



**2020 Annual Report  
to the  
Board of Land and Natural Resources**

**Status of the Implementation of the  
Mauna Kea Comprehensive Management Plan**

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## **Executive Summary**

### **Comprehensive Management Plan Historical Perspective**

Following the recommendation of the Office of the Auditor's 2005 report, *Follow-up Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve*, the Office of Maunakea Management continued with its preparation of what was referred at the time as an integrated management plan. The process involved the development of two separate plans, cultural and natural resources management plans, with the intention of merging the two documents into one integrated plan, later coined Comprehensive Management Plan (CMP) by the Auditor.

Approval of the CMP by the Board of Land and Natural Resources formalized the State's management requirements for the University's management areas on Maunakea. The University's Board of Regents' acceptance of the responsibility to implement the CMP also delegated CMP implementation to the Office of Maunakea Management as the single entity to manage a comprehensive integrated plan.

### **Office of Maunakea Management**

The Office of Maunakea Management (OMKM) was created when the Board of Regents approved the *Mauna Kea Science Reserve Master Plan* in June 2000. Together with two community-based volunteer advisory groups, Kahu Kū Mauna and Maunakea Management Board, the Board of Regents committed to community-based management. The Master Plan identified the need for a single entity to manage a comprehensive integrated plan to be based on the Island of Hawai'i housed within the University of Hilo and funded as a separate, ongoing program unit. Housing OMKM within the University system made a clear statement that the University accepted the responsibility for OMKM's function.

The role and responsibilities of OMKM involves not only land stewardship with the main focus on protecting the cultural, natural and scientific resources and managing public and commercial activities, but overseeing the project review process including construction and decommissioning processes. The latter is not the same as proposing projects that can range from camera and weather instrument installation to the addition of safety features to facilities to observatory development. ***Projects are proposed by the respective facility or the University and the role of OMKM, Kahu Kū Mauna, and Maunakea Management Board is to review these projects for compliance with the CMP, 2000 Master Plan, rules and regulations including DLNR's Conservation District rules, and subleases and leases.*** The Master Plan does not include as part of OMKM's, Kahu Kū Mauna's and Maunakea Management Board's scope of responsibilities the determination of the number of telescopes to construct and/or decommission. Those determinations are made outside of OMKM.

### **Implementation of Comprehensive Management Plan on Track**

The CMP contains 103 management actions covering protection of the resources, managing access, activities and uses, education and outreach to management of mountain operations and the built environment. OMKM categorized its efforts in implementing the CMP's diverse range of responsibilities into five major categories: research and monitoring; resources management programs; education, training and outreach; visitor management; and permitting, enforcement and facility oversight. All of the CMP actions have either been implemented (completed), are ongoing, or are in stages of undergoing implementation. The majority of CMP actions are ongoing and are essential components of OMKM's stewardship responsibilities, in other words, as long as OMKM has land management stewardship responsibilities on Maunakea those activities will continue to be implemented.

In addition to Appendices listing descriptions of OMKM's activities and status of implementation for each CMP management action, this year's annual report contains additional Appendices detailing OMKM's stewardship functions and activities since its inception that are related to OMKM's categories of implementation.

## **1. Comprehensive Management Plan (CMP) Background**

The State Auditor recommended in the December 2005 *Follow-Up Audit of the Management of Mauna Kea and the Mauna Kea Science Reserve*, State Auditor that the University of Hawai'i "develop, implement, and monitor a comprehensive management plan for natural, cultural and historic resources of the summit and Hale Pohaku area". The University prepared a Comprehensive Management Plan (CMP), and 2009, the Board of Land and Natural Resources (BLNR) approved the CMP. Upon approval, the CMP became the State's management plan for the University's management lands on Maunakea.

The CMP is consistent with the purposes and values of the State's Conservation District lands and OMKM's mission of achieving sustainable management and stewardship through "community involvement and programs that protect, preserve and enhance the natural, cultural and recreational resources of Mauna Kea while providing a world class center dedicated to education, research and astronomy." The CMP's overarching goal is to provide management strategies that protect, preserve, and enhance Maunakea Kea's resources.

A requirement of the Board of Land and Natural Resources approval of the CMP is the submittal of annual reports on the status of the implementation of the CMP.

## **2. Annual Report**

As identified in the 2009 Mauna Kea Comprehensive Management Plan, management action MEU-1 states: OMKM shall produce an annual progress report on the management goals, objectives, and actions for the year and what progress was made towards meeting them. "This Progress Report is not intended to be a status report on the resources in the UH Management Areas; rather, it is meant to inform management and stakeholders of the progress of the program and direction it is to take in the future."

### **2.1 Overview of CMP Management Actions**

The CMP contains 103 management actions categorized into four component plans which are further subdivided into sub-components (Table 1).

*Table 1. CMP component plans.*

<b>CMP SECTION</b>	<b>COMPONENT PLAN</b>
7.1	Understanding and Protecting Mauna Kea's Resources
7.1.1	Native Hawaiian Cultural Resources
7.1.2	Natural Resources
7.1.3	Education and Outreach
7.1.4	Astronomy Resources
7.2	Managing Access and Use
7.2.1	Activities and Uses
7.2.2	Permitting and Enforcement
7.3	Managing the Built Environment
7.3.1	Infrastructure and Maintenance
7.3.2	Construction Guidelines
7.3.3	Site Recycling, Decommissioning, Demolition and Restoration
7.3.4	Considering Future Land Use
7.4	Managing Operations
7.4.1	Operations and Implementation
7.4.2	Monitoring, Evaluation, and Updates

### **2.2 Assigning Categories and Priorities**

Each management actions was assigned into one of four categories. These categories represent time periods during which it was estimated the actions would be implemented.

Immediate	1 - 3 years
Short term	4 - 6 years
Mid-term	7 - 9 years

Long-term      10 + years

In a change from earlier reports, for the 2020 report OMKM has updated the five priority categories for reporting. These changes reflect evolving concerns regarding “Visitor Management” following the adoption of administrative rules; interest in the “Permitting, Enforcement and Facility Oversight” of facility compliance with Conservation District Use Permits, and infrastructure improvements at Halepōhaku and decommissioning progress of two telescopes. Research & Monitoring have been combined into a single reporting category as these programs have matured. “Education, Training and Outreach” and “Printed Materials & Public Forums” were consolidated having similar purposes. Efforts have been initiated in all of the categories and are described below.

#### **Priority Categories**

- 1) Research & Monitoring
- 2) Resources Management Programs
- 3) Education, Training, and Outreach
- 4) Visitor Management
- 5) Permitting, Enforcement and Facility Oversight

### **2.3 Reporting Definitions**

**2010-2011** Each management action was initially assigned one of four progress status designations: **As Needed**, **Short to Long Term**, **Ongoing**, or **Completed**.

**2012** In 2012 the **Ongoing** category was further divided into two groups, **Ongoing** and **In Progress**, to distinguish management actions that are part of OMKM’s regular responsibilities (ongoing) and those that require specialized implementation (in progress).

**2014-present** Based on feedback from the Office of the Auditor, State of Hawaii, beginning with 2014, the definitions for Ongoing and In Progress were further refined. **Ongoing** refers to activities that have established processes in place and are performed as part of OMKM’s daily responsibilities. For example, processes for reporting disturbances to historic properties are established while actual reporting is **Ongoing** as necessary. **In Progress** refers to actions that require specialized implementation such as the development of policies or hiring consultants and researchers, and while efforts are **In Progress** the action or process is not yet complete.

*Table 2. Evolution of the Definition of the Terms Ongoing and In-Progress (years 2010 through 2014)*

2010 – 2011	2012 - 2013		2014
<b>Ongoing are actions that are being implemented</b>	<b>Ongoing</b> was divided into two groups		Auditor’s recommendation
	<b>Ongoing</b> are activities that are performed as part of OMKM’s daily responsibilities	<b>In-Progress</b> are actions that require specialized implementation, e.g., development of policies or hiring of consultants	<b>Ongoing</b> was further defined as activities that have established processes in place and are performed as part of OMKM’s daily responsibilities. <b>In-Progress</b> are actions that requires specialized implementation and while efforts are in-progress, the action or process is not yet complete.

