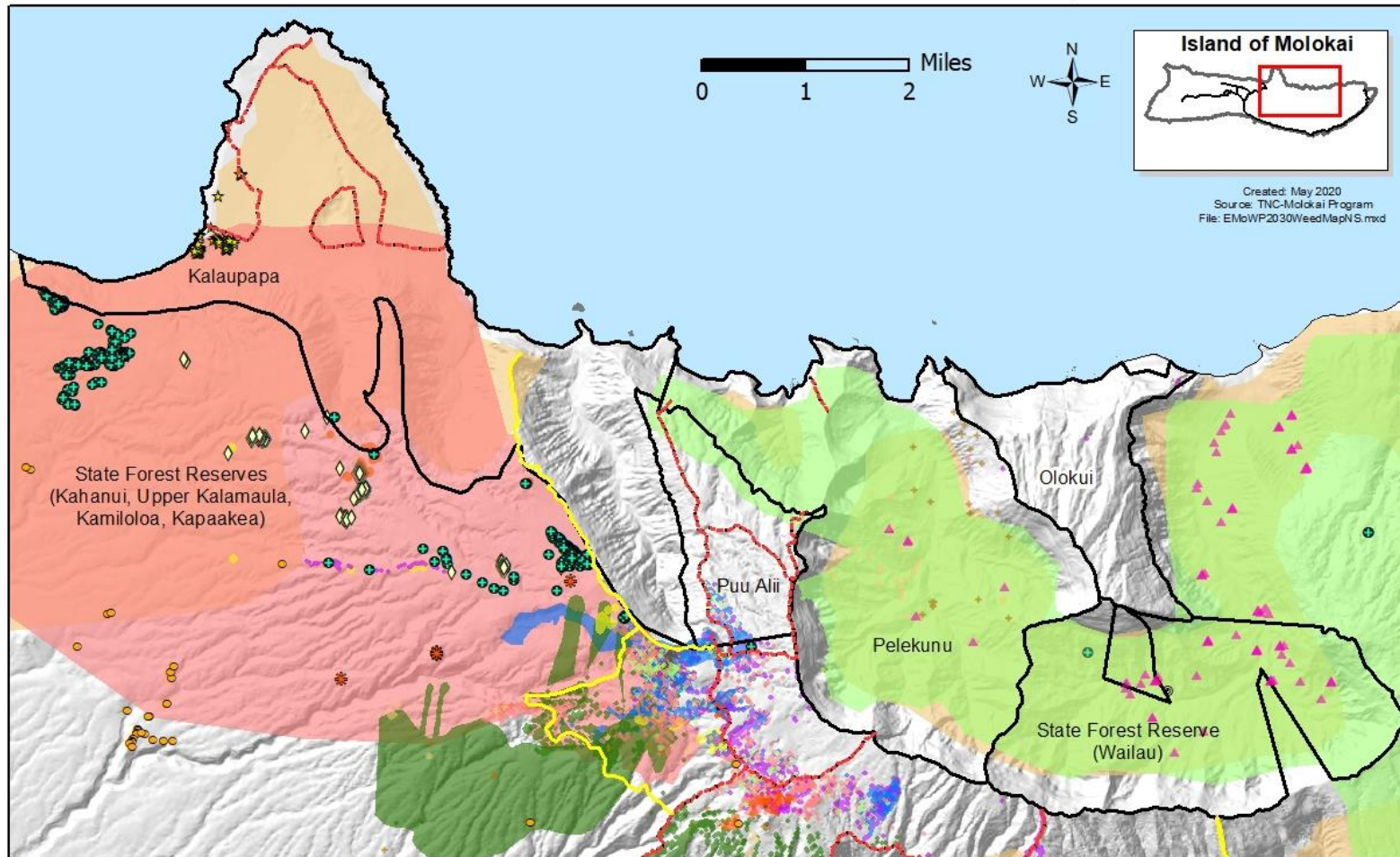
- |                             |                        |                        |                    |                    |
|-----------------------------|------------------------|------------------------|--------------------|--------------------|
| ~ Fences under construction | <b>MoMISC Targets</b>  | ▲ African tulip        | ■ Karakanut        | ■ Pines            |
| ~ Existing Fences           | ★ Rubber vine          | ✚ Other Priority Weeds | ■ New Zealand Flax | ■ Strawberry Guava |
| ~ Major Road                | ● Australian tree fern |                        | ■ Paperbark        | ■ Tibouchina       |
| □ South Slope Partners      | ● Fireweed             |                        | ■ Blackberry       | ■ Clidemia         |
|                             | ● Gorse                |                        |                    | ■ Christmasberry   |





Figure 10- EMoWP North Slope Weed Map

## Known Weed Extents and Locations in the EMoWP North Slope\*

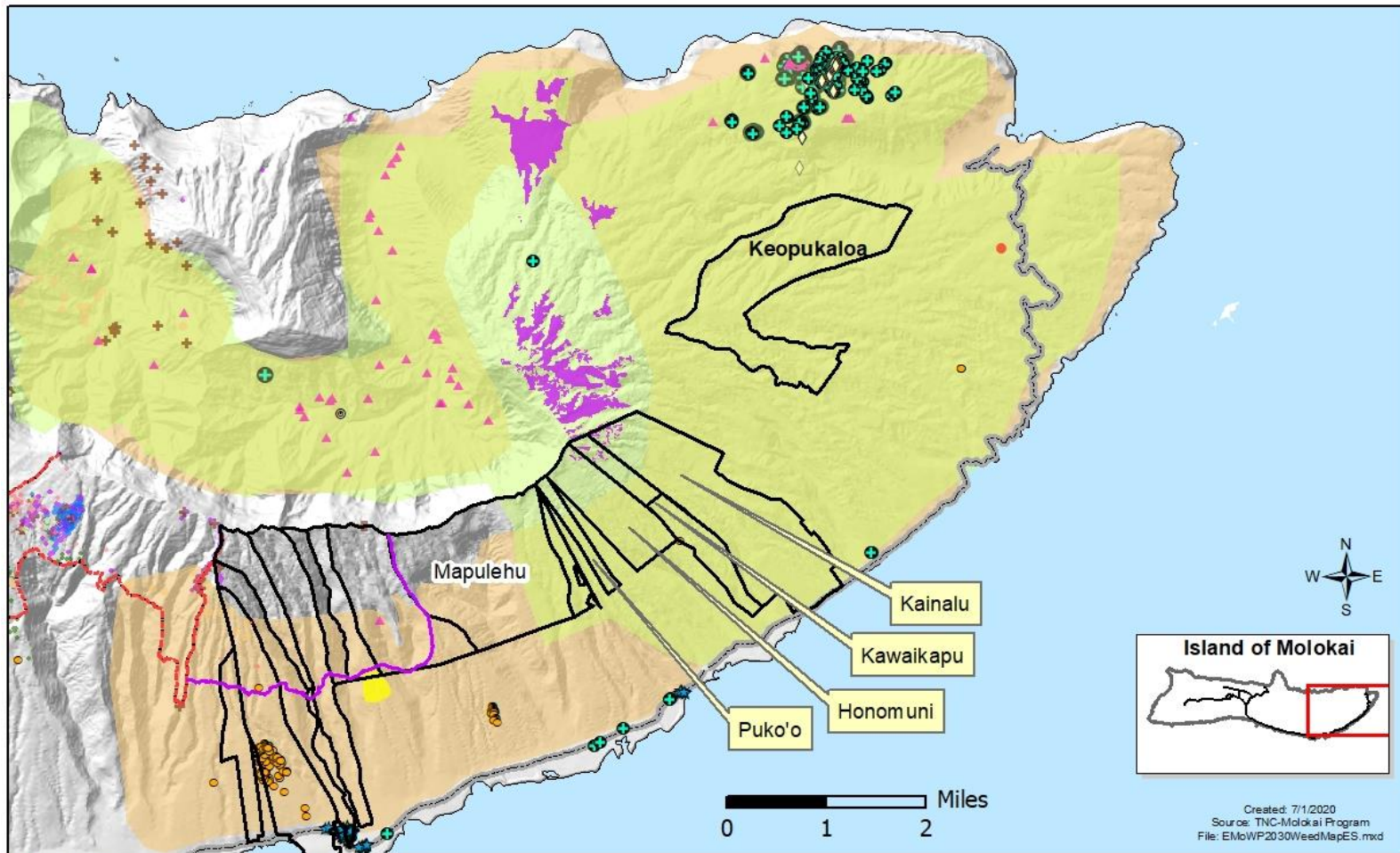


\* Extents may not indicate continuous (solid) infestations.

- |                             |                    |                        |                        |                  |
|-----------------------------|--------------------|------------------------|------------------------|------------------|
| ~ Fences                    | ■ Paperbark        | ■ Tibouchina           | <b>MoMISC Targets</b>  | ◇ Mulesfoot fern |
| ~ Fences Under Construction | ■ Pines            | ■ Clidemia             | ★ Mexican Poppy        | ★ Gorse          |
| □ North Slope Partners      | ■ Blackberry       | ▲ African tulip        | ● Australian tree fern | ● Fireweed       |
| ■ Karakanut                 | ■ Strawberry Guava | ✦ Other Priority Weeds |                        | ● Kahili Ginger  |
| ■ New Zealand Flax          | ■ Christmasberry   |                        |                        |                  |

Figure 11- EMoWP East Slope Weed Map

## Known Weed Extents and Locations in the EMoWP East Slope\*



\* Extents may not indicate continuous (solid) infestations.

- |                               |                       |                |                  |                  |
|-------------------------------|-----------------------|----------------|------------------|------------------|
| East Slope Partners           | <b>MoMISC Targets</b> | Mulesfoot fern | New Zealand Flax | Strawberry Guava |
| Pakui Fence (in construction) | Australian tree fern  | Rubber vine    | Paperbark        | Tibouchina       |
| Fences                        | Fireweed              | Kahili Ginger  | Pines            | Clidemia         |
| Major Roads                   |                       | Blackberry     | Christmasberry   |                  |



## C. Monitoring & Research

### 1. Threat Monitoring

#### a. Ungulate Activity Surveys (help to achieve Goal 1,2 & 7)

Ungulate activity monitoring along belt transects has been on-going in Kamakou Preserve since 1984 and can be an effective way to monitor areas of moderate pig density. Additionally, three transects have been added in Kamalō since 2003. These transects were standardized to 500 meters in length in 1993 and quarterly monitoring was switched to semi-annual monitoring in 2003. Ungulate monitoring involves surveying for presence or absence of feral ungulate activity (digging, foraging, rubbing, scat, etc.) between stations along these transects. The percentage of ungulate activity is then compared over time. Alternate methods are now being used for fenced areas where ungulates have been eliminated to reduce impacts to recovering vegetation. See Ungulate Activity Graphs below.

Because of its intactness, the Kamalō Kapualei fenced subunit is believed to be at very low ungulate levels, and it is unlikely that we will pursue data collection through the intensive ungulate transect method in these areas. Similarly, ungulate activity surveys were suspended for the ungulate free Kamakou Remote fenced unit, confirming its continued ungulate free status through fence checks and hunt sweeps. Ungulate activity information will be collected through these means and the understory vegetation monitoring to reduce human impact to the area, unless further data suggests the need to do otherwise.

#### b. ROD and other microbial and invertebrate threats

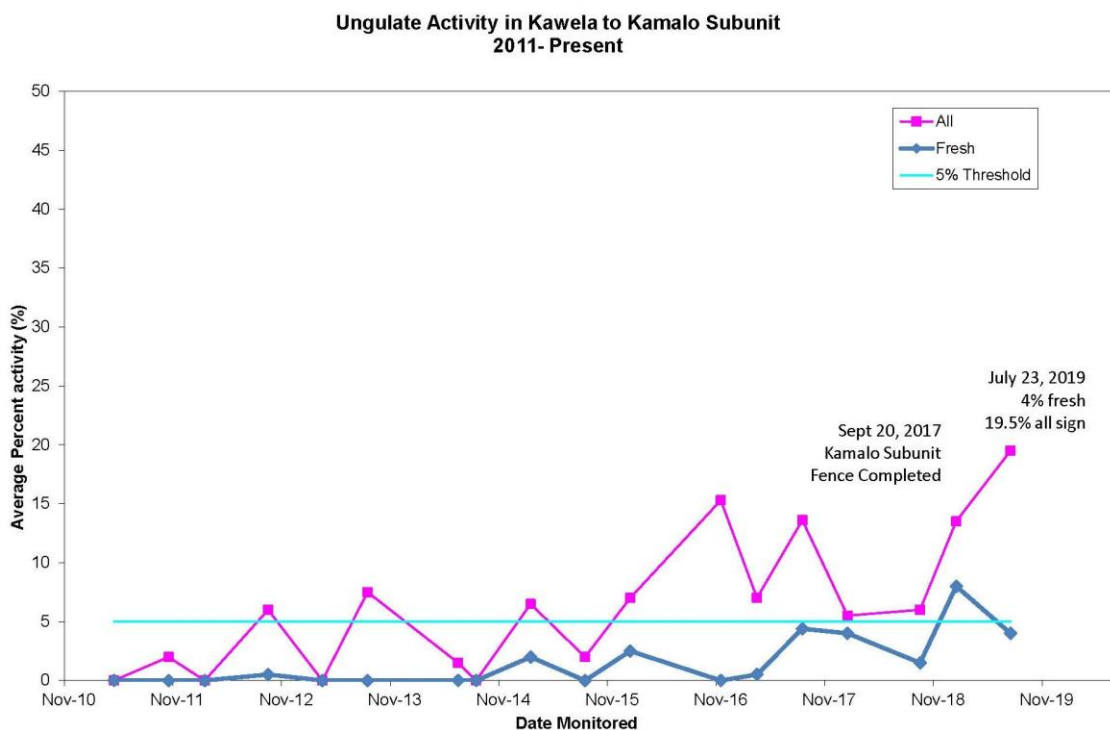
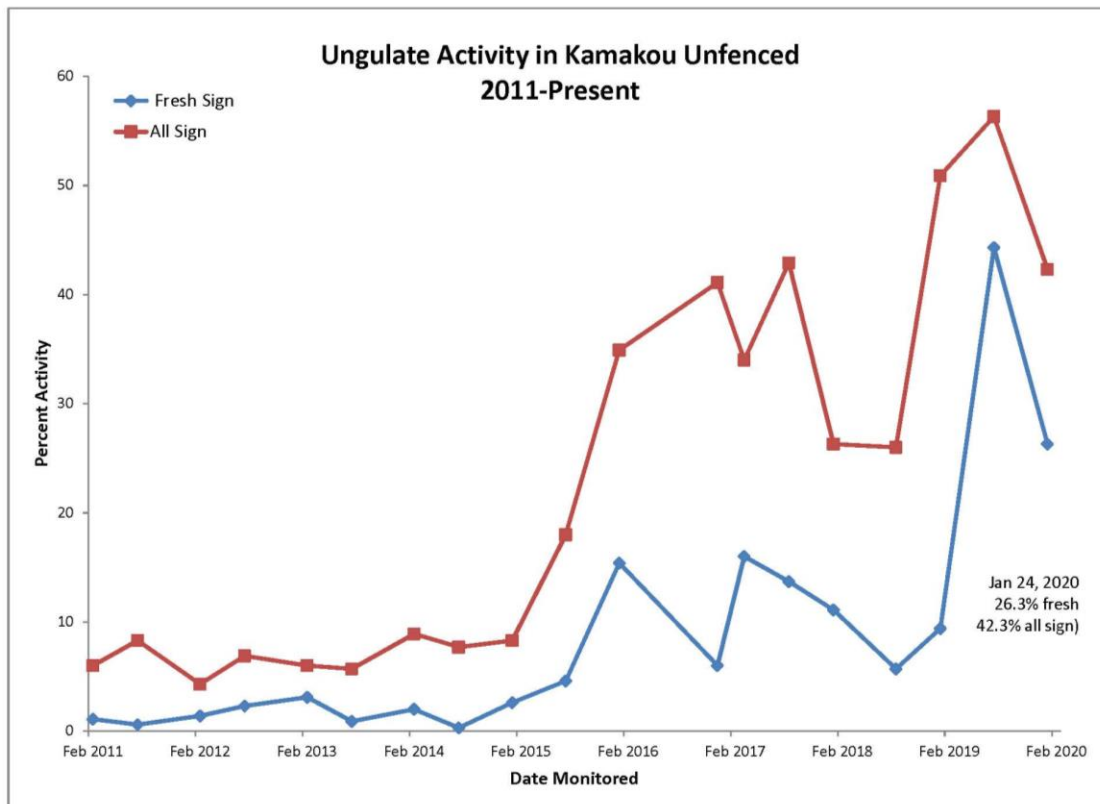
Non-native insects and small mammal damage occurs in Moloka'i's native ecosystems. Rats, mice, and other rodents pose a threat to rare native tree snails (*Partulina/Perdicella* spp.). Insects such as the aggressive, ground-dwelling carnivorous wasp *Vespula* may prey upon native insects and sting people. Other potential incipient pests, like the coqui frog, may also have unknown effects on native food webs. Perhaps the single greatest threat to Molokai's forest are the Rapid 'Ōhi'a Death fungi (*Ceratocystis* spp.), currently known from Hawai'i and Kaua'i islands with additional cases now being noted on O'ahu. ROD education will be given to those inquiring with the Conservancy about hikes in Kamakou. A rotorod station to detect *Ceratocystis* spores is maintained at Pu'u o Hōkū on Molokai's east end, a potential site for introduction of wind-blown spores. Should it prove effective, a second unit may be installed at Waikolu. Efforts will be to secure a ROD decontamination station at the Forest Reserve to prevent its introduction into Molokai's 'ōhi'a forest.