Used in this report, the definitions are:

- **Short to Long Term:** Management action still to be implemented during its scheduled time period.
- **In Progress:** Management action that requires specialized implementation has been initiated, process is not yet complete.
- **Ongoing:** Management action is implemented and processes are in place to fulfill this requirement, actions will continue indefinitely because they are part of OMKM's continuing management responsibilities.
- **Completed:** Management action is completed.

## 2.4 Annual Reports are Cumulative

Each successive report builds upon the previous year's report, thereby the annual reports beginning with 2011 are cumulative. As an annual report, this submission provides additional detail on activities occurring in calendar year 2019.

## 3. Summary of Implementation Activities

Most management actions have either been implemented or are in progress. Many actions are considered 'ongoing' as they are long term, continuous land management responsibilities. Appendix F details the implementation status with explanations for individual CMP management actions. Appendix G details the cumulative annual progression of implementation status from 2010 to present.

Below is a summary of implementation activities in support of the management action status determination.

### 3.1 Research & Monitoring (Appendix A)

Following the implementation of studies and establishing baseline inventories to determine the presence, distribution, and abundance of a resource, the next step is monitoring to assess the status of the resource over time. Along with inventories and monitoring, data from research provides the basis for the development of resource protection programs. OMKM utilizes resources available within the UH system including faculty, graduate and undergraduate students, in its efforts to fulfill CMP mandates. Details on OMKM's activities related to research and monitoring is presented in Appendix A.

#### **Cultural Resources**

##### Historic Property Monitoring (

Following the completion of an archaeological inventory survey of the Maunakea Science Reserve and summit access road, annual assessments of the archaeological sites (historic properties) began in 2012. In compliance with the Long Term Historic Property Monitoring Plan, approved by SHPD in 2014, assessment of historic properties in the Astronomy Precinct and alongside the summit access road is conducted annually while the more remote sites are assessed on a three and five year rotational basis. Annual reports for these efforts are submitted to SHPD after consultation with the Kahu Kū Mauna Council on management action recommendations.

##### Collecting Information on Traditional and Customary Practices

In consultation with Kahu Kū Mauna, OMKM's process for collecting information on traditional and customary practices is through published documents from studies, oral histories, or through other formal methods of information gathering, such as environmental assessments and impact statements. Examples of published works include the 1999 "Oral History and Consultation Study for the Mauna Kea Science Reserve and Hale Pōhaku Complex Development Plan Update", 2005 archival project and oral history "Mauna Kea-Ka Piko Kaulana o Ka 'Āina", 2009 "Cultural Resource Management Plan", and various cultural assessments completed as part of HRS Chapter 343 mandates. Similar third party materials, such as the USGS Open File Report 2017-1043 "Conversing with Pelehonuamea: A workshop combining 1,000+ years of traditional Hawaiian knowledge with 200 years of scientific thought on Kīlauea volcanism" also incorporate information on Maunakea's traditional and customary practices. Additional partnerships within the UH-system and other State-agency partners, continue to be pursued.

## ***Biological Resources***

### ***Arthropod (Wēkiu Bug and Alien Species) Monitoring***

Monitoring of the wēkiu bugs and alien arthropods, which began in 2002 and 2007 respectively, is conducted annually. Beginning in 2013 monthly surveys are also made in and around the surrounding areas of the facilities at the 9,200 foot elevation while quarterly arthropod surveys are conducted at facilities at the summit.

### ***Biodiversity of Arthropods***

Field work for the 2011 study of the biodiversity of arthropods in the summit region in the Halepōhaku area is complete. Specimen curation and report writing are anticipated to be complete in 2020. As a result of OMKM's research and monitoring efforts, the species of native moth previously documented at Halepōhaku and the summit region were formally described in the scientific literature; <https://biotaxa.org/Zootaxa/article/viewFile/zootaxa.4545.2.7/38727> and found to actually be two distinct species. Additional state-of-the-science DNA PhD-level research is augmenting this research. The "Metabarcoding Maunakea Project" includes three objectives: (1) update existing databases of the arthropod species on Maunakea, (2) understand the diet (food webs) of native and endemic species using metabarcoding, and (3) use of this dietary data to understand the impacts of invasive species. This study is anticipated to continue into 2022.

### ***Wēkiu Bug***

A study of the characterization and mapping of wēkiu bug habitat was completed in 2016. A study on the restoration of wēkiu bug habitat that was initiated in 2015 culminated in the publication of a thesis in early 2018. A PhD candidate is studying wēkiu bug microbial endosymbionts (i.e. gut bacteria) to understand the evolutionary shifts in diet and habitat from seed eating *Nysius* to the carnivorous wēkiu bug. This research is also anticipated to continue into 2022.

### ***Botanical Monitoring***

Monitoring of botanical resources is completed in conjunction with the yearly historic property monitoring.

### ***Vertebrate Biology***

Begun in 2017 and continuing through 2021, the study on the distribution of native Hawaiian birds and bats within the University of Hawai'i management areas uses radar and acoustic technologies to identify the areas of bird and bat habitat use on Maunakea.

## ***Geology, Hydrology, and Erosion***

### ***Lake Waiau Photo Monitoring***

While not part of UH's managed lands, in a cooperative effort with DLNR's Natural Area Reserve, OMKM rangers photo document monthly the level of Lake Waiau in the Mauna Kea Ice Age Natural Area Reserve, and periodically hike to the adze quarry to assess conditions.

### ***Study of Erosion Processes***

A multi-year study of surface erosion processes on cinder cones that was initiated in 2014 is anticipated to conclude in 2020. A second iteration of terrestrial LiDAR mapping (detailed digital elevation mapping) was completed in 2017. In 2018 field work included data collection in the Halepōhaku area while in 2019 the Maunakea Summit Access Road corridor was added to the study area. A final round of data collection occurred in 2020. This study will help to better understand natural erosion as well as help characterize arthropod habitat.

### ***Permafrost***

OMKM funded a study to assess the presence of permafrost and whether conditions for the formation of permafrost still exist—this project is transitioning to a monitoring phase to document the long-term status of permafrost on Maunakea. The publication "The Coldest Places in Hawaii: The Ice-Preserving Microclimates of High-Altitude Craters and Caves on Tropical Island Volcanoes" characterized unique climate phenomena found on Maunakea (<https://doi.org/10.1175/BAMS-D-17-0238.1>).

### Groundwater Hydrology

A groundwater hydrology study was begun in late 2017 and is anticipated to include up to 5 years of data collection, looking at sources of groundwater in west Hawai'i, including sensors at the summit and at Halepōhaku.

### Observatories Assist with Volcano Threat Assessment

The U.S. Geological Survey national volcanic threat assessment was updated, addressing the ongoing Kīlauea eruption as well as Maunakea and other Hawaiian volcanoes. Low-light cameras developed by the astronomical observatories installed at the summit with views of the eruption and lava flow areas, proved extremely helpful in monitoring eruption activities.

### ***Weather and Climate Research***

#### Climate Change Models

A multi-year study developing climate change models to determine impacts to the summit ecosystem 50-years in the future is available in a public data archive (<http://thredds.soest.hawaii.edu:8080/thredds/catalog/downscaling/catalog.html>).

#### Long-Term Temperature Records

A separate study integrating long-term temperature records and other types of climate data for earlier years when temperature was not recorded was completed and a journal manuscript is in review. Research into climate processes for this plan was published as "Temperature Trends in Hawai'i: A Century of Change, 1917–2016"; <https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.6053>. The article "Snow cover in Hawai'i (1893–1953) and its effect on ground temperature" was published as a result of coordination across several research projects, with a Farrington High School graduate (now a college undergraduate) as the lead author; <https://doi.org/10.1080/15230430.2019.1600963>.

#### Vog Monitoring

Sulfur dioxide sensors were installed at Halepōhaku to help assess vog distribution and allow visitors to better manage public health concerns; <https://tatacenter-airquality.mit.edu/hawaii-vog>.

#### Weather Monitoring

The above studies in conjunction with development of a plan to improve weather monitoring on the summit as part of a sea level to summit network of weather stations will help to track changes in weather and climate over the long term and will provide data to evaluate altitudinal changes and impacts on ecosystems from sea level to the summit.

### ***Invasive Species Threats***

#### Measures to Prevent Introduction of Invasive Species

In 2015, OMKM initiated a study to evaluate measures to prevent the introduction of invasive species, in particular the inspections of vehicles and equipment. This included an analysis of the feasibility of a vehicle washing facility as a means of helping to prevent the introduction of invasive species. This study concluded in early 2018 and provides management-specific recommendations as part of a MS thesis.