### Management Actions

- Conduct biannual ungulate surveys along unfenced transects and graph results.
- Conduct annual ungulate surveys on Pelekunu transects.
- Annually assess need for additional transects.

- Continue to support DOFAW ROD detection aerial/ground surveys
- Evaluate Rotorod system for detection of ROD spores and install additional unit if feasible.
- Support DOFAW efforts to install ROD decontamination statio

Figure 12- Ungulate Activity Graphs



## **2. Viability Monitoring**

### **a. Understory Monitoring (Goal 7) (See Molokai Understory Monitoring Map)**

Past vegetation monitoring methods were intensive, difficult to implement, and involved a great deal of investment of time and energy. To avoid these challenges, Molokai Understory Monitoring (MUM) was developed in 2006 to give a “coarse” look at forest health by sampling understory vegetation using 100 square meter plots. Photos, a plant checklist and a threat assessment were incorporated to look at basic forest health measures.

Six MUM transects were installed across Molokai’s South Slope and are being remonitored on a rotating basis to identify changes in forest health. (See map). Remonitoring has shown that MUM is capable of summarizing coarse changes in forest health with its simple measures.

MUM measures Hawaiian forest health by the following: very good = >90% native cover; good =75-90% native cover; fair =50-74% native cover; poor =<50% native cover. As transects are established, MUM will provide a better assessment of overall Molokai forest health (see map). Additionally, MUM uses existing reference trails and fence lines as benchmarks to make it easier to locate monitoring stations in the future and to reduce impacts to the forest systems.

#### **Management Actions**

- **Complete annual MUM monitoring.**
- **Annually assess need for additional MUM transects and ungulate transect.**
- **Complete map summary after every monitoring session.**



Figure 13- FY20 MUM Summary Map

## Molokai Understory Monitoring (MUM) Summary Map

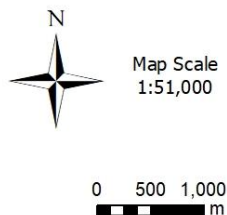
### Structures

- Pāku'i Fenced Fence
- DoFAW Fence in Progress
- Existing Fences

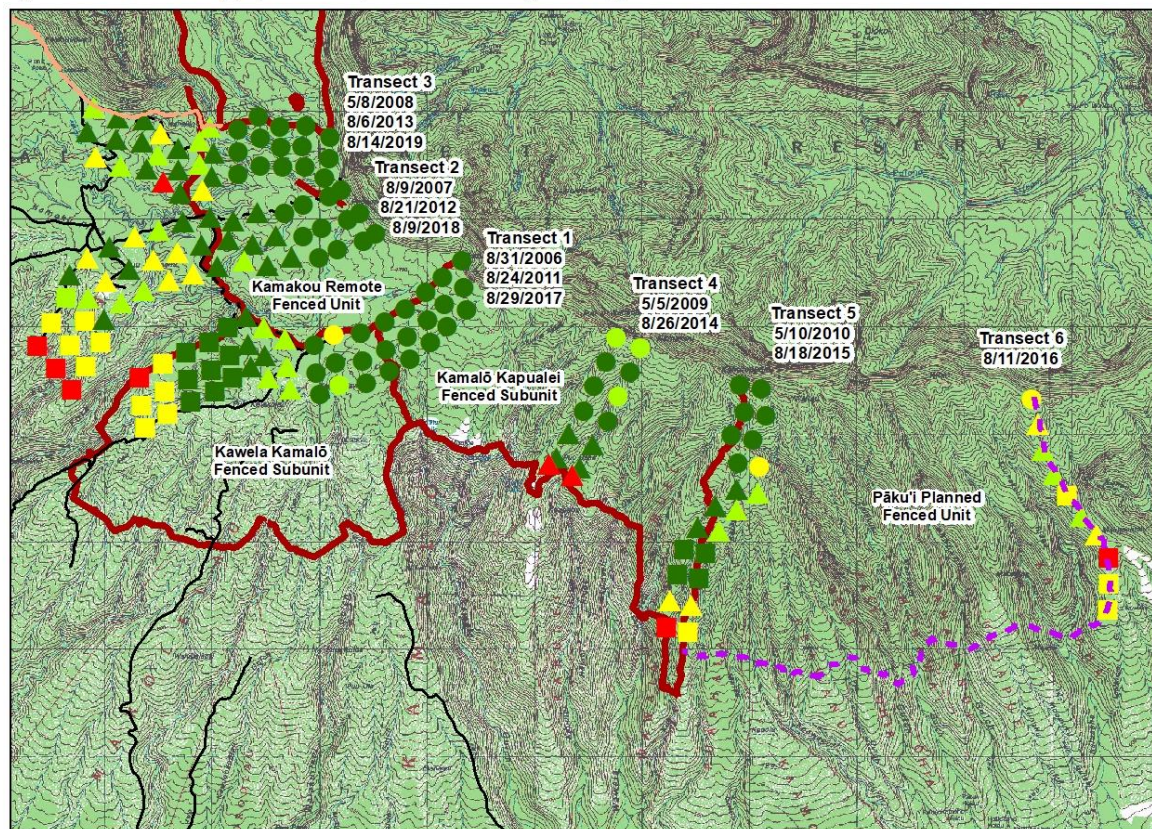
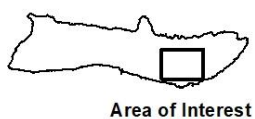
### Vegetation Types

- Wet Forest
- ▲ Mesic Forest
- Mesic Shrubland
- - - Trails
- 4WD Roads

Created: Sep 27, 2019  
 Map Scale: 1:51,000  
 Data Sources: TNC Molokai  
 File: MUMSumMap4.mxd



### Island of Molokai



The Nature Conservancy

Protecting nature. Preserving life.®

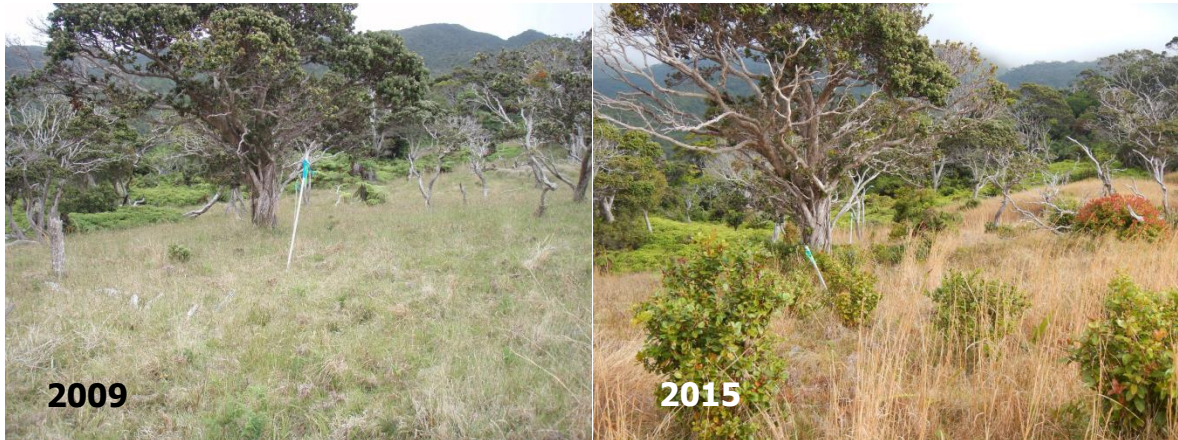
### INTEGRITY CRITERIA FOR TERRESTRIAL VEGETATION COMMUNITIES

Vegetation Rank	Very Good	Good	Fair	Poor
<u>Understory Condition</u>	> 90% of existing cover is native	90% - 75% of existing cover is native	74% - 50% of existing cover is native	< 50% of existing cover is native
<u>Cover composition of native plants below canopy layer</u>	> 90% of existing cover is native	90% - 75% of existing cover is native	74% - 50% of existing cover is native	< 50% of existing cover is native



### **b. Landscape photomonitoring**

Photomonitoring involves taking photographs of the same place over time, and is a powerful tool for visually depicting the effects of management. USGS (See page 21-22) gives examples of how photomonitoring can help in documenting changes over time. Landscape photomonitoring will be developed and time intervals established in key landscape sites over the next 5 years.



Above the fence in Kapualei, ‘ōhi‘a trees are regenerating and the forest expanding as goat numbers are reduced.

### **Management Actions**

- **Establish photomonitoring in key sites.**
- **Determine interval for each site.**

### **c. Rare plant and vegetation species surveys (Goal 7)**

Of the well over one hundred native plants species considered rare on Molokai, there are forty designated as critically endangered by the Plant Extinction Prevention Program (see following table). Each one of these species is known to have less than fifty individuals left in the wild, and half of these species were known only to occur on Molokai (single island endemics). PEPP’s goals are to identify, locate, propagate and out plant Molokai’s critically endangered plants. The Molokai Plant Extinction Prevention (MoPEP) is now part of the State’s NEPM program and is conducting key propagating and outplanting of PEP species in EMoWP fenced areas. EMoWP will continue to provide support to MoPEP’s efforts.

The following is the list of plants they are preventing from going extinct:

**Molokai Critically Endangered Plant Target Species:**

An “SIE” denotes it as a Single Island Endemic.

<i>Brighamia rockii</i> SIE <i>Cyanea dunbariae</i> SIE <i>Cyanea grimesiana</i> <i>Cyanea munroi</i> <i>Cyanea procera</i> SIE <i>Cyanea profuga</i> SIE <i>Cyanea solanacea</i> SIE <i>Gardenia brighamii</i> <i>Labordia triflora</i> SIE <i>Lysimachia maxima</i> SIE <i>Melicope mucronulata</i> <i>Pittosporum halophilum</i> SIE <i>Pritchardia munroi</i> SIE <i>Scaevola coriacea</i> <i>Schiedea laui</i> SIE <i>Silene alexandri</i> <i>Bidens wiebkei</i> SIE <i>Diellia erecta</i> f. <i>alexandri</i> <i>Hedyotis mannii</i> <i>Hibiscus arnottianus</i> ssp. <i>immaculatus</i> SIE <i>Hibiscus brackenridgei</i> ssp. <i>molokaiana</i> SIE	<i>Marsilea villosa</i> <i>Phyllostegia stachyoides</i> <i>Plantago princeps</i> var. <i>laxiflora</i> <i>Platanthera holochila</i> <i>Solanum nelsonii</i> <i>Stenogyne bifida</i> SIE <i>Phyllostegia hispida</i> SIE <i>Clermontia oblongifolia</i> ssp. <i>brevipes</i> SIE <i>Cyrtandra halawensis</i> SIE <i>Cyrtandra hematos</i> SIE <i>Diplazium molokaiense</i> <i>Phyllostegia mannii</i> <i>Schiedea lydgatei</i> SIE <i>Solanum incompletum</i> <i>Sesbania tomentosa</i> <i>Pritchardia hillebrandei</i> SIE <i>Chamaesyce skottsbergei</i> <i>Portulaca villosa</i> <i>Eugenia koolauensis</i>
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**Management Actions**

- **Develop plant species list when going into new areas.**
- **Record and report presence of rare plants during field activities.**
- **Assist MoPEP with logistical needs**
- **Assist MoPEP with rare plant surveys and provide information on new occurrences.**

**d. Stream Monitoring**

Stream Monitoring is conducted every two years in Pelekunu stream, one of the most intact remaining Hawaiian continuous perennial stream systems in the state, having a full host of native freshwater stream fish (‘o‘opu) and shellfish in a stream system that remains undiverted from its highest reaches to the coast. TNC’s biennial monitoring there involves community members to count and size the native fish and shellfish to determine species distribution and abundance across stream reaches. If community members demonstrate interest in taking the lead to monitor additional streams in other ahupua‘a for these stream species, the EMoWP will support their efforts when practical.

**Management Actions**

- **Support community stream monitoring effort if feasible**
- **Monitor Pelekunu Stream every two years**



**D. Wildland Fire Management (Goal 8)** is critical for the South Slope as past fires have demonstrated their devastating effects. The EMoWP will focus its effort on continuing to develop the Molokai Fire Task Force’s (MFTF) role in assisting the Molokai Fire Department (MFD) and the State’s Division of Forestry and Wildlife (DoFAW) in planning and exercising wildland fire pre-suppression and suppression activities. Every year in February, the MFTF conducts “fire readiness” meetings to prepare for the upcoming fire season. In the past, the MFTF efforts have helped increase the development and maintenance of key fire breaks, updated the Molokai Fire Departments communication system, and engaged key community agencies and members, all of which have improved fire readiness and suppression.



Kawela Plantation Unit 3  
Access Road Fire Break

#### **Management Actions**

- **Facilitate MFTF “fire readiness” planning meetings**
- **Assist MFD and DOFAW with fire pre-suppression and suppression activities.**

**E. Community Outreach/Partners (help to achieve Goal 10, 3, 5, 6, 8)** is essential on the island of Molokai, population of just over 7,000 residents. Ahupua’a residents can provide specific information and history about their ‘āina/place. Such intimate knowledge is vital in developing appropriate place-based strategies. In addition, community engagement helps develop comprehensive conservation goals that are not just supported, but owned by local communities. The EMoWP conducts and participates in meetings, updates, events, and projects that keep the community and partners informed of the EMoWP’s activities, successes and challenges and opportunities for engagement.

#### **Management Actions**

- **Implement annual Molokai Earth Day Celebration events in April (Keiki Day and Evening)**
- **Continue to engage community volunteers in management activities including monitoring, ungulate control and weed removal activities.**
- **Conduct annual partners meeting in August.**
- **Recruit landbased partners east of Kapualei.**
- **Complete landowner management “Right of Entry” or “License Agreement” as needed.**
- **Complete semi-annual “Nature’s Newsflash”**
- **Conduct Mana’e Mauka Working Group (MMWG) meeting/engagement as necessary.**
- **Engage with ‘Aha Ki’ole O Moloka’i**
- **Repair key roads when feasible, to access management areas for all partners.**

#### **E. Acquisition**

1. **Lead or assist with acquisition of properties for the EMoWP.**

#### **IV. 2030 Budget Projections**

##### **A. Annual Budget Projections (Based on FY16 Projections and subject to change)**

1. Salary and Benefits (does not include for Moo/Pele)	\$400,000
2. Contract – Management, Helicopter & Road	\$300,000
3. Vehicles, Equipment & Supplies (All Programs including Community Outreach)	\$90,000
4. Travel/Training	\$2,5000
5. Other (Admin, utilities, Communication, etc)	\$15,000
<b>Total</b>	<b>\$830,000.00</b>

##### **B. Annual Funding Sources (Based on FY16 Projections and subject to change)**

1. Department of Water Supply (DWS), County of Maui	\$250,000
2. Kamakou Natural Partnership Program (NAPP), State NARS Fund	\$191,000
3. Pelekunu Natural Partnership Program (NAPP), State NARS Fund	\$78,000
4. Watershed Partership Program Grant (WPPG), State NARS Fund	\$100,000
5. Kamehameha Schools (KS) matching private	\$60,000
6. TNC private or matching funds	\$151,000
<b>Total</b>	<b>\$830,000.00</b>

##### **C. Estimated Cost and Funding Needs for CIP/Aquisition Projects**

1) Pāku'i Fence Unit – State CIP Contract, funded	\$1,200,000
2) State Puaahala Acquisition	
3) Waiahookalo Fence – State CIP	
4) Kamakou Lower Fence – State CIP Contract, funded	\$1,000,000
5) Others	

**We would like to thank all our partners who contributed to the 2030 EMoWP Watershed Management Plan. In particular we would like to acknowledge Paul Hosten for Kalaupapa National Historical Park section; Dr. Fern Duvall for the Puu Alii and Olokui NAR section; Juanita Colon for the Kawela section and Lance De Silva for the Wailau section. Finally, to the TNC Molokai Staff- Stephanie Dunbar-Co for the East Slope section, Wailana Moses for the Weed Control section, Russell Kallstrom, Brian Naeole, and Ed Misaki for coordinating, editing and completing this process.**



## **V. EMoWP Past Highlights**

There are several important EMoWP benchmarks that are key to the future success of conservation projections (Section III) of East Molokai. First, was the formation of the East Molokai Watershed Partnership between conservation partners, major landowners, funding agencies, and the Molokai community (See **Appendix 7 for attached MOU**). Second, was the Kamalo/Kapualei Watershed project which demonstrated and put into actions many of the projections for the future. Third, the development of key monitoring systems to measure the changes of these areas as management is implemented on the ground.

### **1999**

- ❖ Kamalo/Kapualei Watershed Proposal completed and EMoWP formed.

### **2001**

- ❖ Kamalo/Kapualei 5.5 mile contour fence completed.
- ❖ Kamalo/Kapualei 1<sup>st</sup> goat survey completed, approximately 1,300 goats counted.
- ❖ Helicopter assisted hunts involving community hunters began.
- ❖ Fence vegetation monitoring systems developed and installed.
- ❖ Began live humane trapping using macadamia nuts as bait to catch pigs in Kamakou Preserve.

### **2002**

- ❖ 2<sup>nd</sup> goat survey completed, approximately 1,400 goats counted.
- ❖ Kamalo Conservation Advisory Council formed to help facilitate participation between the Kamalo community and EMoWP.
- ❖ Trap captures 1<sup>st</sup> live pig (after almost 1 year of baiting)!

### **2003**

- ❖ Kapualei Ranch signs a License Agreement with TNC and DLNR to conduct Aerial shooting in the steep unsafe sections of their land. Two missions completed with over 800 goats dispatched.
- ❖ Kawela Plantation Homeowner's Association joins EMoWP and additionally, signs a Memorandum of Agreement with TNC to manage their "common lands."
- ❖ March and June EPA Land-based Pollutants on Coral Reefs Workshops ranks south slope of Molokai as one of the top priority areas for land-based/ocean non-point source pollutant – sedimentation.
- ❖ Molokai Fire Task Force's 1<sup>st</sup> meeting.
- ❖ Kamalo ungulate transect 15 installed.

### **2004**

- ❖ DLNR begins aerial shooting protocol update and suspends Aerial shooting.
- ❖ John McAfee (Makolelau) signs EMoWP MOU and becomes an EMoWP Partner.
- ❖ Petitioner filed a contested-case against the Kawela fence CDUA.
- ❖ Kamalo ungulate transect 16 installed.

## **2005**

- ❖ Kawela fence Contested Case hearing occurred in early March and the hearing officer gave a favorable ruling for the fence in June.
- ❖ A USFWS HCCI grant funds Kawela Plantation common lands road improvement.
- ❖ TNC Molokai staff begins integrating GPS/GIS and radio telemetry technology into everyday activities.

## **2006**

- ❖ Kawela fence project began by the 2<sup>nd</sup> quarter and by the 4<sup>th</sup> quarter 60% of the fence had been completed.
- ❖ Molokai Understory Monitoring method developed and implemented. Transect 1 installed and summarized.
- ❖ Over 20 miles of Fire breaks established by partners of the MFTF.
- ❖ EMoWP/TNC partners with MoMISC to begin conducting Miconia aerial survey resulting in no detections.
- ❖ EMoWP/TNC hosts 1<sup>st</sup> Genetic Safety Net (now called Plant Extinction Prevention Program-PEPP) meeting on Molokai.
- ❖ Kamalo ungulate transect 17 installed.

## **2007**

- ❖ The Kawela and Kamakou portions of the Kawela Fence project completed. Due to the change in ownership at Makolelau, the fence has not been constructed for the Makolelau portion. Permission being sought with the new owners.
- ❖ DLNR aerial shooting protocol update completed, aerial shooting statewide resumes.
- ❖ TNC decides to contract Prohunt to conduct animal monitoring and control efforts on Maui, Molokai and Kauai.
- ❖ Aerial weed surveys conducted over the EMoWP south slope landscape. The information will help to develop a comprehensive weed plan to the south Slope.
- ❖ MoMISC surveys were also conducted for a new detection of Australian tree fern and for Miconia (no detections). MoMISC also survey and controlled rubber vine over an 81,000 acre area, adjacent to the EMoWP south slope areas.
- ❖ Aerial shooting resumes on the north slopes of Molokai.
- ❖ MUM transect 2 installed.

## **2008**

- ❖ 2015 South Slope Weed Management Plan completed.
- ❖ 2015 South Slope Management Plan completed.
- ❖ New weed database system developed for Weed tracking.
- ❖ Makolelau portion of East Molokai Watershed contour fence completed.
- ❖ MUM transect 3 installed and monitored.
- ❖ New Zealand ProHunt group conducts contract animal control across EMoWP, teaching latest technology and animal control techniques.
- ❖ Garnett native plant enhancement contracts begin.

## 2009

- ❖ Resumption of South and North Slope Aerial Shooting
- ❖ MUM transect 4 installed and monitored.
- ❖ Kawela to Kaunakakai Wildland Fire (Aug-Sept)
- ❖ USGS Ridge to Reef Project begins

## 2010

- ❖ TNC Kinohi! TNC organization wide adopts “contract models” for management.
- ❖ MUM transect 5 installed and monitored.

## 2011

- ❖ Deer Mesh retrofit
- ❖ Pono Pacific contracted for animal and weed control on South Slope
- ❖ First “re-” monitoring of MUM transect 1. Stations show improvement after completion of Kawela fence.

## 2012

- ❖ FLIR used in ACETA
- ❖ Kapualei fence completed

## 2013

- ❖ East Slope joins EMoWP
- ❖ Ridge to Reef Summary Report
- ❖ Mana‘e Mauka Working Group holds its first meeting and 16 community members, including MMWG members, fly the East Slope



## 2014

- ❖ Kamakou Fence completed
- ❖ Pāku‘i ground surveys begin

## 2015

- ❖ Pāku‘i ground surveys complete
- ❖ \$1.855 million secured towards State Pua‘ahala purchase

## 2016

- ❖ Kamakou fence unit free of pigs

## 2017

- ❖ Kamalō Subunit fence constructed
- ❖ Kamalō Kapualei fenced subunit remote traps set and captures 4 pigs



- ❖ Owners of Pua‘ahala property agree to sell to State

#### **2018**

- ❖ 5.5 mile Pakui fence project funded
- ❖ Waiahookalo fence funded
- ❖ Kamakou Lower fence put on State CIP list for funding.

#### **2019**

- ❖ South Slope aerial shooting permit expanded to all animals in steep gulches
- ❖ Kamakou Lower Fence Funded
- ❖ Kawela Kamalo fenced subunit trapping begins
- ❖ Pāku‘i started (Oct), including hiring of local fence crew

#### **2020**

- ❖ Pua‘ahala acquired (Jan)
- ❖ Kamakou Lower fence started (Jan)
- ❖ Waiahookalo fence completed
- ❖ Waikolu Rim fence upper portion completed

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**APPENDIX 1**  
**NATIVE NATURAL COMMUNITIES OF MOLOKAI'S SOUTH SLOPE\***

NATURAL COMMUNITY	GLOBAL RANK(a)
<b>Lowland</b>	
'Ōhi'a/Uluhe ( <i>Metrosideros/Dicranopteris</i> ) Lowland Wet Woodland <sup>1,2</sup>	G3
Uluhe ( <i>Dicranopteris</i> ) Lowland Wet Shrubland <sup>1,2</sup>	G3
'Ōhi'a ( <i>Metrosideros</i> ) Lowland Mesic Shrubland	G3
Halapepe ( <i>Pleomele auwahiensis</i> ) Lowland Mesic Woodland	G1
Olopuā ( <i>Nestigis sandwicensis</i> ) Lowland Mesic Forest	G2
'Ōhai ( <i>Sesbania tomentosa</i> ) Lowland Dry Shrubland	G1
<b>Montane</b>	
'Ōhi'a/'Ōlapa ( <i>Metrosideros/Cheirodendron</i> ) Montane Wet Forest <sup>1,2</sup>	GNR
'Ōhi'a ( <i>Metrosideros</i> ) Mixed Montane Scrub Bog	G2
'Ōhi'a ( <i>Metrosideros</i> ) Mixed Shrub Montane Wet Forest <sup>1,2</sup>	G3
'Ōhi'a ( <i>Metrosideros</i> ) Montane Wet Scrub Forest	GNR
Hawaiian Mixed Fern & Shrub Assemblage on Montane Wet Cliff	G3
<b>Aquatic Community</b>	
Hawaiian Continuous Perennial Stream	G1
<b>Subterranean Community</b>	
Small-eyed Rock Centipede/Ground Beetle ( <i>Lithobius/Carabid</i> ) Montane Wet Piping Cave	G1

1 =Known also from Pu'u Ali'i NAR

2 =Known also from Oloku'i NAR

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, March 2008:

- G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
- G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
- G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
- G4 = Apparently Secure. Uncommon but not rare; some cause for long-term concern due to declines or other factors.
- G5 = Secure. Common; widespread and abundant.
- GNR = Not Yet Ranked.

\*South Slope refers to Kamakou Preserve, Kawela Plantation, Kamalo, and Kapualei. Compiled in 2008 from TNC field data, 2007 HINHP Database, Plant Extinction Prevention Program Data and Nov 2002 Checklist of Vascular Plants in Wawaia & Kumueli, Moloka'i, Hawai'i by Ken Wood and Steve Pearlman.