#### Invasive Species Protocols - Updates

Invasive species prevention protocols were updated in 2018 addressing relevant recommendations from the 2018 MS thesis research (above).

### ***Other Studies***

#### Visitor and Commercial Tour Capacity Study

In collaboration with UH Mānoa's School of Travel Industry Management, OMKM initiated a study in 2019 to assess the capacity for commercial tour operations and public visitation on UH's managed lands. Data collection efforts have been hampered by road closures associated with the 2019 start-up efforts of the Thirty Meter Telescope project and reduced activity in 2020 due to COVID-19 pandemic.



### 3.2. Resource Management Programs (Appendix B)

Resource management programs may be policies, plans, or long-term action programs which purpose is to preserve or protect the resources, or to help ensure the health and safety of those visiting and working on the mountain. The adoption of administrative rules in January 2020 will necessitate careful review of policies related to resource management, with potential concurrent updates to practices and procedures. Details on OMKM's resource management programs are listed in the Appendix B.

#### **Cultural Resources**

OMKM, together with Kahu Kū Mauna, developed policies for the construction of new cultural features, including the stacking of rocks, the scattering of human remains, placement of offerings, buffers around historic properties and visitation and use of ancient shrines. The Maunakea Management Board (MKMB) approved these policies in early 2018 after extensive community consultation held over a period of several years by Kahu Kū Mauna.

#### **Invasive Species**

Data from surveys and studies provide valuable information for developing management programs to protect the resources such as the endemic wēkiu bug. Invasive flora and fauna are a concern because of their potential impact not only on the wēkiu bug, but also on other native species, and on the "health" of Maunakea's unique ecosystem. OMKM's invasive species prevention, response and control plan is actively being implemented, especially regarding observatory related activities. Preventing the introduction of predatory ants remains a high priority. The adaptive-management invasive species plan is periodically reviewed and updated, with annual reports prepared and made publicly available.

#### Removal of Invasive Weeds

OMKM continues its efforts to remove fireweed (*Senecio madagascarensis*). While on patrol, rangers remove fireweed found along the road and in the summit areas. OMKM's invasive weed pull program brings community volunteers to the Halepōhaku area to pull fireweed, mullein and other invasive plants. It is OMKM's goal to manage invasive weeds and to revegetate the area with native vegetation.

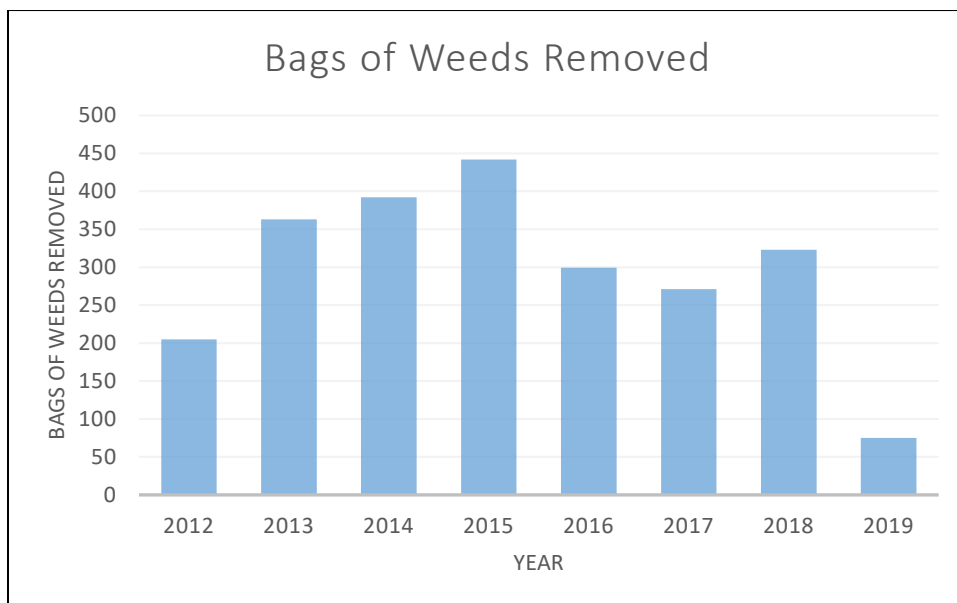
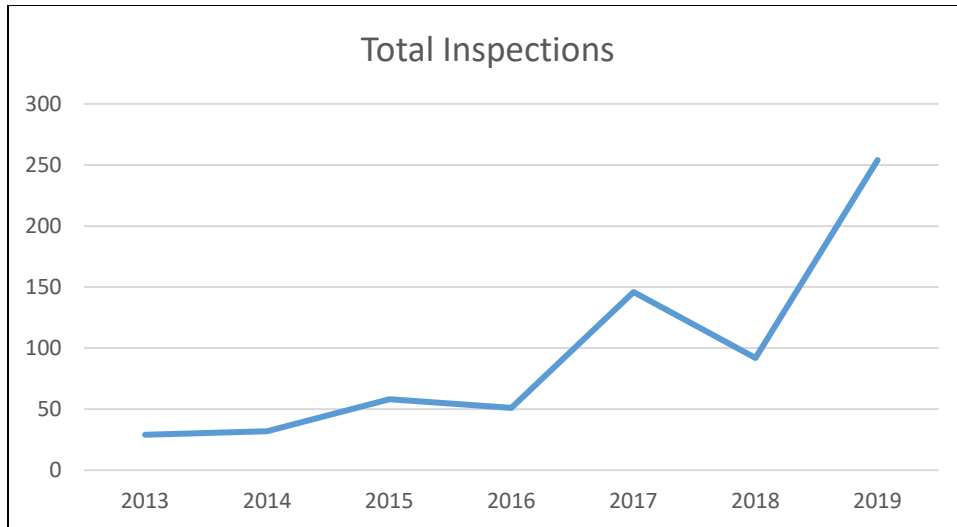


Figure 1. Bags of weeds removed from UH managed lands by volunteers. The 2019 quantity is lower than otherwise due to the extended road closure associated with Thirty Meter Telescope (TMT) start-up attempts and corresponding lack of access by staff and volunteers.

### Inspections to Mitigate Risk

As part of its invasive species prevention and control program a qualified biologist conducts inspections of construction materials and other activities as identified in the “Maunakea Invasive Species Management Plan”. Inspections document materials being delivered, remediation required, deliveries denied entry, and other aspects of activity on Maunakea.



*Figure 2. Number of invasive species inspections conducted each year. Quantities have been increasing due to awareness as the program presence becomes well-established. The elevated numbers in 2019 reflect construction activity associated with Visitor Information Station parking improvements. 2020 data not shown.*

### **Native Plant Propagation**

A Capital Improvement Project (CIP) that created new parking at the Visitor Information Stations (see *Infrastructure Safety Improvements* below) included approval for the installation of a greenhouse for propagating native plants, including māmane to replace trees removed in addition to other native plants for revegetating the Halepōhaku area. Planning and community outreach for this new greenhouse is ongoing.



*Figure 3. A feral pig near the summit of Maunakea in October 2014. Such observations of animals is unusual in the Maunakea Science Reserve. Hunting rules fall under the jurisdiction of the Department of Land and Natural Resources (DLNR). The Office of Maunakea Management supports DLNR wildlife management by reporting such sightings, monitoring for impacts, and providing support as requested.*

### **3.3 Education, Training, and Outreach (Appendix C)**

One of the key tenets of the Public Access Plan is that “an informed public is best prepared to make good decisions and act responsibly.” OMKM also recognizes the importance of establishing community relationships and keeping them informed of OMKM’s activities. Details on OMKM’s activities related to outreach, education and training are provided in Appendix C.

Education and outreach efforts include the development of educational materials, such as brochures, signage and the dissemination of materials, OMKM regularly updates its heritage and resources guide (brochure). This guide along with the safety brochure, “*Visiting Maunakea Safely and Responsibly*,” are distributed at the Visitor Information Station (VIS) at the 9,200 foot elevation and at the ‘Imiloa Astronomy Center. OMKM also seeks opportunities to speak to community groups and organizations about OMKM’s activities.