**APPENDIX 2**  
**RARE NATIVE PLANTS OF MOLOKAI'S SOUTH SLOPE\***

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
<i>Adenophorus periens</i> [ <i>Oligadenus periens</i> ]		G1	LE
<i>Alectryon macrococcus</i> var. <i>macrococcus</i> <sup>3</sup>	'ala'alahua, māhoe	G1T1	LE
<i>Bidens wiebkei</i>	ko'oko'olau, kōko'olau	G1	LE
<i>Bonamia menziesii</i>		G1	LE
<i>Canavalia molokaiensis</i> <sup>3</sup>	'āwikiwiki, puakauhi	G1	LE
<i>Clermontia oblongifolia</i> ssp. <i>brevipes</i> <sup>1</sup>	'ōhā, 'ōhā wai	G3T1	LE
<i>Ctenitis squamigera</i>	pauoa	G1	LE
<i>Cyanea mannii</i>	'ōhā, hāhā, 'ōhā wai	G2	LE
<i>Cyanea procera</i> <sup>1</sup>	'ōhā, hāhā, 'ōhā wai	G1	LE
<i>Cyanea profuga</i>	-	GH	LE
<i>Cyanea solanacea</i> <sup>1,2</sup>	hāhā nui, pōpolo	G1	LE
<i>Cyanea solenocalyx</i> <sup>1,2</sup>	hāhā, pua kala	G2	SOC
<i>Cyrtandra halawensis</i> <sup>2</sup>	ha'iwale, kanawao ke'oke'o	G1	SOC
<i>Cyrtandra hematos</i> <sup>2</sup>	ha'iwale, kanawao ke'oke'o	G1	LE
<i>Cyrtandra macrocalyx</i>	ha'iwale, kanawao ke'oke'o	G2	SOC
<i>Cyperus fauriei</i>	-	G1	LE
<i>Diellia erecta</i>	-	G1	LE
<i>Dissochondrus biflorus</i>	-	G2	SOC
<i>Eurya sandwicensis</i> <sup>1,2</sup>	ānini	G2	SOC
<i>Exocarpos gaudichaudii</i> <sup>3</sup>	heau	G1	SOC
<i>Gouania hillebrandii</i>	-	G1	LE
<i>Hedyotis mannii</i> <sup>3</sup>	-	G1	LE
<i>Joinvillea ascendens</i> ssp. <i>ascendens</i> <sup>2</sup>	'ohe	G5T1	LE
<i>Labordia triflora</i>	-	G1	LE
<i>Lobelia dunbariae</i> ssp. <i>paniculata</i>	'ōhā, hāhā, 'ōhā wai	G1T1	SOC
<i>Lepidium bidentatum</i> var. <i>o-waihense</i>	'ānaunau, 'ānounou	G5T2	SOC
<i>Lysimachia maxima</i> <sup>1</sup>	-	G1	LE
<i>Melicope hawaiiensis</i>	alani	G2	SOC
<i>Melicope mucronulata</i>	alani	G1	LE
<i>Melicope reflexa</i>	alani	G1	LE
<i>Nesoluma polynesianum</i>	keahi	G2	SOC
<i>Neraudia melastomifolia</i>	ma'aloa	G2	SOC
<i>Nothocestrum latifolium</i>	'aiea	G1	LE
<i>Peperomia rockii</i>	-	G1	SOC
<i>Phyllostegia hispida</i> <sup>1</sup>	-	G1	LE
<i>Phyllostegia mannii</i> <sup>1</sup>	-	G1	LE
<i>Phyllostegia pilosa</i> <sup>4</sup>	-	G1	LE
<i>Phyllostegia stachyoides</i>	-	G1	LE
<i>Plantago princeps</i> var. <i>laxiflora</i> <sup>2,3</sup>	ale	G2T1	LE
<i>Platanthera holochila</i>	-	G1	LE
<i>Pritchardia munroi</i>	loulu	G1	LE
<i>Pteris lydgatei</i>	-	G1	LE
<i>Ranunculus mauensis</i> <sup>1,3</sup>	makou	G2	LE
<i>Scaevola coriacea</i>	naupaka	G1	LE

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
<i>Schiedea diffusa</i>	-	G1	LE
<i>Schiedea lydgatei</i>	-	G1	LE
<i>Schiedea nuttallii</i>	-	G1	LE
<i>Schiedea pubescens</i> var <i>pubescens</i>	-	G1	LE
<i>Schiedea sarmentosa</i>		G1	LE
<i>Sicyos cucumerinus</i>	‘ānunu, kūpala	G1	SOC
<i>Silene alexandrii</i>	-	G1	LE
<i>Silene lanceolata</i>	-	G1	LE
<i>Spermolepis hawaiiensis</i>	-	G2	LE
<i>Stenogyne bifida</i> <sup>1</sup>	-	G1	LE
<i>Vigna o-wahuensis</i>	-	G1	LE
<i>Zanthoxylum hawaiiense</i> <sup>3</sup>	hea‘e, a‘e	G1	LE

Number of Endangered Plants: 43

Number of Plant Species of Concern: 13

1 = Also known (currently or historically) from Pu‘u Ali‘i NAR

2 = Also known (currently or historically) from Oloku‘i NAR

3 = Also known (currently or historically) from Kalaupapa National Historical Park

4 = Formerly known as *Phyllostegia mollis*.

(a) Key to Global Ranks as defined by the NatureServe.Org:

GH = Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery.

G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 = Imperiled. At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 = Vulnerable. At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 = Apparently Secure. Uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 = Secure. Common; widespread and abundant.

T1 = Subspecific taxa critically imperiled globally.

(b) Federal Status:

LE = Taxa formally listed as endangered.

LT = Taxa formally listed as threatened.

C = Candidate taxa for which substantial information on biological vulnerability and threat(s) support proposals to list them as endangered or threatened.

SOC = Species of Concern that available information does meet the criteria for concern and the possibility to recommend as candidate.

\*South Slope refers to Kamakou Preserve, Kawela Plantation, Kamalo, and Kapualei. Compiled in 2015 from TNC field data, 2007 HINHP Database, Plant Extinction Prevention Program Data and Nov 2002 Checklist of Vascular Plants in Wawaia & Kumueli, Moloka‘i, Hawai‘i by Ken Wood and Steve Pearlman. Updated 13 May 2019

### APPENDIX 3 PLANT CHECKLIST OF MOLOKAI'S SOUTH SLOPE\*

<b>Scientific Name</b>	<b>Status</b>	<b>Common Name(s)</b>	<b>Family</b>
<i>Acacia mearnsii</i>	nat	black wattle	Fabaceae
<i>Adenophorus hymenophylloides</i>	end	palai huna	Grammitidaceae
<i>Adenophorus periens</i>	end	palai <a href="#">lā'au</a>	Grammitidaceae
<i>Adenophorus pinnatifidus</i>	end		Grammitidaceae
<i>Adenophorus tamariscinus</i>	end	wahine noho mauna	Grammitidaceae
<i>Adenophorus tripinnatifidus</i>	end		Grammitidaceae
<i>Adiantum capillus-veneris</i>	ind	'iwa'iwa	Pteridaceae
<i>Adiantum raddianum</i>	nat		Pteridaceae
<i>Ageratina adenophora</i>	nat	Maui pamakani	Asteraceae
<i>Ageratina riparia</i>	nat	Hamakua pamakani	Asteraceae
<i>Ageratum conyzoides</i>	nat	maile hohono	Asteraceae
<i>Agrostis stolonifera</i>	nat		Poaceae
<i>Alectryon macrococcus</i> var. <i>macrococcus</i>	end	`ala'alahua, māhoe	Sapindaceae
<i>Alnus nepalensis</i>	nat	Nepal alder	Betulaceae
<i>Alphitonia ponderosa</i>	end	kauila, kauwila	Rhamnaceae
<i>Alyxia stellata</i>	Ind	maile	Apocynaceae
<i>Amaranthus spinosus</i>	nat	Spiny amaranth	Amaranthaceae
<i>Amauropelta globulifera</i>	end	palapalai a Kamapua'a	Thelypteridaceae
<i>Andropogon virginicus</i>	nat	broomsedge	Poaceae
<i>Anoectochilus sandwicensis</i>	end	ke kino o Kanaloa	Orchidaceae
<i>Anthoxanthum odoratum</i>	nat	sweet vernal grass	Poaceae
<i>Anthurium</i> spp.	nat	anthurium	Araceae
<i>Araucaria araucana</i>	U	monkey puzzle	Araucariaceae
<i>Araucaria columnaris</i>	nat	Cook Island pine	Araucariaceae
<i>Argemone glauca</i>	end	pua kala	Papaveraceae
<i>Artemisia australis</i>	end	ahinahina	Asteraceae
<i>Asclepias physocarpa</i>	nat	balloon plant	Asclepidaceae
<i>Asplenium acuminatum</i>	end	lola	Aspleniaceae
<i>Asplenium aethiopicum</i>	ind	'iwa'iwa a Kane	Aspleniaceae
<i>Asplenium contiguum</i>	end	'iwa	Aspleniaceae
<i>Asplenium insiticium</i>	ind	pi'ipi'i lau manamana	Aspleniaceae
<i>Asplenium lobulatum</i>	ind	pi'ipi'i lau manamana	Aspleniaceae
<i>Asplenium polyodon</i>	ind		Aspleniaceae
<i>Astelia menziesiana</i>	end	pa'iniu	Asteliaceae
<i>Athyrium microphyllum</i>	end	'ākōlea	Athyriaceae
<i>Axonopus fissifolius</i>	nat	carpetgrass, narrow-leaved carpetgrass	Poaceae
<i>Bidens menziesii</i> subsp. <i>menziesii</i>	end	kōko'olau, ko'oko'olau	Asteraceae
<i>Bidens pilosa</i>	nat	tinehe, kinehi	Asteraceae
<i>Bidens wiebkei</i>	end		Asteraceae
<i>Blechnum appendiculatum</i>	nat		Blechnaceae
<i>Boehmeria grandis</i>	end	'akolea	Urticaceae
<i>Boerhavia coccinea</i>	nat		Nyctaginaceae
<i>Bonamia menziesii</i>	end		Convulvaceae
<i>Broussaisia arguta</i>	end	puahanui, kanawao	Hydrangeaceae
<i>Buddleia asiatica</i>	nat	dog tail	Buddlejaceae
<i>Callistopteris baldwinii</i>	ind		Hymenophyllaceae
<i>Calotropis gigantea</i>	nat	crown flower; pua kalaunu	Apocynaceae
<i>Canavalia molokaiensis</i>	end	puakauhi	Fabaceae
<i>Cannabis sativa</i>	U	marijuana	Cannabaceae
<i>Carex alligata</i>	end		Cyperaceae
<i>Carex meyenii</i>	ind		Cyperaceae
<i>Carex wahuensis</i> subsp. <i>wahuensis</i>	end		Cyperaceae
<i>Casuarina equisetifolia</i>	nat	ironwood	Casuarinaceae
<i>Cenchrus ciliaris</i>	nat	buffel grass	Poaceae
<i>Centaurium erythraea</i>	nat		Gentianaceae
<i>Centella asiatica</i>	nat	Asiatic pennywort, pohe kula	Apiaceae
<i>Cerastium fontanum</i> subsp. <i>triviale</i>	nat		Caryophyllaceae



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<i>Chamaecrista nictitans</i>	nat	partridge pea	Fabaceae
<i>Cheirodendron trigynum subsp. trigynum</i>	end	'ōlapa	Araliaceae
<i>Chenopodium carinatum</i>	nat		Amaranthaceae
<i>Chenopodium oahuense</i>	nat	'aweoweo	Amaranthaceae
<i>Christella cyatheoides</i>	end	kikawaio, pakikawaio	Thelypteridaceae
<i>Christella dentata</i>	nat	pai'i'iha	Thelypteridaceae
<i>Christella parasitica</i>	nat		Thelypteridaceae
<i>Cibotium chamissoi</i>	end	hāpu'u	Dicksoniaceae
<i>Cibotium glaucum</i>	end	hāpu'u pulu	Dicksoniaceae
<i>Cibotium glaucum x menziesii</i>	end	hāpu'u	Dicksoniaceae
<i>Cibotium menziesii</i>	end	hāpu'u 'i'i	Dicksoniaceae
<i>Cirsium vulgare</i>	nat	Bull thistle, pua kala	Asteraceae
<i>Clermontia arborescens</i>	end		Campanulaceae
<i>Clermontia grandiflora subsp. munroi</i>	end		Campanulaceae
<i>Clermontia kakeana</i>	end	oha wai	Campanulaceae
<i>Clermontia oblongifolia</i>	end		Campanulaceae
<i>Clermontia oblongifolia ssp. brevipes</i>	end	oha, oha wai	Campanulaceae
<i>Clermontia pallida</i>	end		Campanulaceae
<i>Clidemia hirta</i>	nat	Koster's curse	Melastomataceae
<i>Cocculus orbiculatus</i>	ind	huehue	Menispermaceae
<i>Coniogramme pilosa</i>	end		Pteridaceae
<i>Conyza bonariensis</i>	nat	Hairy horseweed, lani wela	Asteraceae
<i>Conyza canadensis</i>	nat	horseweed	Asteraceae
<i>Coprosma foliosa</i>	end	pilo	Rubiaceae
<i>Coprosma ochracea</i>	end	pilo	Rubiaceae
<i>Coprosma pubens</i>	end	pilo	Rubiaceae
<i>Coprosma spp.</i>	end	pilo	Rubiaceae
<i>Coprosma ternata</i>	end	pilo	Rubiaceae
<i>Cordyline fruticosa</i>	pol	ti, ti leaf	Agavaceae
<i>Corynocarpus laevigatus</i>	nat	karakanut	Corynocarpaceae
<i>Crotolaria pallida</i>	nat	rattle pod	Fabaceae
<i>Crotolaria spp.</i>	nat	rattle pod	Fabaceae
<i>Ctenitis latifrons</i>	end	'akolea	Dryopteridaceae
<i>Ctenitis squamigera</i>	end		Dryopteridaceae
<i>Cuphea carthagenensis</i>	nat	Tarweed, Colombian cuphea	Lythraceae
<i>Cupressus macrocarpus</i>	nat	Monterey Cypress	Cupressaceae
<i>Cyanea mannii</i>	end	haha	Campanulaceae
<i>Cyanea procera</i>	end		Campanulaceae
<i>Cyanea profuga</i>	end	haha	Campanulaceae
<i>Cyanea solanacea</i>	end	pōpolo, haha	Campanulaceae
<i>Cyanea solenocalyx</i>	end	pua kala, haha	Campanulaceae
<i>Cynodon dactylon</i>	nat	bermuda grass	Poaceae
<i>Cyperus fauriei</i>	end		Cyperaceae
<i>Cyperus gracilis</i>	nat	McCoy grass	Cyperaceae
<i>Cyperus polystachyos</i>	ind		Cyperaceae
<i>Cyrtandra biserrata</i>	end	ha'iwale	Gesneriaceae
<i>Cyrtandra grayana</i>	end	ha'iwale	Gesneriaceae
<i>Cyrtandra grayi</i>	end	ha'iwale	Gesneriaceae
<i>Cyrtandra halawensis</i>	end	ha'iwale	Gesneriaceae
<i>Cyrtandra hematos</i>	end	ha'iwale	Gesneriaceae
<i>Cyrtandra macrocalyx</i>	end	ha'iwale	Gesneriaceae
<i>Cyrtandra procera</i>	end	ha'iwale	Gesneriaceae
<i>Deparia petersenii</i>	nat		Athyriaceae
<i>Deparia prolifera</i>	end		Athyriaceae
<i>Deschampsia nubigena</i>	end		Poaceae
<i>Desmodium triflorum</i>	nat		Fabaceae
<i>Dianella sandwicensis</i>	ind	'uki'uki, 'uki	Liliaceae
<i>Dicranopteris linearis</i>	ind	uluhe	Gleicheniaceae
<i>Diella erecta</i>	end		Aspleniaceae
<i>Digitaria fuscescens</i>	nat		Poaceae
<i>Diospyros sandwicensis</i>	end	lama	Ebenaceae

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<i>Diplazium sandwichianum</i>	end	hō'i'o, pohole	Athyriaceae
<i>Diplopterygium pinnatum</i>	ind	uluhe lau nui	Gleicheniaceae
<i>Dissochondrus biflorus</i>	end		Poaceae
<i>Dodonaea viscosa</i>	ind	'a'ali'i; 'ā'ali'i	Sapindaceae
<i>Doodia kunthiana</i>	end	'ōkupukupu	Blechnaceae
<i>Drymaria cordata</i> var. <i>pacifica</i>	nat	pilipili	Caryophyllaceae
<i>Dryopteris fusco-atra</i>	end	'i'i	Dryopteridaceae
<i>Dryopteris glabra</i>	end	kīlau, hohiu	Dryopteridaceae
<i>Dryopteris glabra</i> var. <i>soripes</i>	end	kīlau, hohiu	Dryopteridaceae
<i>Dryopteris hawaiiensis</i>	end		Dryopteridaceae
<i>Dryopteris unidentata</i>	end	'akole	Dryopteridaceae
<i>Dryopteris unidentata</i> var. <i>paleacea</i>	end	'akole	Dryopteridaceae
<i>Dryopteris unidentata</i> var. <i>unidentata</i>	end	'akole	Dryopteridaceae
<i>Dryopteris wallichiana</i>	end	'i'o nui, laukahi	Dryopteridaceae
<i>Dubautia carrii</i>	end	na'ena'e	Asteraceae
<i>Dubautia laxa</i>	end	na'ena'e	Asteraceae
<i>Dubautia linearis</i>	end	na'ena'e	Asteraceae
<i>Dubautia plantaginea</i>	end	na'ena'e	Asteraceae
<i>Dubautia plantaginea</i> subsp. <i>plantaginea</i>	end	na'ena'e	Asteraceae
<i>Dubautia scabra</i> subsp. <i>leiophylla</i>	end	na'ena'e	Asteraceae
<i>Ehrharta stipoides</i>	nat	meadow rice grass	Poaceae
<i>Elaphoglossum crassifolium</i>	end	hoe a Maui, 'ēkaha	Lomariopsidaceae
<i>Elaphoglossum fauriei</i>	end	hoe a Maui, 'ēkaha	Lomariopsidaceae
<i>Elaphoglossum paleaceum</i>	ind	maku'e	Lomariopsidaceae
<i>Elaphoglossum wawrae</i>	end	hoe a Maui, 'ekaha	Lomariopsidaceae
<i>Embelia pacifica</i>	end	kili'oe	Primulaceae
<i>Eragrostis grandis</i>	end		Poaceae
<i>Erechtites valerianifolia</i>	nat		Asteraceae
<i>Erigeron karvinskianus</i>	nat	daisy fleabane	Asteraceae
<i>Erythrina sandwicensis</i>	end	wiliwili	Fabaceae
<i>Eucalyptus robusta</i>	nat		Myrtaceae
<i>Euphorbia celastroides</i> var. <i>amplectens</i>	end	'akoko	Euphorbiaceae
<i>Euphorbia hirta</i>	nat	hairy spurge	Euphorbiaceae
<i>Euphorbia prostrata</i>	nat	prostrate spurge	Euphorbiaceae
<i>Eurya sandwicensis</i>	end	anini, wanini	Theaceae
<i>Exocarpus gaudichaudii</i>	end	heau	Santalaceae
<i>Festuca molokaiensis</i>	end	Molokai fescue	Poaceae
<i>Festuca</i> spp	nat		Poaceae
<i>Fimbristylis dichotoma</i>	ind		Cyperaceae
<i>Fraxinus uhdei</i>	nat	tropical ash	Oleaceae
<i>Freycinetia arborea</i>	ind	ieie	Pandanaceae
<i>Furcraea foetida</i>	nat	Mauritius hemp	Agavaceae
<i>Gahnia beecheyi</i>	end	Uki, forest sawsedge	Cyperaceae
<i>Gnaphalium purpureum</i>	nat	cudweed	Asteraceae
<i>Gouania hillebrandii</i>	end		Rhamnaceae
<i>Grammitis forbesiana</i>	end		Grammitidaceae
<i>Grammitis hookeri</i>	ind	maku'e lau li'i	Grammitidaceae
<i>Grammitis tenella</i>	end	mahinalua	Grammitidaceae
<i>Grevillea banksii</i>	nat	kahili flower	Proteaceae
<i>Grevillea robusta</i>	nat	silk oak	Proteaceae
<i>Hedychium coronarium</i>	nat	white ginger	Zingiberaceae
<i>Heterotheca grandiflora</i>	nat	telegraph weed	Asteraceae
<i>Hibiscus elatus</i>	nat	Cuba blast	Malvaceae
<i>Hillebrandia sandwicensis</i>	end	'aka'aka'awa	Begoniaceae
<i>Huperzia phyllantha</i>	ind	wawae'iole	Lycopodiaceae
<i>Huperzia</i> sp.	U		Lycopodiaceae
<i>Hydrocotyle verticellata</i>	nat		Apiaceae
<i>Hypericum mutilum</i>	nat		Hypericaceae
<i>Hypochoeris radicata</i>	nat	hairy cat's ear, gosmore	Asteraceae
<i>Hypolepis hawaiiensis</i>	end		Dennstaedtiaceae
<i>Ilex anomala</i>	ind	kāwa'u	Aquifoliaceae
<i>Indigofera suffruticosa</i>	nat		Fabaceae
<i>Isachne distichophylla</i>	end		Poaceae
<i>Joinvillea ascendens</i> ssp. <i>ascendens</i>	end	'ohe	Joinvilleaceae
<i>Juncus effusus</i>	nat	Japanese mat rush, bog rush	Juncaceae
<i>Juncus planifolius</i>	nat		Juncaceae
<i>Kadua acuminata</i>	end	manono	Rubiaceae
<i>Kadua centranthoides</i>	end	manono	Rubiaceae

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<i>Kadua hillebrandii</i>	end	manono	Rubiaceae
<i>Kadua mannii</i>	end	pilo	Rubiaceae
<i>Kadua terminalis</i>	end	manono	Rubiaceae
<i>Kalanchoe pinnata</i>	nat	air plant	Crassulaceae
<i>Korthalsella complanata</i>	ind	hulumoa	Santalaceae
<i>Korthalsella cylindrica</i>	end	hulumoa	Santalaceae
<i>Korthalsella remyana</i>	end	hulumoa	Santalaceae
<i>Labordia hedyosmifolia</i>	end	kāmakahala	Loganiaceae
<i>Labordia hirtella</i>	end	kāmakahala	Loganiaceae
<i>Labordia triflora</i>	end	kāmakahala	Loganiaceae
<i>Labordia waiolani</i>	end	kāmakahala	Loganiaceae
<i>Lantana camara</i>	nat	lantana	Verbenaceae
<i>Lellingeria saffordii</i>	end	kihe	Grammitidaceae
<i>Lepidium bidentatum</i> var. <i>o-waihense</i>	end	'ānaunau, 'ānōunou, kūnānā	Brassicaceae
<i>Lepisorus thunbergianus</i>	ind	pākahakaha, pua'akuhihia	Polypodiaceae
<i>Leptecophylla tameiameiae</i>	ind	pūkiawe	Ericaceae
<i>Leucaena leucocephala</i>	nat	koa haole	Fabaceae
<i>Liparis hawaiiensis</i>	end	'awapuhi a Kanaloa	Orchidaceae
<i>Lipochaeta rockii</i>	end	nehe	Asteraceae
<i>Lobelia dunbarii</i> subsp. <i>paniculata</i>	end		Campanulaceae
<i>Lobelia gloria-montis</i>	end		Campanulaceae
<i>Lobelia hypoleuca</i>	end		Campanulaceae
<i>Lophostemon confertus</i>	nat	brush box	Myrtaceae
<i>Luzula hawaiiensis</i> var. <i>glabrata</i>	end		Juncaceae
<i>Lycopodiella cernua</i>	ind	wāwae'iole	Lycopodiaceae
<i>Lycopodium venustulum</i>	end	wāwae'iole	Lycopodiaceae
<i>Lysimachia hillebrandii</i>	end	lehua kolo	Primulaceae
<i>Lysimachia maxima</i>	end		Primulaceae
<i>Lysimachia remyi</i>	end		Primulaceae
<i>Lythrum maritimum</i>	nat		Lythraceae
<i>Machaerina angustifolia</i>	ind	'uki, 'uki'uki	Cyperaceae
<i>Marattia douglasii</i>	end	mule's foot fern, kapua`ilio, pala	Marattiaceae
<i>Mecodium recurvum</i>	end	`ōhi'a kū	Hymenophyllaceae
<i>Melaleuca quinquenervia</i>	nat	paperbark	Myrtaceae
<i>Melicope clusiifolia</i>	end	alani; mokihana	Rutaceae
<i>Melicope hawaiiensis</i>	end	alani	Rutaceae
<i>Melicope molokaiensis</i>	end	alani	Rutaceae
<i>Melicope mucronulata</i>	end	alani	Rutaceae
<i>Melicope parvifolia</i> , <i>sessilis</i>	end	alani	Rutaceae
<i>Melicope peduncularis</i>	end	alani	Rutaceae
<i>Melicope reflexa</i>	end	alani	Rutaceae
<i>Melicope sessilis</i>	end	alani	Rutaceae
<i>Melinis minutiflora</i>	nat	molasses grass	Poaceae
<i>Melinis repens</i>	nat	natal red top	Poaceae
<i>Metrosideros polymorpha</i>	end	`ōhi'a	Myrtaceae
<i>Metrosideros polymorpha</i> var. <i>glaberrima</i>	end	`ōhi'a	Myrtaceae
<i>Metrosideros polymorpha</i> var. <i>incana</i>	end	`ōhi'a	Myrtaceae
<i>Metrosideros waialealae</i> var. <i>fauriei</i>	end	`ōhi'a	Myrtaceae
<i>Microlepia strigosa</i>	ind	palapalai	Dennstaedtiaceae
<i>Myoporum sandwicense</i>	ind	naio	Myoporaceae
<i>Myrsine lanaiensis</i>	end	kōlea	Primulaceae
<i>Myrsine lessertiana</i>	end	kōlea	Primulaceae
<i>Myrsine sandwicensis</i>	end	kōlea lau li'i	Primulaceae
<i>Nageia falcatus</i>	nat	podocarpos	Podocarpaceae
<i>Nasturtium microphyllum</i>	nat	watercress	Brassicaceae
<i>Neonotonia wightii</i>	nat	glycine	Fabaceae
<i>Nephrolepis cordifolia</i>	ind	kupukupu	Nephrolepidaceae
<i>Nephrolepis exaltata</i> subsp. <i>hawaiiensis</i>	ind	kupukupu	Nephrolepidaceae
<i>Nephrolepis multiflora</i>	nat	kupukupu	Nephrolepidaceae
<i>Neraudia melastomifolia</i>	end	ma'aloa	Urticaceae
<i>Nertera granadensis</i>	ind	mākole	Rubiaceae
<i>Nesoluma polynesicum</i>	end	keahi	Sapotaceae
<i>Nestegis sandwicensis</i>	end	olopua	Oleaceae



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<i>Nothoecstrum latifolium</i>	end	`aiea	Solanaceae
<i>Nothoecstrum sp.</i>	end	`aiea	Solanaceae
<i>Nothoperanema rubiginosa</i>	end		Dryopteridaceae
<i>Nototrichium sandwicense</i>	end	kulu'i	Amaranthaceae
<i>Ochrosia compta</i>	end	hōlei	Apocynaceae
<i>Opuntia ficus-indica</i>	nat	panini, cactus	Cactaceae
<i>Osteomeles anthyllidifolia</i>	ind	`ūlei	Rosaceae
<i>Oxalis corniculata</i>	ind	yellow clover leaf	Oxalidaceae
<i>Oxalis debilis</i>	nat	pink clover leaf	Oxalidaceae
<i>Panicum maximum</i>	nat	guinea grass	Poaceae
<i>Panicum torridum</i>	end	Kakonakona	Poaceae
<i>Paspalum conjugatum</i>	nat	Hilo grass	Poaceae
<i>Paspalum urvillei</i>	nat	vasey grass	Poaceae
<i>Passiflora edulis</i>	nat	liliko'i	Passifloraceae
<i>Pennisetum clandestinum</i>	nat	kikuyu grass	Poaceae
<i>Peperomia cookiana</i>	end	`ala'ala wai nui	Piperaceae
<i>Peperomia expallescens</i>	end	`ala'ala wai nui	Piperaceae
<i>Peperomia latifolia</i>	end	`ala'ala wai nui	Piperaceae
<i>Peperomia macraeana</i>	end	`ala'ala wai nui	Piperaceae
<i>Peperomia mauiensis</i>	end	`ala'ala wai nui	Piperaceae
<i>Peperomia rockii</i>	end	`ala'ala wai nui	Piperaceae
<i>Peperomia tetraphylla</i>	ind	`ala'ala wai nui	Piperaceae
<i>Perrottetia sandwicensis</i>	end	olomea	Celastraceae
<i>Phormium tenax</i>	nat	New Zealand Flax	Hemerocallidaceae
<i>Phyllostegia glabra var. glabra</i>	end	ulihi	Lamiaceae
<i>Phyllostegia hispida</i>	end		Lamiaceae
<i>Phyllostegia mannii</i>	end		Lamiaceae
<i>Phyllostegia pilosa</i>	end		Lamiaceae
<i>Phyllostegia stachyoides</i>	end		Lamiaceae
<i>Physalis peruviana L.</i>	nat	pohā	Solanaceae
<i>Phytolacca octandra</i>	nat	pokeweed	Phytolaccaceae
<i>Phytolacca sandwicensis</i>	end	pōpolo, pokeweed	Phytolaccaceae
<i>Picris hieracioides</i>	nat	ox tongue, hawkweed	Asteraceae
<i>Pilea peploides</i>	ind		Urticaceae
<i>Pinus elliottii</i>	nat	pine	Pinaceae
<i>Pinus spp.</i>	nat	pine	Pinaceae
<i>Pipturus albidus</i>	end	mamake, mamaki	Urticaceae
<i>Pittosporum argenteum</i>	end	hō'awa	Pittosporaceae
<i>Pittosporum glabrum</i>	end	hō'awa	Pittosporaceae
<i>Planchonella sandwicensis</i>	end	`āla'a, aulu	Sapotaceae
<i>Plantago pachyphylla var. maviensis</i>	end	laukahi kuahiwi	Plantaginaceae
<i>Plantago princeps var. laxiflora</i>	end		Plantaginaceae
<i>Platanthera holochila</i>	end	puahala-a-Kāne	Orchidaceae
<i>Pleomele auwahiensis</i>	end	halapepe	Asparagaceae
<i>Pluchea carolinensis</i>	nat	marsh fleabane, sourbush	Asteraceae
<i>Pneumatopteris sandwicensis</i>	end	hō'i'o kula	Thelypteridaceae
<i>Polygonum punctatum</i>	nat	smartweed	Polygonaceae
<i>Polypodium pellucidum</i>	end	`ae	Polypodiaceae
<i>Pritchardia munroi</i>	end	loulou	Arecaceae
<i>Prosopis pallida</i>	nat	kiawe, mesquite	Fabaceae
<i>Prunus spp.</i>	nat	plum	Rosaceae
<i>Pseudognaphalium sandwicense var. sandwicense</i>	end	`ena'ena	Asteraceae
<i>Psidium cattleianum</i>	nat	strawberry guava	Myrtaceae
<i>Psidium guajava</i>	nat	common guava	Myrtaceae
<i>Psilotum complanatum</i>	ind	moa	Psilotaceae
<i>Psilotum nudum</i>	ind	moa	Psilotaceae
<i>Psychotria hawaiiensis</i>	end	kōpiko	Rubiaceae
<i>Psychotria maritima</i>	end	kōpiko	Rubiaceae
<i>Psychotria mauiensis</i>	end	kōpiko	Rubiaceae
<i>Pteridium aquilinum var. decompositum</i>	end	kīlau	Pteridaceae
<i>Pteris irregularis</i>	end	mana	Pteridaceae
<i>Pteris lidgatei</i>	end		Pteridaceae
<i>Ranunculus mauiensis</i>	end	makou	Ranunculaceae