After preparation by staff and consultation with the community, a draft “Maunakea Education & Outreach Plan: Maunakea Comprehensive Management Plan Management Action EO-1” was submitted to the Maunakea Management Board for review and approval in December 2019. The Board deferred taking action on the item to allow the University of Hawai‘i system additional time for discussions regarding the reorganization of the Office of Maunakea Management into a to-be-determined structure. After additional time to review and discuss the plan, it was ultimately approved by the Board in July 2020.

#### **Orientation**

The OMKM Maunakea Orientation program was launched in 2012. It is a requirement that all observatory and support staff (both office and on-mountain), vendors, construction workers, mid-level support and VIS staff, UH employees, and commercial tour drivers attend the orientation. An online version with an assessment quiz is available as a more efficient means of delivery and an alternative to in-person sessions. A video orientation for visitors will also be developed to be shown in the VIS. An orientation

plan, approved by the Management Board and DLNR guides implementation and identifies a renewal requirement every 3 years unless otherwise mandated by a permit. See Appendix C for a list and number of orientation sessions and number of certificates issued by OMKM since 2012.

### ***Training***

Beginning in 2016, a staff/employee training program was initiated. All OMKM and Maunakea Observatory Support Services employees are required to attend.

### ***Volunteer Program***

Since its inception in the Spring of 2012, OMKM's community volunteer weed pull program has held 58 events, filled over 2,400 bags of weeds by nearly 1,500 volunteers putting in over 10,400 hours. Groups participating in 2019 include various UH Hilo student groups, local primary school students and families, Observatories, and employee organizations, and environmental science students.

### ***Outreach***

OMKM seeks opportunities to share with the community its activities. OMKM also participates in school and community events showcasing the natural resources found on Maunakea, fun science and keiki activities.

As part of their educational efforts with young children, researchers working on OMKM projects have been going to schools to demonstrate the use of equipment that is used in their scientific studies, such as unmanned aerial vehicles (drones), shares examples of resources such as insect collections, and conducts experiments with the students. Others mentor students, including those who wish to conduct and enter the results of their studies in the State science fair.

## **3.4 Visitor Management (HAR 20-26) (Appendix D)**

### ***OMKM Maunakea Rangers***

The Maunakea Rangers monitor activities on UH's managed lands on a daily basis. They record pertinent data including the number of vehicles by type (4- vs. 2-wheel drive, observatory, commercial and motorcycles) and observations of visitor activities, including hikers, bikers, vehicle speeds, trash, etc. Through their interactions with the public they help to educate people about Maunakea, including the cultural significance, environmental uniqueness, science, and how to visit safely. Many of the management actions relating to public and commercial activities, along with trash pick-up and removal, are carried out by the Rangers as part of their daily responsibilities. Rangers provide first responder first aid and assist in the coordination with County of Hawai'i emergency responders in search and rescue efforts. In addition, twice annually the rangers conduct inspections of the summit and Halepōhaku facilities for compliance with their conservation district use permits.

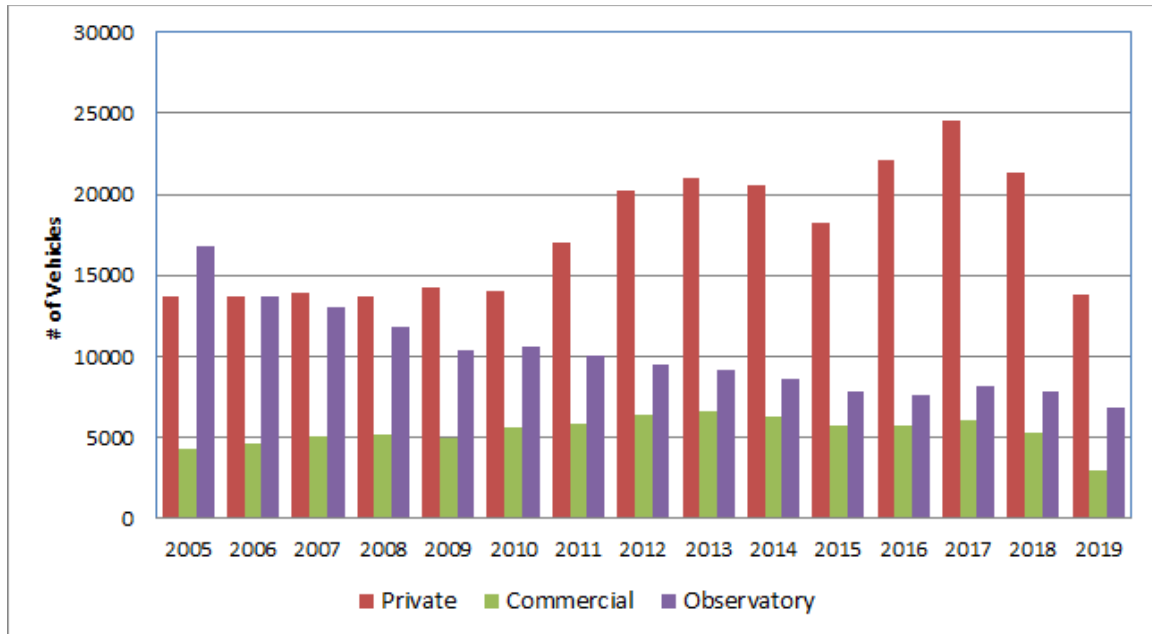


Figure 4. Total Yearly Vehicle Counts by Types of Users. Since 2005: Observatory vehicles have declined, commercial vehicles slightly, private vehicles have greatly increased and dominate traffic.

The Maunakea Summit Access Road is a unique public resource in the State. Maunakea Observatories Support Services (MKSS), an operation of the Maunakea Observatories, operates the only snow removal operations in Hawai'i. The steep road presents both safety challenges as well as is demanding of both vehicles and drivers. Road maintenance by MKSS also provides safe access for the public.

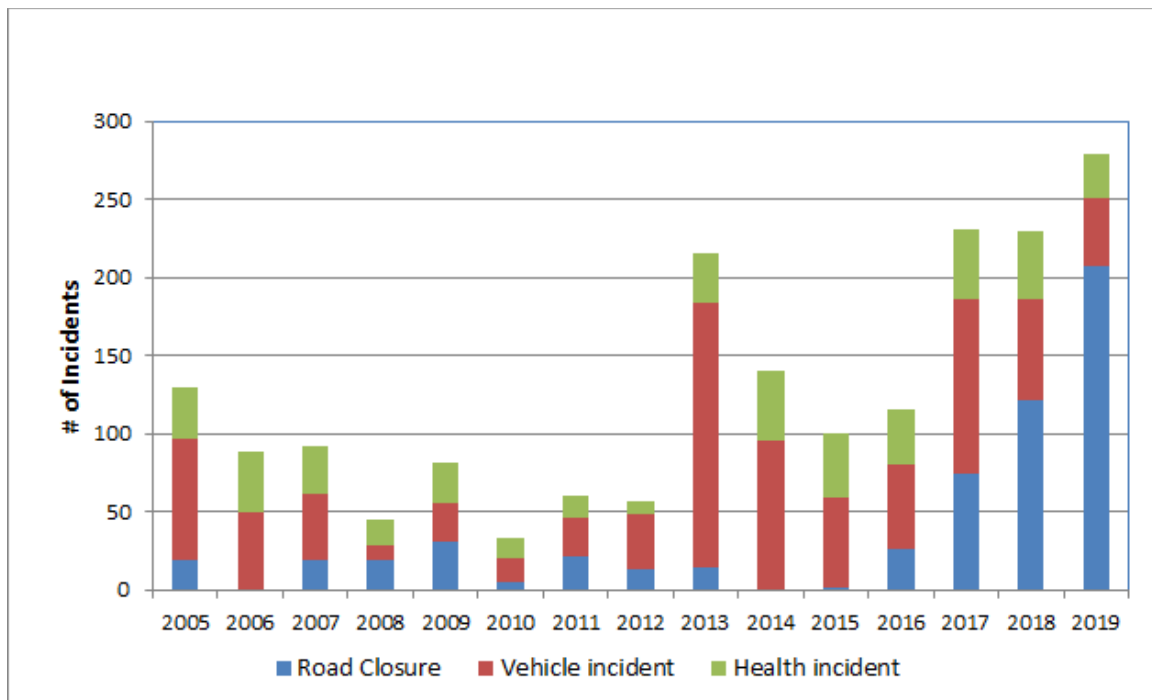


Figure 5. Yearly road closures, vehicle incidents, and health incidents; 2005 to 2019. Consistent road closure data record-keeping was first fully implemented in 2017 after addressing issues with use of road-ice sensors for safety purposes and installation of the automated vehicle counter.