<b>Scientific Name</b>	<b>Status</b>	<b>Common Name(s)</b>	<b>Family</b>
<i>Rhynchospora sclerioides</i>	ind		Cyperaceae
<i>Ricinus communis</i>	nat	castor bean	Euphorbiaceae
<i>Rosa multiflora</i>	nat	English rose; multiflora rose	Rosaceae
<i>Rubus argutus</i>	nat	Prickly Florida blackberry	Rosaceae
<i>Rubus hawaiiensis</i>	end	akala	Rosaceae
<i>Rubus rosifolius</i>	nat	thimbleberry	Rosaceae
<i>Rytidosperma semiannulare</i>	nat	wallaby grass	Poaceae
<i>Sacciolepis indica</i>	nat	Glenwood grass	Poaceae
<i>Sadleria cyatheoides</i>	end	`ama'u	Blechnaceae
<i>Sadleria pallida</i>	end	`ama'u	Blechnaceae
<i>Sadleria souleyetiana</i>	end	`ama'u	Blechnaceae
<i>Sadleria squarrosa</i>	end	`ama'u	Blechnaceae
<i>Santalum ellipticum</i>	end	sandalwood, `iliahi	Santalaceae
<i>Santalum freycinetianum</i> var. <i>freycinetianum</i>	end	sandalwood, `iliahi	Santalaceae
<i>Scaevola chamissoniana</i>	end	naupaka kuahiwi	Goodeniaceae
<i>Scaevola coriacea</i>	end	naupaka	Goodeniaceae
<i>Scaevola gaudichaudii</i>	end	naupaka kuahiwi	Goodeniaceae
<i>Scaevola mollis</i>	end	naupaka kuahiwi	Goodeniaceae
<i>Scaevola procera</i>	end	naupaka kuahiwi	Goodeniaceae
<i>Schiedea diffusa</i>	end		Caryophyllaceae
<i>Schiedea laui</i>	end		Caryophyllaceae
<i>Schiedea lydgatei</i>	end		Caryophyllaceae
<i>Schiedea pubescens</i> var. <i>pubescens</i>	end		Caryophyllaceae
<i>Schiedea sarmentosa</i>	end		Caryophyllaceae
<i>Schinus terebinthifolius</i>	nat	Christmasberry	Anacardiaceae
<i>Schizaea robusta</i>	end	`owāli'i makali'i, `oāli'i makali'i, toothbrush fern	Schizaeaceae
<i>Selaginella arbuscula</i>	end	lepelepe a moa	Selaginellaceae
<i>Selaginella deflexa</i>	end		Selaginellaceae
<i>Senecio sylvaticus</i>	nat	groundsel, wood groundsel	Asteraceae
<i>Sequoia sempervirens</i>	nat	redwood	Taxodiaceae
<i>Sesbania tomentosa</i>	end	`ōhai	Fabaceae
<i>Setaria gracilis</i>	nat	kūkaepua'a, foxtail	Poaceae
<i>Setaria parviflora</i>	nat		Poaceae
<i>Sicyos cucumerinus</i>	end	`ānunu, kūpala	Cucurbitaceae
<i>Sicyos</i> sp	U		Cucurbitaceae
<i>Sida fallax</i>	ind	`ilima	Malvaceae
<i>Silene alexandrii</i>	End		Caryophyllaceae
<i>Silene lanceolata</i>	end		Caryophyllaceae
<i>Smilax melastomifolia</i>	end	hoi kuahiwi	Smilacaceae
<i>Solanum americanum</i>	ind	pōpolo	Solanaceae
<i>Solanum linnaeanum</i>	nat	Apple of Sodom	Solanaceae
<i>Solanum pseudocapsicum</i>	nat	Jerusalem cherry	Solanaceae
<i>Sonchus oleraceus</i>	nat	sow thistle	Asteraceae
<i>Sophora chrysophylla</i>	end	māmane	Fabaceae
<i>Spathoglottis plicata</i>	Nat	Philippine ground orchid	Orchidaceae
<i>Spermolepis hawaiiensis</i>	end		Apiaceae
<i>Sphaerocionium lanceolatum</i>	end	palai hina	Hymenophyllaceae
<i>Sphaerocionium obtusum</i>	end	palai lau li'i	Hymenophyllaceae
<i>Sphenomeris chinensis</i>	ind	pala'a	Lindsaeaceae
<i>Sporobolus</i> sp.	nat		Poaceae
<i>Stachytarpheta dichotoma</i>	nat		Verbenaceae
<i>Stachytarpheta</i> sp.	nat		Verbenaceae
<i>Stenogyne bifida</i>	end		Lamiaceae
<i>Stenogyne kamehamehae</i>	end	Kamehameha mint	Lamiaceae
<i>Sticherus owyhenis</i>	end	uluhe	Gleicheniaceae
<i>Streblus pendulinus</i>	ind	a'ia'i	Moraceae
<i>Syncarpia glomulifera</i>	nat	turpentine tree	Myrtaceae
<i>Syzygium cumini</i>	nat	Java plum	Myrtaceae
<i>Syzygium sandwicensis</i>	end	`ōhi'a hā	Myrtaceae
<i>Tectaria gaudichaudii</i>	end	`iwa'iwa lau nui	Dryopteridaceae
<i>Tetraplasandra hawaiiensis</i>	end	`ohe	Araliaceae

<b>Scientific Name</b>	<b>Status</b>	<b>Common Name(s)</b>	<b>Family</b>
<i>Tetraplasandra oahuensis</i>	end	`ohe mauka	Araliaceae
<i>Thuja plicata</i>	nat	Western red cedar	Cupressaceae
<i>Tibouchina herbacea</i>	nat	cane Tibouchina	Melastomataceae
<i>Toona ciliata</i>	nat	Australian red cedar	Meliaceae
<i>Touchardia latifolia</i>	end	olonā	Urticaceae
<i>Trematolobelia macrostachys</i>	end	koli'i	Campanulaceae
<i>Tropaeolum majus</i>	nat	nasturtium	Tropaeolaceae
<i>Urera glabra</i>	end	ōpuhe	Urticaceae
<i>Vaccinium calycinum</i>	end	`ōhelo	Ericaceae
<i>Vaccinium dentatum</i>	end	`ōhelo	Ericaceae
<i>Vaccinium reticulatum</i>	end	`ōhelo	Ericaceae
<i>Vandenboschia cyrtotheca</i>	end		Hymenophyllaceae
<i>Vandenboschia davallioides</i>	end	palai hihī, kilau	Hymenophyllaceae
<i>Verbena litoralis</i>	nat	ha'uoi	Verbenaceae
<i>Verbesina encelioides</i>	nat	golden crownbeard	Asteraceae
<i>Veronica arvensis</i>	nat	speedwell	Plantaginaceae
<i>Vigna o-wahuensis</i>	end	nanea	Fabaceae
<i>Viola chamissoniana subsp. tracheliiifolia</i>	end	violet, pāmakani	Violaceae
<i>Viola chamissoniana subsp. robusta</i>	end	violet, pāmakani	Violaceae
<i>Viola maviensis</i>	end	bog violet, pāmakani	Violaceae
<i>Wahlenbergia gracilis</i>	nat		Campanulaceae
<i>Wikstroemia forbesii</i>	end	`ākia	Thymelaeaceae
<i>Wikstroemia oahuensis</i>	end	`ākia	Thymelaeaceae
<i>Xylosma hawaiiense</i>	end	maua	Salicaceae
<i>Youngia japonica</i>	nat	Oriental hawksbeard	Asteraceae
<i>Zanthoxylum hawaiiense</i>	end	a'e, mānele	Rutaceae
<i>Zanthoxylum kauaense</i>	end	a'e, mānele	Rutaceae

Status: end      Endemic  
ind      Indigenous  
nat      Naturalized  
U      Indeterminate status

\*South Slope refers to Kamakou Preserve, Kawela Plantation, Kamalo, and Kapualei. Plant checklist compiled in 2015 from TNC field data, 2007 HINHP Database, Plant Extinction Prevention Program Data, Nov 2002 Checklist of Vascular Plants in Wawaia & Kumueli, Moloka`i, Hawai`i by Ken Wood and Steve Perlman, 2006-2019 Understory Monitoring Data, 2006 Kawela I Road Survey and verified plants on Kamakou Preserve Plant List by Wailana Moses.



**APPENDIX 4**  
**RARE NATIVE BIRDS OF MOLOKAI'S SOUTH SLOPE\***

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK (a)	FEDERAL STATUS (b)
<i>Myadestes lanaiensis rutha</i>	Oloma'o, Moloka'i thrush	GHTH	LE
<i>Paroreomyza flammea</i>	Kākāwahie, Moloka'i creeper	GH	LE
<i>Vestiaria coccinea</i>	'Iwi	G4T1	SE,-

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, March 2008:

- GH = Possibly Extinct (species)— Missing; known from only historical occurrences but still some hope of rediscovery.
- G4 = Apparently Secure. Uncommon but not rare; some cause for long-term concern due to declines or other factors.
- T1 = Subspecific taxa critically imperiled globally (5 or fewer populations).
- TH = Subspecific taxa historical. No recent observations.

(b) Federal Status:

- LE = Taxa formally listed as endangered.
- SE = Molokai population considered endangered by the state only.
- = No federal status.

\*South Slope refers to Kamakou Preserve, Kawela Plantation, Kamalo, and Kapualei. Compiled in 2008 from TNC field data, 2007 HINHP Database, Plant Extinction Prevention Program Data and Nov 2002 Checklist of Vascular Plants in Wawaia & Kumueli, Moloka'i, Hawai'i by Ken Wood and Steve Pearlman.

**APPENDIX 5**  
**RARE LAND SNAILS OF MOLOKAI'S SOUTH SLOPE\***

SCIENTIFIC NAME	COMMON NAME	Biodiversity and Mapping RANK (a)	FEDERAL STATUS (b)
<i>Partulina mighelsiana</i> <sup>1,2</sup>	Achatinellid Land Snail	G1	SOC
<i>Partulina proxima</i> <sup>1</sup>	Achatinellid Land Snail	G1	SOC
<i>Partulina redfieldi</i> <sup>1</sup>	Achatinellid Land Snail	G1	SOC
<i>Partulina tessellata</i> <sup>1,2</sup>	Achatinellid Land Snail	G1	SOC
<i>Perdicella helena</i>	Achatinellid Land Snail	G1	SOC

1 = Also known (currently or historically) from Pu'u Ali'i NAR

2 = Also known (currently or historically) from Oloku'i NAR

(a) Key to Global Ranks as defined by the Hawai'i Natural Heritage Program, March 2008:

- G1 = Critically imperiled. At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

(b) Federal Status:

- SOC = Species of Concern that available information does meet the criteria for concern and the possibility to recommend as candidate.

\*South Slope refers to Kamakou Preserve, Kawela Plantation, Kamalo, and Kapualei. Compiled in 2008 from TNC field data, 2007 HINHP Database, Plant Extinction Prevention Program Data and Nov 2002 Checklist of Vascular Plants in Wawaia & Kumueli, Moloka'i, Hawai'i by Ken Wood and Steve Perlman.

## Appendix 6\*

\*Due to sensitivity of rare plant information included throughout the report, only the plant checklist of Ken Wood and Steve Perlman's original Nov 2002 "Personal Observations of the Kumueli-Wawaia Region Molokai, Hawaii" was included as an appendix.