The Maunakea Ranger corps has a target staffing level of seven full-time and one part time rangers. This allows OMKM to schedule three rangers for duty and ensures a minimum of two rangers on duty should one ranger be sick or on vacation.

### ***UH Internal Audit of Maunakea Support Services and Office of Maunakea Management***

A UH internal audit of OMKM's and MKSS' finances was performed in 2018 and a report was presented to the UH Board of Regents Committee on Independent Audit in December 2018. The audit concluded that the "University entities involved with Maunakea have developed processes and procedures to appropriately account for their respective transactions in connection with their management of Maunakea." The audit evaluated university funds, lease payments and external funds received in support of stewardship, management, education and other activities related to Maunakea.

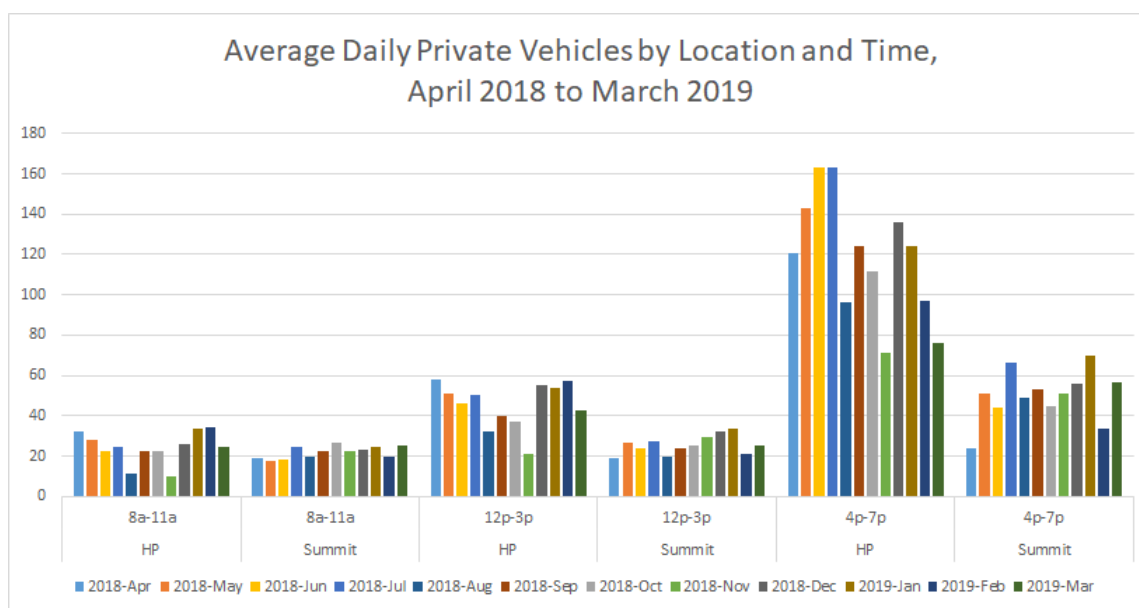
### ***Administrative Rules***

In 2018 draft administrative rules were reviewed by Kahu Kū Mauna and the Mauna Kea Management Board and a recommendation was submitted to the Board of Regents who approved the draft rules for public hearings. In July 2018, Governor Ige gave his approval to move ahead with public hearings. Pursuant to HRS Chapter 91, public hearings were held in September 2018. Changes to the rules based on public comments received were made and a second round of public hearings held in 2019. The UH Board of Regents adopted the rules on Nov. 6, 2019 after a special 11-hour meeting at UH Hilo, where 99 people testified.

There are 15 CMP management actions that require administrative rules for implementation. These include categories involving natural and astronomy resources, education and outreach, infrastructure and maintenance, infrastructure and maintenance, and in particular, activities and uses. Administrative rules were approved by Governor Ige in January 2020.

### ***Vehicle Counter***

An automated vehicle counter was installed in 2015 to count the number of vehicles that drive above Halepōhaku. This counter, through a radio-frequency identification system, is able to identify observatory, UH, and commercial tour vehicles that drive to the summit. A portable vehicle counter installed in 2018 is being used in conjunction with the automated counter to help determine the number of vehicles go only to the VIS.



*Figure 6. Average Daily Private Vehicles by Location and Time, April 2018 thru March 2019. Each day, the heaviest summit traffic occurs during sunset. Yet, even during the heavy sunset period, most vehicles stay at HP rather than continue to the summit.*

### ***Road Condition Sensors***

A test road condition sensor installed in 2013 has shown the device accurately senses the presence of ice on the road. Two additional sensors have been installed along hazardous road sections prone to the development of ice, in particular black ice. When ice is detected the sensors automatically send email notifications to rangers who take action such as closing the road to protect the safety of the visiting public. Installation of additional sensors will be based on demonstrated utility of the first three in a network configuration.

## **3.5 Permitting, Enforcement, and Facility Oversight (Appendix E)**

The CMP identifies oversight of Conservation District Use, commercial tour, special use, and other permit compliance as a critical function of OMKM. Such oversight is essential for both resource protection as well as public safety. Oversight functions for commercial tour, special use, and other permit types is addressed in preceding sections of this report. This portion addresses facilities, including observatories, support functions, and the Visitor Information Station facilities.

### ***Operations Monitoring, and Maintenance Plan (OMMP)***

An OMMP is implemented and identify maintenance needs, protocols and strategies that minimizes impacts to the resources and ensures that permittees comply with the conditions of their CDUPs. As part of the OMMP each observatory and MKSS is required to submit a description of anticipated projects over a five-year period. These five-year outlook of projects are updated annually and presented to Kahu Kū Mauna who determines the level of review for each project. When projects are submitted to OMKM for approval, those not requiring further review can be taken directly to the MKMB. Those requiring further review are presented first to Kahu Kū Mauna followed by review and approval by the MKMB.

### ***CMP Compliance***

Twice annually OMKM rangers conduct inspections of all summit facilities for compliance with their Conservation District Use Permits.

### ***CMP Actions and Mitigation***

As a requirement of the MKMB, applicants of projects are required to review the CMP and submit measures to comply with relevant CMP actions as part of the project's proposal. When applicable, mitigation measures are also included in the proposals.

### ***Infrastructure Safety Improvements***

Parking, vehicle and pedestrian flow, and visitor capacity concerns are addressed in the improvements to parking and safe drop off and pickup of visitors at the VIS. In compliance with CMP IM-9, the project involved the construction in 2019 of a new paved parking lot and an ingress access lane both are which are on the same side of the road as the VIS. Summit Access Road repair and improvements were also evaluated. The permit for this project included the requirement that a minimum of 130 māmane trees be planted within two years of completion, with no less than an 80% survival rate (104 trees). As of December 26, 2019 there were 121 māmane, 17 'āweowe, 1 puakala, 25 pāwale, and 12 'ena'ena surviving seedlings in the project area. While restoration efforts in 2019 benefitted from relatively moist climate conditions, mortality rates associated with 2018-2019 efforts for this project often exceed 50% due to frost or dry conditions. Thus, sustained revegetation efforts will continue in 2020. Capital improvement project funds were provided for this project.

### ***Observatory Decommissioning***

The Caltech Submillimeter Observatory (CSO) announced their intent to decommission in 2009. They submitted a "Notice of Intent" (NOI) to decommission to UH for approval under the auspices of the 2010 Mauna Kea Observatories Decommissioning Plan, and their NOI was approved in 2016. In January 2020 Caltech provided a detailed schedule which anticipates concluding the deconstruction, removal, and restoration processes in 2022.

The UH Hilo "Hökū Ke'a" Educational Observatory submitted their NOI in 2015 for approval by the Maunakea Management Board. Their NOI was approved by MKMB in February 2020 after assurances

were made by UH Hilo that undergraduate astronomy opportunities would not be lost. UH Hilo is proceeding with the decommissioning process as described in the 2010 Mauna Kea Observatories Decommissioning Plan and anticipates completing restoration efforts in 2023.

***Observatory Planning & Construction***

Thirty Meter Telescope (TMT) construction permits were approved by the Board of Land and Natural Resources (BLNR) in 2017 and upheld through various court challenges. Construction start-up efforts were attempted on July 15, 2019—however no access to UH managed lands on Maunakea occurred by TMT partners due to a protest-related road closure. The road closure ended on December 28, 2019.

Planning and project scoping for a new educational telescope for UH Hilo, to replace the Hōkū Ke‘a facility but at a location other than the Maunakea summit region, began in 2015 and is ongoing.



## **Appendix A: Research & Monitoring**

### **Research & Monitoring of Cultural and Natural Resources**

## CULTURAL RESOURCES

<p><b>FINAL REPORT</b></p> <p><b>Long-Term Historic Property Monitoring Plan for the University of Hawaii Management Areas on Mauna Kea, Ka'ohe Ahupua'a, Hamakua District, Hawai'i Island, State of Hawai'i.</b></p> <p>TMK: (3)4-4-015:009, 12</p> <p><i>Prepared for:</i></p> <p>Office of Mauna Kea Management University of Hawaii, Hilo 640 North A'ohoka Street, Suite 203 Hilo, HI 96720</p> <p>April 2014</p> <p><b>PACIFIC CONSULTING SERVICES, INC.</b></p> <p>720 Iwilei Road, Suite 424, Honolulu Hawaii 96817</p>
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<p><b>FINAL REPORT</b></p> <p><b>Burial Treatment Plan for Burial Sites in the Mauna Kea Science Reserve and the Mauna Kea Access Road Corridor, Ka'ohe Ahupua'a, Hamakua District, Island of Hawai'i.</b></p> <p>TMK: (3) 4-4-015:009 and (3) 4-4-015:por.001</p> <p><i>Prepared for:</i></p> <p>Office of Mauna Kea Management University of Hawaii, Hilo 640 North A'ohoka Street, Suite 203 Hilo, HI 96720</p> <p>July 2014</p> <p><b>PACIFIC CONSULTING SERVICES, INC.</b></p> <p>720 Iwilei Road, Suite 424, Honolulu Hawaii 96817</p>
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2012	Draft Report, [Revised] 2012 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. September, 2017. Pending final review by SHPD.
2013	Draft Report, 2013 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. March, 2018. Pending review by SHPD
2014	Draft Report, Long-Term Monitoring of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, #3 (2014). October, 2016. Pending review by SHPD
2015	Draft Report, 2015 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. May, 2018. Pending review by SHPD
2016	Draft Report, 2016 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. June, 2018. Pending review by SHPD
2017	Draft Report, 2017 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. July, 2018. Pending review by SHPD
2018	Draft Report, 2018 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. December, 2018. Pending review by SHPD
2019	Draft Report, 2019 Assessment of Historic Properties within Three University of Hawaii Management Areas on Mauna Kea, Ka'ohē Ahupua'a, Hāmākua District, Hawai'i Island, State of Hawai'i. February, 2020. Pending review by SHPD

## NATURAL RESOURCES

2002	Annual surveys of the wēkiu bug begin
2007	Annual surveys of other arthropods begin
2007-2008	Results of the 2007-2008 Alien Species and Wekiu Bug ( <i>Nysius wekiuicola</i> ) Surveys on the Summit of Mauna Kea, Hawai'i Island. <a href="http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2007-2008_AlienArthropod-Wekiubug.pdf">http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2007-2008_AlienArthropod-Wekiubug.pdf</a>
2009	Results of the 2009 Alien Species and Wēkiu Bug ( <i>Nysius wekiuicola</i> ) Surveys on the Summit of Mauna Kea, Hawai'i Island. <a href="http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2009_AlienArthropod-Wekiubug.pdf">http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2009_AlienArthropod-Wekiubug.pdf</a>
2010	Results of the 2010 Alien Species and Wēkiu Bug ( <i>Nysius wekiuicola</i> ) Surveys on the Summit of Mauna Kea, Hawai'i Island. <a href="http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2010_AlienArthropod-Wekiubug.pdf">http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2010_AlienArthropod-Wekiubug.pdf</a>
2011	Results of the 2011 Alien Species and Wēkiu Bug ( <i>Nysius wekiuicola</i> ) Surveys on the Summit of Mauna Kea, Hawai'i Island.

	<a href="http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2011_AlienArthropod-Wekiubug.pdf">http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2011_AlienArthropod-Wekiubug.pdf</a>
2012	Results of the 2012 Alien Species and Wēkiu Bug ( <i>Nysius wekiuicola</i> ) Surveys on the Summit of Mauna Kea, Hawai'i Island. <a href="http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2012_AlienArthropod-Wekiubug.pdf">http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/BM_2012_AlienArthropod-Wekiubug.pdf</a>
2013	Results of the 2013 Alien Species and Wēkiu Bug ( <i>Nysius wekiuicola</i> ) Surveys on the Summit of Mauna Kea, Hawai'i Island. <a href="http://www.malamamaunakea.org/uploads/environment/MKISMP/OMKM_2013InvasiveSpeciesReport_20150521.pdf">http://www.malamamaunakea.org/uploads/environment/MKISMP/OMKM_2013InvasiveSpeciesReport_20150521.pdf</a>
2014	2014 Invasive & Native Species Monitoring Report <a href="http://www.malamamaunakea.org/uploads/environment/MKISMP/OMKM_2014InvasiveSpeciesReport.pdf">http://www.malamamaunakea.org/uploads/environment/MKISMP/OMKM_2014InvasiveSpeciesReport.pdf</a>
2015	2015 Invasive & Native Species Monitoring Report – in review
2016	2016 Invasive & Native Species Monitoring Report – in preparation
2017	2017 Invasive & Native Species Monitoring Report – in preparation
2018	2018 Invasive & Native Species Monitoring Report – in preparation
2019	2019 Invasive & Native Species Monitoring Report – in preparation

### Photo Documentation

Photographic monitoring of the Road Corridor helps document the distribution, abundance, and seasonality of fireweed (*Senecio madagascariensis*) on Maunakea.

<http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/RdCorridorSummary.pdf>

Lake Wai'au time series of water level photographs, 2012 – present.

[http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/LakeWaiau\\_2012-present-all\\_PhotoComparison.pdf](http://www.malamamaunakea.org/uploads/environment/EnvironmentDocuments/LakeWaiau_2012-present-all_PhotoComparison.pdf)

### Research Activities

Surveys and studies on Historic Properties and cultural resources	<p>2005 – 2009. Archaeological inventory of historic properties of the Science Reserve, summit access road and Halepōhaku.</p> <p>2004 - 2006. Archival study and compilation of native traditions, historical accounts, and oral history interviews for Mauna Kea.</p> <p>2005 – 2009. Archaeological inventory of historic properties of the Science Reserve, summit access road and Halepōhaku.</p>
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<p>Surveys and studies on:</p> <ul style="list-style-type: none"> <li>• Geology and erosion</li> <li>• Climate and weather</li> </ul>	<p>2006 – Climatological analysis of meteorological observations at the summit of Maunakea</p> <p>2007 – Review Mauna Loa weather data dating back to 1958 to assess climate conditions on Maunakea to help with wēkiu bug research</p> <p>2012 – 2018. Study to assess presence of permafrost and whether conditions for formation of permafrost still exist.</p> <p>2011– 2017. A multiyear study on the development of a climate change modeling program to help forecast climate change on the summit to help determine impacts to the summit ecosystem.</p> <p>2012 – High Altitude Climate of the Island of Hawai'i publication.</p> <p>2013 – ongoing. OMKM is working with the Department of Geography at UH Manoa on the development of a sea level to summit weather monitoring network to help track climate change. OMKM's participation is to help the location and installation on weather station on the summit.</p> <p>2014 –ongoing. Surficial study of the geology and erosion in cinder cone environments above 12,500'. High-resolution topographic maps, and imagery have been completed.</p> <p>2013 – 2016. Study to extend the long term temperature records for the State of Hawaii by integrating other climate data for earlier years when temperature was not recorded.</p>
<p>Surveys on human activities and needs:</p>	<p>2001 – ongoing. Rangers continue to submit daily reports on human activities; data are input in a database.</p> <p>2015 – ongoing. An automated vehicle counter keeps a real time count of all vehicles traversing above Halepōhaku. Rangers also conduct daily counts of vehicles identifying 2 wheel vs 4 wheel drive vehicles.</p> <p>2018 – ongoing. Rangers install an axle vehicle counter to assess in conjunction with the automated vehicle counter, the number of vehicles that go only to Halepōhaku.</p> <p>2019 – ongoing. A study of visitor activities and carrying capacity.</p>
<p>Ongoing surveys and studies of the wēkiu bug and other arthropods</p>	<p>2006 – 2011 Modeling the ecology of the wēkiu bug's Maunakea environment</p> <p>2011 – A study of how geology (pu'u and terrain), wind speeds and direction influence insect and snow pack deposits on the summit to help supplement wēkiu bug research.</p> <p>2011 – 2018. Multi-year survey of the summit region and at the mid-level area at 9,200 ft elevation to assess the biodiversity of arthropods. Including a 2016 MS Thesis on biodiversity in the Halepōhaku area.</p> <p>2012 – 2018. Study to assess presence of native and non-native plant and arthropod species.</p> <p>2014 – 2016. A study evaluating the characterization and mapping of wēkiu bug habitat has been completed.</p> <p>2015 – ongoing. A multi-year wēkiu bug habitat restoration plan is being implemented, also part of the TMT CDUP requirements. OMKM is currently supporting this management action.</p> <p>2016 – Habitat mapping of wēkiu bugs using existing remote sensing and arthropod trap data.</p> <p>2017 – ongoing. Study to investigate diet and parasite loads in alpine arthropods.</p>
<p>Alien and invasive species</p>	<p>2012 – 2015. Development of an invasive species management plan. It is composed of modules addressing various aspects of the invasive species prevention, response, and control. Implementation is ongoing</p> <p>2015 – 2018. A study to evaluate measures to prevent the introduction of invasive species, in particular the inspection of vehicles and equipment was initiated in 2015.</p>