**Table 4. Checklist of Vascular Plants in Wawaia & Kumueli, Moloka'i, Hawai'i**

end=Endemic to Hawai'i

SIE=Moloka'i Single Island Endemic

ind=Indigenous

R=Rare

nat=Naturalized

E=Endangered

pol=Polynesian Introduction

Angiosperms-Dicots	Status	Wawaia	Kumueli
Anacardiaceae			
<i>Schinus terebinthifolius</i> Raddi	nat	Wawaia	Kumueli
Apocynaceae			
<i>Alyxia oliviformis</i> Gaud.	end	Wawaia	Kumueli
Aquifoliaceae			
<i>Ilex anomala</i> Hook. & Arnott	ind	Wawaia	Kumueli
Araliaceae			
<i>Cheirodendron trigynum</i> (Gaud.) A. Heller subsp. <i>trigynum</i>	end	Wawaia	Kumueli
<i>Tetraplasandra hawaiiensis</i> A. Gray	end	Wawaia	
<i>Tetraplasandra oahuensis</i> (A. Gray) Harms	end		Kumueli
Asteraceae			
<i>Ageratina adenophora</i> (Spreng.) R. King & H. Robinson	nat	Wawaia	Kumueli
<i>Ageratina riparia</i> (Regel) R. King & H. Robinson	nat	Wawaia	Kumueli
<i>Ageratum conyzoides</i> L.	nat	Wawaia	Kumueli
<i>Bidens wiebkii</i> Sherff	end E SIE		Kumueli
<i>Cirsium vulgare</i> (Savi) Ten.	nat	Wawaia	Kumueli
<i>Dubautia linearis</i> (Gaud.) D. Keck subsp. <i>opposita</i> (Sherff) G. Carr	end	Wawaia	Kumueli
<i>Dubautia plantaginea</i> Gaud. subsp. <i>plantaginea</i>	end	Wawaia	Kumueli
<i>Dubautia scabra</i> (DC) D. Keck subsp. <i>leiophylla</i> (A. Gray) G. Carr	end	Wawaia	Kumueli
<i>Erechtites valerianifolia</i> (Wolf) DC	nat	Wawaia	Kumueli
<i>Hypochoeris radicata</i> L.	nat	Wawaia	Kumueli
<i>Pluchea carolinensis</i> (Jacq.) G. Don	nat	Wawaia	
Buddlejaceae			
<i>Buddleia asiatica</i> Lour.	nat	Wawaia	Kumueli
Campanulaceae			
<i>Clermontia grandiflora</i> Gaud. subsp. <i>munroi</i> (St. John) Lammers	end	Wawaia	Kumueli
<i>Clermontia kakeana</i> Meyen	end	Wawaia	Kumueli
<i>Clermontia pallida</i> Hillebr.	end	Wawaia	Kumueli
<i>Cyanea mannii</i> (Brigham) Hillebr.	end E SIE	Wawaia	Kumueli
<i>Cyanea profuga</i> C. N. Forbes	end E SIE	Wawaia	
<i>Lobelia hypoleuca</i> Hillebr.	end	Wawaia	Kumueli
Caryophyllaceae			
<i>Cerastium fontanum</i> Baumg. subsp. <i>triviale</i> (Link) J alas	nat	Wawaia	Kumueli
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult. var. <i>pacifica</i> Mizush.	nat	Wawaia	Kumueli
Celastraceae			
<i>Perrottetia sandwicensis</i> A. Gray	end	Wawaia	Kumueli
Cucurbitaceae			

<i>Sicyos sp</i>		Wawaia	
Epacridaceae			
<i>Styphelia tameiameia</i> (Cham. & Schlechtend.) F.v. Muell.	ind	Wawaia	Kumueli
Ericaceae			
<i>Vaccinium dentatum</i> Sm.	end	Wawaia	Kumueli
<i>Vaccinium reticulatum</i> Sm.	end	Wawaia	Kumueli
Flacourtiaceae			
<i>Xylosma hawaiiense</i> Seem.	end	Wawaia	Kumueli
Gesneriaceae			
<i>Cyrtandra biserrata</i> Hillebr.	end R SIE	Wawaia	Kumueli
<i>Cyrtandra grayi</i> C.B. Clarke	end	Wawaia	Kumueli
Goodeniaceae			
<i>Scaevola chamissoniana</i> Gaud.	end	Wawaia	Kumueli
<i>Scaevola mollis</i> Hook. & Arnott	end		Kumueli
Hydrangeaceae			
<i>Broussaisia arguta</i> Gaud.	end	Wawaia	Kumueli
Lamiaceae			
<i>Phyllostegia glabra</i> (Gaud.) Benth. var. <i>glabra</i>	end	Wawaia	
<i>Phyllostegia stachyoides</i> A. Gray	end E	Wawaia	
Loganiaceae			
<i>Labordia hirtella</i> H. Mann	end	Wawaia	Kumueli
<i>Labordia triflora</i> Hillebr.	end E SIE	Wawaia	Kumueli
<i>Labordia waiolani</i> Wawra	end	Wawaia	
Lythraceae			
<i>Lythrum maritimum</i> Kunth	nat	Wawaia	Kumueli
Menispermaceae			
<i>Cocculus orbiculatus</i> (L.) DC	ind	Wawaia	Kumueli
Moraceae			
<i>Streblus pendulinus</i> (Endl.) F.v. Muell.	ind		Kumueli
Myoporaceae			
<i>Myoporum sandwicense</i> A. Gray	ind		Kumueli
Myrsinaceae			
<i>Myrsine lessertiana</i> A. DC	end	Wawaia	Kumueli
Myrtaceae			
<i>Metrosideros polymorpha</i> Gaud. var. <i>glaberrima</i> (H. Lev.) St. John (end )		Wawaia	Kumueli
<i>Metrosideros polymorpha</i> Gaud. var. <i>incana</i> (H. Lev.) St. John	end	Wawaia	Kumueli
<i>Metrosideros waialealae</i> (Rock) Rock var. <i>fauriei</i> (H. Lév) J. Wyndham Dawson & Stemmermann	end	Wawaia	Kumueli
Oleaceae			
<i>Nestegis sandwicensis</i> (A. Gray) Degener, I. Degener & L. Johnson	end	Wawaia	Kumueli
Oxalidaceae			
<i>Oxalis corniculata</i> L.	ind	Wawaia	Kumueli
Piperaceae			
<i>Peperomia cookiana</i> C. DC	end	Wawaia	Kumueli



<i>Peperomia latifolia</i> Miq.	end	Wawaia	Kumueli
<i>Peperomia macraeana</i> C. DC	end	Wawaia	Kumueli
<i>Peperomia mauiensis</i> Wawra	end		Kumueli
<i>Peperomia rockii</i> C. DC	end R SIE	Wawaia	Kumueli
<i>Peperomia tetraphylla</i> (G. Forster) Hook. & Arnott	ind	Wawaia	Kumueli
Pittosporaceae			
<i>Pittosporum glabrum</i> Hook. & Arnott	end	Wawaia	Kumueli
Primulaceae			
<i>Lysimachia hillebrandii</i> J.D. Hook. ex A. Gray	end		Kumueli
<i>Lysimachia remyi</i> Hillebr.	end	Wawaia	
Rosaceae			
<i>Osteomeles anthyllidifolia</i> (Sm.) Lindl.	ind		Kumueli
<i>Rubus hawaiiensis</i> A. Gray	end	Wawaia	Kumueli
<i>Rubus rosifolius</i> Sm.	nat	Wawaia	Kumueli
Rubiaceae			
<i>Coprosma foliosa</i> A. Gray	end		Kumueli
<i>Coprosma granadensis</i> (L. fil.) Heads	ind	Wawaia	Kumueli
<i>Coprosma ochracea</i> W. Oliver	end	Wawaia	Kumueli
<i>Coprosma ternata</i> W. Oliver	end	Wawaia	Kumueli
<i>Hedyotis acuminata</i> (Cham. & Schlechtend.) Steud.	end	Wawaia	Kumueli
<i>Hedyotis centranthoides</i> (Hook. & Arnott) Steud.	end	Wawaia	Kumueli
<i>Hedyotis terminalis</i> (Hook. & Arnott) W. L. Wagner & Herbst	end	Wawaia	Kumueli
<i>Psychotria mariniana</i> (Cham. & Schlechtend.) Fosb.	end	Wawaia	Kumueli
<i>Psychotria mauiensis</i> Fosb.	end	Wawaia	Kumueli
Rutaceae			
<i>Melicope molokaiensis</i> (Hillebr.) T. Hartley & B. Stone	end	Wawaia	Kumueli
<i>Melicope peduncularis</i> (H. Lévl.) T. Hartley & B. Stone	end	Wawaia	Kumueli
<i>Zanthoxylum kauaense</i> A. Gray	end	Wawaia	Kumueli
Santalaceae			
<i>Santalum freycinetianum</i> Gaud. var. <i>freycinetianum</i>	end	Wawaia	Kumueli
Sapindaceae			
<i>Dodonaea viscosa</i> Jacq.	ind	Wawaia	Kumueli
Sapotaceae			
<i>Pouteria sandwicensis</i> (A. Gray) Baehni & Degener	end		Kumueli
Solanaceae			
<i>Physalis peruviana</i> L.	nat	Wawaia	Kumueli
Thymelaeaceae			
<i>Wikstroemia forbesii</i> Skottsb.	end SIE	Wawaia	Kumueli
Urticaceae			
<i>Boehmeria grandis</i> (Hook. & Arnott) A. Heller	end	Wawaia	Kumueli
<i>Pilea peploides</i> (Gaud.) Hook. & Arnott	ind	Wawaia	Kumueli
<i>Pipturus albidus</i> (Hook. & Arnott) A. Gray	end	Wawaia	Kumueli
<i>Touchardia latifolia</i> Gaud.	end	Wawaia	
<i>Urera glabra</i> (Hook. & Arnott) Wedd.	end	Wawaia	Kumueli
Verbenaceae			
<i>Lantana camara</i> L.	nat	Wawaia	Kumueli
Violaceae			
<i>Viola chamissoniana</i> Ging. subsp. <i>robusta</i> (Hillebr.) W. L. Wagner, Herbst & Sohmer	end SIE	Wawaia	Kumueli
Viscaceae			

ind end	Wawaia Wawaia	Kumueli Kumueli
pol end	Wawaia Wawaia	Kumueli
end E SIE	Wawaia	
end ind end ind ind	Wawaia Wawaia Wawaia Wawaia Wawaia	Kumueli Kumueli Kumueli Kumueli Kumueli
nat	Wawaia	Kumueli
ind	Wawaia	Kumueli
end R	Wawaia	
ind	Wawaia	Kumueli
nat nat nat end nat nat nat	Wawaia Wawaia Wawaia Wawaia Wawaia Wawaia Wawaia	Kumueli Kumueli Kumueli Kumueli Kumueli Kumueli Kumueli
end	Wawaia	Kumueli
ind end	Wawaia Wawaia	Kumueli
end nat end end	Wawaia Wawaia Wawaia Wawaia	Kumueli Kumueli Kumueli Kumueli
nat end end end end	Wawaia Wawaia Wawaia Wawaia	Kumueli Kumueli Kumueli Kumueli Kumueli
end end	Wawaia Wawaia	Kumueli Kumueli

*Microlepia strigosa* (Thunb.) C. Presl  
*Pteridium decompositum* (Gaud.) W. H. Wagner

ind  
end

Wawaia  
Wawaia

Kumueli  
Kumueli

#### Dryopteridaceae

*Ctenitis latifrons* (Brack.) Copel.  
*Ctenitis squamigera* (Hook. & Arnott) Copel  
*Dryopteris fusco-atra* (Hillebr.) W.J. Rob.  
*Dryopteris unidentata* (Hook. & Arnott) C. Chr.  
*Dryopteris unidentata* (Hook. & Arnott) C. Chr. var.  
*paleaceae* (Hillebr.) Herat ex Fraser-Jenk.  
*Elaphoglossum crassifolium* (Gaud.) W.R. Anderson &  
Crosby  
*Elaphoglossum paleaceum* (Hook. & Grev.) Sledge  
*Nephrolepis cordifolia* (L.) C. Presl  
*Nephrolepis exaltata* (L.) Schott subsp. *hawaiiensis* W.H.  
Wagner (ined.)  
*Nephrolepis multiflora* (Roxb.) F.M. Jarrett ex C.V.  
Morton  
*Nothoperanema rubiginosa* (Brack.) A.R. Sm. & D.  
Palmer  
*Tectaria cicutaria* (L.) Copel. subsp. *gaudichaudii*  
(Mett.) W.H. Wagner (ined.)

end  
end E  
end  
end  
end

Wawaia  
Wawaia  
Wawaia  
Wawaia  
Wawaia

Kumueli  
Kumueli  
Kumueli

end

Wawaia

Kumueli

ind  
ind  
end

Wawaia  
Wawaia  
Wawaia

Kumueli  
Kumueli  
Kumueli

nat

Wawaia

Kumueli

end

Wawaia

Kumueli

end

Wawaia

Kumueli

#### Gleicheniaceae

*Dicranopteris linearis* (Burm. f.) Underw. f. *linearis*  
*Diplopterygium pinnatum* (Kunze) Nakai

ind  
ind

Wawaia  
Wawaia

Kumueli  
Kumueli

#### Grammitidaceae

*Adenophorus tamariscinus* (Kaulf.) Hook. & Grev.  
*Grammitis tennela* Kaulf.  
*Oligadenus pinnatifidus* (Gaud.) W.H. Wagner (ined.)

end  
end  
end

Wawaia  
Wawaia  
Wawaia

Kumueli  
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#### Hymenophyllaceae

*Callistopteris baueriana* (Endl.) Copel.  
*Mecodium recurvum* (Gaud.) Copel.  
*Sphaerocionium obtusum* (Hook. & Arnott) Copel.  
*Vandenboschia cyrtotheca* (Hillebr.) Copel.

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#### Lindsaeaceae

*Sphenomeris chinensis* (L.) Maxon

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#### Lycopodiaceae

*Huperzia* sp.  
*Huperzia phyllanthus* (Hook. & Arnott) R.D. Dixit  
*Lycopodiella cernua* (L.) Pichi Serm.

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#### Polypodiaceae

*Lepisorus thunbergianus* (Kaulf.) Ching

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#### Psilotaceae

*Psilotum complanatum* Sw.

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#### Pteridaceae

*Adiantum capillus-veneris* L.  
*Adiantum raddianum* C. Presl  
*Coniogramme pilosa* (Brack.) Hieron.  
*Pteris irregularis* Kaulf.

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#### Selaginellaceae

*Selaginella arbuscula* (Kaulf.) Spring

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#### Thelypteridaceae

*Christella cyatheoides* (Kaulf.) Holttum  
*Pneumatopteris sandwicensis* (Brack.) Holttum

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**Appendix 7 – EMoWP MOU****MEMORANDUM OF UNDERSTANDING  
East Moloka'i Watershed Partnership**Biological  
Resources  
Discipline

THIS MEMORANDUM OF UNDERSTANDING, made and entered into on the 14 day of Jan, 2003, by and between the US Environmental Protection Agency, Hawai'i Department of Health, Hawai'i Division of Forestry and Wildlife, Kalaupapa National Historical Park, Kamehameha Schools Bishop Estate, Kapualei Ranch, Maui County, Maui Board of Water Supply, Moloka'i Enterprise Community Governance Board, Moloka'i-Lana'i Soil and Water Conservation District, USDA Natural Resources Conservation Service, The Nature Conservancy, US Fish and Wildlife Service, US Geological Survey - Water Resources Division, and Kawela Plantation Homeowner's Association, herein known as the EAST MOLOKA'I WATERSHED PARTNERSHIP (EMoWP) and hereinafter called the PARTNERS, agree to participate in cooperative management activities of the East Moloka'i watershed, on the basis of the following facts and circumstances:

WHEREAS, East Moloka'i's native ecosystems are important to the water resources for the island of Moloka'i; and

WHEREAS, active management is needed to maintain a healthy watershed in order to sustain the future quality and quantity of Moloka'i's water supply; and

WHEREAS, active management of these watersheds would also benefit Hawai'i's native flora and fauna; and

WHEREAS, the Hawaiian concept of the ahupua'a acknowledges that all parts of a watershed, from the mountains to the sea, are interconnected, and that activities carried out in one portion of a watershed can affect the rest of the watershed; and

WHEREAS, active management of the East Moloka'i watershed is also important to the programs of each the PARTNERS (Attachment 1); and

WHEREAS, the lands managed by some of the PARTNERS share common boundaries (Figure 1); and

WHEREAS, many of the threats to the forested watershed, such as feral ungulates, fire, insects, diseases, and invasive non-native plants, occur across these common boundaries; and

WHEREAS, significant economic and staffing advantages will accrue to the PARTNERS if the management of these threats is shared; and

WHEREAS, effective management is best achieved through the coordinated actions of all major landowners in the watershed.