Other (Flora and Fauna) Studies	2016 – ongoing. Initiated seabird, forest bird and bat inventory study
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## Monitoring Activities

Historic Properties (archaeological sites)	<p>2011– ongoing. On a monthly basis, OMKM Rangers photo document the level of Lake Waiau in DLNR's Maunakea Ice Age Natural Area Reserve (MKIANAR). Rangers also periodically hike to the adze quarry in the MKIANAR) to assess conditions. Rangers pick up and remove trash from their hikes into the MKIANAR.</p> <p>2012 – ongoing. Annual archaeological monitoring of historic properties (archaeological sites). The Long-Term Historic Monitoring Plan was approved by State of Hawaii Historic Preservation Division (SHPD) in 2014.</p> <p>2014 – SHPD approved the Long Term Historic Properties Monitoring Plan for UH Managed lands on Maunakea.</p>
Wēkiu bug and alien species.	<p>2002 – ongoing. Annual surveys on wekiu bug have been conducted since 2002.</p> <p>2007 – ongoing. Annual surveys of alien species are conducted on UH Managed lands</p>
Invasive species	<p>2013 – ongoing. Monthly surveys for invasive species are conducted at the facilities at the mid-level, 9,200 ft elevation, including the VIS and the support facilities.</p> <p>2013 – ongoing. Quarterly surveys for invasive species are conducted at all the summit facilities for invasive species.</p> <p>2013 – ongoing. Natural resources personnel accompany archaeologists in their annual monitoring to assess sites and surrounding areas for native and invasive species</p>
Flora	2013 – ongoing. Annual surveys of historic properties and wēkiu bug habitat include collection of vegetation presence and abundance.

## **Appendix B: Resource Management Programs**

Selected publications related to resource management programs along with a summary of activities, are listed below.

## Maunakea Invasive Species Management Plan and appendices

Maunakea Invasive Species Management Plan. 2015. PCSU Technical Report v191.

### **Standard Operating Procedures (SOPs): detail and instructions for all mountain users.**

SOP 01: Cleaning of Vehicles and Personal Belongings. v1.3. (pdf)

SOP 02: Inspection of Vehicles, Construction Materials, Scientific Equipment, & Supplies. v1.3. (pdf)

SOP 03: Cafeteria Food Shipments (Receiving). v1.0. (pdf)

SOP 10: Invasive Invertebrate Early Detection Surveys of Facilities. v1.0. (pdf)

SOP 11: Annual Alien Invertebrate Early Detection & Wēkiu Bug Monitoring. v1.1. (pdf)

SOP B: Maunakea Vertebrate Threats, Identification, Collection, and Processing Guide. v1.1. (pdf)

SOP C: Maunakea Invertebrate Threats, Identification, Collection, & Processing Guide. v1.0. (pdf)

SOP D: Maunakea Plant Threats, Identification, Collection & Processing Guide. v2.2.(pdf)

SOP Z: Revising the Invasive Species Management Plan. v1.1. (pdf)

### **Invasive Species Inspections**

Inspections of large vehicles and their loads for invasive species began in 2013. To date 808 large vehicles and loads have been inspected. Of the total number of vehicles inspected 782 vehicles passed inspections and were approved immediately or after quick remediation, 17 were rejected and required re-inspection, and 9 were non-compliant, that is no requests for inspections were made prior to proceeding to the mountain

	2013	2014	2015	2016	2017	2018	2019	2020
Keck	2		14	11	15	21	51	17
Subaru	3	8	17	11	30	16	10	4
JCMT							1	
UKIRT						2	5	
UH88			1	1	57	2	8	7
IRTF	2			1	1	10	2	1
CFHT	11		3		4	10		3
SMA				10	19	16	21	6
CSO			4					
UH24						3		
VLBA			4			2	1	
Gemini	4	12	9	13	13	9	6	
TMT*		14	18				75	
MKSS/VIS	6	11	4	5	8	2	150	1
<b>Subtotal Total</b>	<b>28</b>	<b>45</b>	<b>74</b>	<b>52</b>	<b>147</b>	<b>94</b>	<b>330</b>	<b>39</b>
Rush	NR	NR	NR	NR	NR	NR	110	16
No Rush	NR	NR	NR	NR	NR	NR	220	23
Remediation	4	12	19	8	15	10	58	2
No Remediation	24	33	55	44	132	84	272	37
Approved	28	43	71	52	146	90	316	37
Rejected		2	3		1		11	
Non-compliance						4	3	2

\*The majority of invasive species inspections for the TMT were conducted by the Big Island Invasive Species Committee (BIISC).



**Rush/ No Rush:** Note: Information on whether a request was a rush was not recorded (NR) until 2019. Rush inspections are those that were not requested in advance (four days prior) to the scheduled delivery.

**Remediation/ No remediation:** Remediation occurred when there was a cleanliness or invasive species concern with the load or vehicle. Most remediation actions entailed pressure washing or vacuuming. *No remediation* are vehicles or loads that did not have a cleanliness or invasive species concern.

**Approved/ Rejected/ Non-compliance:** Vehicles and loads that were clean and free of invasive species passed inspection and were *approved*. Vehicles and loads for which remediation could not occur quickly such as from power washing or vacuuming were *rejected* and required re-inspection after the concern was addressed. *Non-compliance* was documented when vehicles or loads did not request an invasive species inspection and traversed to UH managed lands without approval.