NOW, THEREFORE, the PARTNERS hereby agree in principle as follows:

1. To develop jointly, where appropriate, watershed management plans for areas within the East Moloka'i Watershed Partnership, that will document resource values and identify priority watershed management objectives and strategies within the areas included in the Partnership.
2. To consider jointly, at such places and at such intervals as may be mutually agreed upon by the PARTNERS, general programs and management projects for the East Moloka'i Watershed Partnership.
3. To determine costs of watershed management programs and projects agreed upon in #2, and join in cooperative efforts to raise outside funds for those projects to the extent each PARTNER is authorized by law.



4. To develop and implement specific agreements and working plans for individual projects considered by all or some of the PARTNERS having mutual interests. Such agreements and working plans may be developed whenever appropriate.
5. To enter into specific agreements between all or some of the PARTNERS, as the occasion demands and to the extent each PARTNER is authorized by law, for the use of specialized equipment, hiring and supervision of personnel, transfer of funds, purchasing of supplies, and other matters pertaining to the general purposes of management agreed upon by all or some of the PARTNERS, on terms and conditions to be agreed upon between the affected PARTNERS. Expenditures under this Memorandum of Understanding will be determined by specific working agreements entered into under authority of this instrument.
6. That any partner may terminate its involvement in this Memorandum of Understanding by providing 90 days prior written notice to the other PARTNERS.  
  
That this Memorandum of Understanding is not to be construed as an instrument which commits any "partner" to any specific expenditure of funds or to any exchange of funds for any purpose.
7. That additional partners may join the EMoWP at a later date, by executing an amendment of this agreement, a form of which is attached at Attachment 2, by which it agrees with the terms of this MOU and work cooperatively with all PARTNERS in fulfilling its objectives.
8. The use of the term "partnership" in this document is not intended to evidence formation of a legal partnership but rather to express a spirit of cooperation in attaining mutual goals among those identified as "partners." Hence there shall be no sharing of profits or losses, assets or liabilities. Those identified as "partners" shall not have the liability of partners, nor the power to bind others identified as partners. Rather each "partner" organization agrees that it shall be responsible for any contract it makes or any injury it causes or any injury or damage suffered by it or by its own personnel or equipment.
9. That this Agreement does not modify any agency's existing authorities by reducing, expanding, or transferring any of the statutory or regulatory authorities and responsibilities of any of the signatory agencies.

IN WITNESS WHEREOF, the PARTNERS hereto have executed this Memorandum of Understanding as of the first date above written.

KAMEHAMEHA SCHOOLS BISHOP ESTATE

By: R. Kalam Shoude

Date: June 9, 2002

KAPUALEI RANCH/JAMES AUSTIN OWNER'S REPRESENTATIVE

By: James L. Austin

Date: 1-14-04

MOLOKA'I ENTERPRISE COMMUNITY GOVERNANCE BOARD

By: Jerine Co

Date: 050603

US ENVIRONMENTAL PROTECTION AGENCY

By: Nancy Wiltse

Date: June 9, 2003

HAWAII DEPARTMENT OF HEALTH

By: \_\_\_\_\_

Date: \_\_\_\_\_

HAWAII DIVISION OF FORESTRY AND WILDLIFE

By: Mark Bink

Date: 01/7/03

KALAUPAPA NATIONAL HISTORICAL PARK

By: Thomas Stockman

Date: 5/22/03

MAUI COUNTY

By: Alan M. Arakawa

Date: 6/9/03

APPROVED AS TO FORM AND LEGALITY:

Edward S. Kushi, Jr.  
Deputy Corporation Counsel  
County of Maui

~~MAUI BOARD OF WATER SUPPLY~~

By: \_\_\_\_\_

Date: \_\_\_\_\_

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initials

MOLOKA'I-LANA'I SOIL & WATER CONSERVATION DISTRICT

By: Julia K. Vira

Date: 5/5/03

USDA NATURAL RESOURCES CONSERVATION SERVICE

By: Christopher W. Smith

Date: 7/22/03

THE NATURE CONSERVANCY

By: Grace Lee

Date: 5/9/03

US FISH AND WILDLIFE SERVICE

By: Craig Gould

Date: 7/3/03

US GEOLOGICAL SURVEY - WATER BIOLOGICAL RESOURCES DIVISION DISCIPLINE

By: William H. Harte

Date: 7/10/03

KAWELA PLANTATION HOMEOWNER'S ASSOCIATION

By: Melvin Chung

Melvin Chung, President

By: Robert Macmillan

Robert Macmillan, Secretary

Date: \_\_\_\_\_



## **Attachment 1: Partners Description and Roles**

**Kamehameha Schools Bishop Estate (KSBE):** KSBE was established in 1884 under the Will of Bernice Pauahi Bishop. Princess Pauahi was a great granddaughter of Kamehameha and the last descendant of his line of Hawai'i ali'i. Through her Will, Pauahi committed more than 378,500 acres of her inherited lands to the creation and maintenance of Kamehameha Schools. Thousands of Hawaiian youth from across the state are served through the programs of the Schools. On the island of Moloka'i, KSBE has joined with other ali'i trusts and Hawaiian organizations to create the Kulana 'O'iwi multi-service center at Kalama'ula. The Estate's landownership includes the 4,000 acre ahupua'a of Kamalo, running from the ridgeline adjoining Pelekunu to Kamahu'ehu'e fish pond.

**Kapuaiei Ranch:** Kapuaiei Ranch is headed by James Austin of the Austin family, who are the landowners of the Kapuaiei Ahupua'a. The Ranch is located in the lower elevations of the property. The upper elevations contain some the best intact native rainforest ecosystems on Moloka'i's south slope. The Austin family sees an opportunity to manage their upper forested watershed area through the East Moloka'i Watershed Partnership for watershed protection and preservation of native ecosystems. The EMoWP could provide necessary resources that would otherwise not be available.

**Moloka'i Enterprise Community Governance Board (Lokahi Committee):** The Moloka'i Rural Empowerment Zone application was prepared in the summer of 1998 as part of a national competition between rural communities for USDA designation as a Rural Empowerment Zone (EZ) or an Enterprise Community (EC). The community planning process was spearheaded by a volunteer Coordinating Committee made up of representatives of Moloka'i's business, academic, social service, and government sectors. Seven subcommittees were created to address specific subject areas within the plan: Economic Development, Education, Environment, Hawaiian Culture, Health and Human Services, Recreation and Fine Arts, and Youth Leadership Development. In all, over 60 meetings were held by the various committees during a four month planning period, and these meetings involved nearly 200 individuals from all walks of life on Moloka'i. Two general public meetings were also held and about 300 people attended these meetings. Moloka'i's strategic plan is based on a vision statement that describes the way the island should be a decade from now. The statement paints a picture of strong and self-reliant community, a healthy and productive natural environment, and a living Hawaiian culture that nurtures and sustains the island and her people. Protection and enhancement of the island's environment was deemed critical to the health of Moloka'i's people and economy, and projects in this area were given high priority in the plan. Protection of water resources was a major concern, since a project looks at the islands natural resources as being connected through the ancient ahupua'a (mountain to seashore) system. Fittingly, the ahupua'a system also links natural resources to economic and human health activities.

**The Nature Conservancy of Hawaii (TNCH):** TNCH is the Hawai'i program of The Nature Conservancy, an international non-profit organization, whose mission is to preserve plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. TNCH manages three preserves on Moloka'i: Kamakou (Mountain/Leeward rainforest, shrublands and bog systems); Pelekunu (Windward rainforest and river systems); and Mo'omomi (coastal sand dunes). TNCH manages the three preserve out of their Moloka'i Office/baseyard located at the Moloka'i Industrial Park, off highway 760 in Kalama'ula. TNCH also conducts Island wide community outreach and volunteer programs out of this office. Presently, there is a staff of 6 people. TNCH's role in the East Moloka'i Partnership is to: assist with the formation of the Partnership, develop community support and involvement, and provide administrative and operational support for the Kamalo-Kapuaiei watershed project.



**United States Fish and Wildlife Service (USFWS):** The mission of the USFWS is: Working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. This statement acknowledges that working cooperatively with partner organizations, private landowners, and local communities is the best way to approach long-term conservation of our native ecosystems. The USFWS has a number of programs designed to provide technical assistance, coordination, and cost-share funding for conservation projects. It is anticipated that the USFWS will contribute to the East Moloka'i Partnership in all these ways.

**U.S. Environmental Protection Agency (EPA):** EPA Offers a variety of training and assistance programs to support local watershed management efforts. EPA's Watershed Academy provides technical watershed information and outreach through live training courses, the Internet, and published documents. EPA has a variety of grant programs that may provide financial support for projects on Moloka'i, including Environmental Justice, Sustainable Development Challenge Grants, Environmental Education, and Wetlands Protection Grants. In addition, EPA has obtained new funding to assist in the restoration of fish ponds on Moloka'i.

**State Division of Forestry and Wildlife (DOFAW):** The Division of Forestry and Wildlife is the largest land management entity in the State of Hawaii, with direct responsibility for approximately 800,000 acres of state trust lands. These lands are managed through an integrated system of forest and natural area reserves, plant and wildlife sanctuaries, and wilderness and game management areas. Responsibility is statewide for watershed and endangered species protection, wildlife fire suppression, public trails and access, and game management programs. Cooperative natural resource programs are also planned and implemented on other public and privately owned lands through natural area and watershed partnerships, forest stewardship programs, urban forestry projects, and other agreements. DOFAW has been a founding member of the East Maui, West Maui, and Koolau Watershed Partnerships. The role of DOFAW in this partnership will be to provide technical assistance and in-kind services in watershed and other natural resource management activities.

**Kalaupapa National Historical Park (NPS):** The National Park Service mission is to manage units of the national park system so as to conserve the scenery and the natural and historic objects and the wild life therein in an unimpaired condition for the enjoyment of future generations. The NPS strives to manage natural resources at the ecosystem scale, and recognizes the essential role of cooperative partnerships to preserve ecosystems across administrative boundaries. Cooperative management of Kalaupapa NHP land with adjoining land managers in the control of feral ungulates, alien plants, and water quality and quantity has proven to be cost effective and efficient. The NPS will provide technical assistance in the monitoring and management of feral ungulates and invasive alien plants.

**State Department of Health, Polluted Runoff Control (PRC) Program:** The Polluted Runoff Control Program is a section within the Department of Health's Clean Water Branch. The mission of the PRC is to protect and improve the quality of water resources for enjoyment of and use by the people of Hawaii through preventing and reducing nonpoint source pollution, balancing health, environmental, economic and social concerns. The program is committed to the watershed initiative and recognizes the importance of watershed management as a tool in reducing polluted runoff. The PRC Program distributes federal CWA Section 319(h) grants along with state revolving fund loans to local entities for the promotion of practices or activities that reduce polluted runoff, assists in the development of a coastal nonpoint pollution control program that is consistent with federal CZARA Section 6217; and sponsors numerous environmental outreach and educational activities.


**Moloka'i-Lana'i Soil and Water Conservation District (MLSWCD):** On August 19, 1948, a charter was received recognizing the Moloka'i Conservation District, and a Certificate of Organization was issued by the Secretary of the Territory of Hawaii. The Moloka'i Soil Conservation District was the third Conservation District to be formed. In 1962, after a Certificate of Inclusion was issued to add the entire island of Lana'i, the name was changed to the Moloka'i-Lana'i Soil and Water Conservation District. Today, there are 16 Conservation Districts Statewide. The function of the MLSWCD is to take available



technical, financial, and educational resources, whatever their source, and focus or coordinate them so they meet the needs of the local land user relating to the conservation of soil water and other natural resources. Current projects include the Manawainui Watershed Implementation Project, Mo'omomi and Waihewahewa Watersheds, Moloka'i Heifer Project, the Moloka'i Agricultural Community (MAC) Program, and County Grading Reviews, Etc. The District continues to promote an awareness of our environment by working with community members and cooperation partners.

**USDA Natural Resource Conservation Services (NRCS):** NRCS, an agency of the U.S. Department of Agriculture works hand-in-hand with people and organizations, conservation districts, and other agencies to conserve natural resources primarily on private lands. The mission of NRCS is to provide leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment. NRCS has a number of cost-share programs designed to provide technical assistance, coordination and funding for conservation projects. NRCS can contribute to the East Moloka'i Partnership in any of these ways.

**Maui Board of Water Supply (Board):** The Board is responsible for the control, management and operation of the county's water systems and water sources. The Board is required to implement with the county general and community plans in carrying out its responsibilities. The mission of the Board is to provide clean water efficiently. Recognizing that resources protection is inherent in both preserving water quality, and efficient use of resources, the Board's commitments to water resources protection and management have increased steadily over the past decade. Public-private partnerships such as the East and West Maui Mountains Watershed Partnerships have already proven to be useful for several reasons. The combined efforts of many, bring more energy, expertise, and focus to the protection of the watershed. United decision making and work management helps to improve planning and implementation, make projects run more smoothly, and to leverage funds for resource protection. The higher profile attached to partnerships increases the public's interest level and assists in generating public awareness and thereby in educating the general public as to their role in water protection. For these reasons, the Board is committed to on-going participation in partnerships, and in the East Moloka'i Watershed Partnership specifically. The Board is prepared to dedicate as needed, staff assistance, public outreach efforts and funding as appropriate.

  
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**Maui County:** Maui County is a political subdivision of the State of Hawaii, encompassing the islands and surrounding waters and islets of Maui, Moloka'i, Lana'i, and Kaho'olawe, except Kalaupapa Settlement on Moloka'i. Under the State constitution, the State and its political subdivisions have responsibility to conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, mineral, and energy sources and to promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self sufficiency of the State. As a political subdivision of the State, then, the County has responsibility to monitor and protect its resources in a manner consistent with State policy. In recent years, the county has increased its commitments to resource protection in general, and to watershed protection specifically. The county has provided funding for watershed protection and miconia removal in Maui County over and above that contribution made by it's semi-autonomous water board. The County will support the East Moloka'i Watershed Partnership with funding or assistance from County personnel as appropriate.

**Kawela Plantation (Kawela Plantation Homeowner's Association):** Kawela Plantation consists of approx. 5,500 acres of land that fall within the East Molokai Watershed. The properties are home to hundreds of endemic Hawaiian plant and animal species. Kawela Plantation sees the EMoWP as an opportunity to manage their upper forested watershed through the cooperative efforts of the Partners and with the resources and work-plans that might not otherwise be available.