## Resource Management Programs

<p>Polices and plans related to cultural resources</p>	<p>2012 – 2014. A burial treatment plan was reviewed by the Hawaii Island Burial Council and approved by the Division of Historic Preservation. It contains a schedule for monitoring.</p> <p>2012 – 2018. Policies relating to the placement and removal of offerings, the scattering of human remains, the construction of new cultural features including the stacking of rocks were developed by Kahu Kū Mauna. In 2016 following public consultation Kahu Kū Mauna approved the policies. The MKMB felt that more community consultation was required before finalizing the policy. Community consultation on these policies then resumed and following this additional consultation, MKMB approved in 2018.</p> <p>2016 – ongoing. The U.S. Department of Defense was contacted to begin the review process prior to any removal efforts of military aircraft.</p> <p>2016 – 2017 Kahu Kū Mauna initiates consultation with Native Hawaiians on protocols per CMP. Advertisements placed in Hawai'i Tribune Herald, Honolulu Star Advertiser December, 11, and 18, 2016; January 5, February 12, March 19, April 16 and May 7, 2017; West Hawai'i Today, similar dates as Hawai Tribune for 2017; Office Hawaiian Affairs, Ka Wai Ola, Months of December 2016 thru May 2017. Kuka Kuka session held on May 21, 2016, including petitioners of TMT contested case, OHA, DHHL, DLNR, and members of the Hawaiian community.</p>
<p>Invasive species control</p>	<p>2012 – ongoing. An active volunteer program to remove fireweed (<i>Senecio madagascariensis</i>) and other invasive plants continues at the mid-level area. Rangers continue to remove fireweed in the upper elevations.</p> <p>2013 – ongoing. The Hawaii Ant Lab and Big Island Invasive Species Committee continue to support implementation of the Invasive Species Management Plan by providing technical support, and assisting with inspections and monitoring work.</p> <p>2015 – ongoing. The Maunakea Invasive Species Management Plan was approved by the MKMB. It is composed of modules addressing various aspects of the invasive species prevention, response, and control. Implementation is ongoing.</p>
<p>Wēkiu bug management plan and habitat restoration plan.</p>	<p>Data from wēkiu bug, invasive/alien arthropod, biodiversity arthropod studies, topography and wēkiu bug food distribution, and climate studies inform updates to management plans and habitat restoration plans for the bug.</p>
<p>Public facilities</p>	<p>2013 – ongoing. Road condition ice-sensor installed on the summit ridge to test the concept. After proving to be reliable, 2 additional sensors</p>

	<p>installed and integrated into road condition assessments and decision-making regarding safe operations.</p> <p>2014 – 2018. CIP funds are used to construct improvements to the ingress and egress at the VIS and to address parking and pedestrian flow. An Environmental Assessment was prepared and published in 2017. A CDUA was submitted for DLNR and a CDUP was approved in June 2018. Funds were also used to study the condition of the summit loop road, make recommendations for repair, including estimated costs.</p> <p>2015 – ongoing. An automated vehicle counter was installed to count the number of vehicles (differentiating: public, commercial, tour, observatory, etc.) that drive above Halepōhaku.</p> <p>2018 – ongoing. Rangers install an axle vehicle counter to assess in conjunction with the automated vehicle counter, the number of vehicles that go only to Halepōhaku.</p>
Develop and maintain a GIS and database program.	<p>2013 – ongoing. A GIS-based data storage and reporting system has been developed. The system is continuously being expanded and enhanced.</p> <p>2001 – ongoing. Rangers have been and continue to submit daily reports summarizing their observations and their activities, including documenting number of vehicles, hikers, incidents, permitted and unpermitted commercial tour operators, etc.</p> <p>2014 – ongoing. An automated vehicle data collection system is operational recording individual observatory, permitted commercial tours, and OMKM vehicles using radio frequency identification tags (RFID) and general public vehicles.</p>
Native Plan Restoration	<p>2013 – 2014. Community volunteers plant over 200 'Āhinahina (silversword) for DLNR in the Forest Reserve.</p> <p>2015. Construct benches for native plant restoration</p> <p>2016 – 2017. Summer interns test seed collection and propagation methods for native plants.</p> <p>2018. Propagation and outplanting of māmane, 'aweoweo, pāwale, puakala, 'ena'ena under CDUP HA-3812 (VIS parking improvements).</p> <p>2019. Continued propagation and out planting of māmane, 'aweoweo, pāwale, puakala, 'ena'ena under CDUP HA-3812 (VIS parking improvements).</p>
Other Plans and activities	<p>2001. OMKM ranger program established.</p> <p>2007 – ongoing. Biannual inspection of facilities for compliance with their CDUPs</p> <p>2009. BLNR approved the Maunakea Comprehensive Management Plan (CMP)</p> <p>2010. BLNR approved the Cultural and Natural Resources Management Plans, Public Access Plan and the Decommissioning Plan, sub-plans to the CMP.</p> <p>2012 – ongoing. Beginning in 2012 applicants of projects are required to review the Comprehensive Management Plan (CMP) and submit measures to comply with relevant CMP actions as part of their project proposals. When applicable, mitigation measures are included in the project proposal.</p> <p>2016 – Completed/ongoing. An Operations, Monitoring, and Maintenance Plan has been developed. The plan recognizes the need to identify maintenance needs, protocols and strategies that minimizes impacts to the resources and ensures that permittees comply with the conditions of their CDUPs. It also serves as a reporting mechanism for CMP compliance activities calls for the coordination of maintenance activities and schedules.</p> <p>2015. Caltech Submillimeter telescope submitted its Notice of Intent (NOI) to decommission initiating the decommissioning process for its observatory</p>

	<p>on the summit. MKMB approved the NOI in 2016. Pursuant to the Decommissioning Plan (DP) for Mauna Kea Observatories, OMKM is overseeing the decommissioning process and Caltech is preparing all necessary documents, including Environmental Assessment (EA), Conservation District Use Permit application and DP requirements. An EA is currently being prepared.</p> <p>2015. UH Hilo submitted its Notice of Intent to decommission initiating the decommissioning process for its summit observatory, Hōkū Ke'a. Public testimony against the decommissioning of UH Hilo's educational telescope resulted in the MKMB deferring approval of the NOI. OMKM is overseeing the decommissioning process and UH Hilo is responsible for carrying out the DP requirements. In 2018, UH Hilo removed the non-operational telescope from inside its summit facility.</p> <p>2016 – ongoing. A staff/employee training plan was prepared and has been implemented. All OMKM and Maunakea Observatory Support Services are required to attend.</p> <p>2017 – ongoing. A Sign Plan was approved by the MKMB. This plan helps ensure appropriate review and consistency in sign design and use.</p> <p>2018 – ongoing. An Orientation plan was prepared, approved by the Maunakea Management Board and Department of Land and Natural Resources. This plan addresses requirements for visitors, employees/permittees/contractors, as well special orientation requirements as may be mandated in permits.</p>
Signs	<p>2012 – An inventory and map of all the signs on UH's managed lands was completed. The inventory of the signs on UH managed lands is being updated.</p> <p>2017 – ongoing. A Sign Plan was approved by the MKMB. Installation of signs still requires DLNR approval, the plan helps ensure appropriate review and consistency in design and use.</p> <p>With input from Rangers and Kahu Kū Mauna, signs were installed to highlight cultural awareness and safety issues.</p>

## **Appendix C: Education, Training, and Outreach**

OMKM community engagement and outreach

## OMKM COMMUNITY UPDATES (CMP EO-3)

Oct. 9, 2008	Rotary Club of Volcano, OMKM stewardship
Aug. 16, 2009	UH Hilo Chancellor's advisory group; OMKM stewardship
Apr. 8, 2009	Board of Land and Natural Resources, OMKM stewardship
Oct. 1, 2009	UH President M.R.C Greenwood; OMKM stewardship
Oct. 14, 2009	Senate Higher Education Committee; OMKM stewardship
Dec. 5, 2009	Visitor Information Station, Universe Tonight; OMKM stewardship
Mar. 25, 2010	Board of Land and Natural Resources; OMKM's proposed CMP subplans
Apr. 8, 2010	Board of Land and Natural Resources, update of CMP implementation; OMKM stewardship
Sept. 9, 2010	Kona Town Hall at Old Airport; OMKM stewardship
Apr. 2 2011	Visitor Information Station, Universe Tonight; update on OMKM stewardship
Oct. 10, 2011	OHA visit to Maunakea; OMKM stewardship
Feb. 28, 2012	Administrators and Educators; OMKM stewardship
Jun, 15, 2012	Institute for Astronomy External Review; OMKM stewardship
Jul. 3, 2012	OMKM's resource library
Jul. 24, 2012	UH Manoa Chancellor; OMKM stewardship
Sept.14, 2012	Hawaii Island Realtors Tradeshow; OMKM stewardship and UH commitment to community-based management
Dec. 12, 2012	Big Island Representatives; OMKM stewardship and commitment to community-based management
Dec. 27, 2012	Big Island Invasive Species Committee; outreach needs for invasive species management
Feb. 5, 2013	Rotary Club of South Hilo; OMKM stewardship and UH commitment to community-based management
Feb. 7, 2013	Hawaii Island Chamber of Commerce; General membership meeting; 12 Years of community-based management of the summit of Mauna Kea
Feb. 22, 2013	Rotary Club of Hilo; OMKM stewardship and commitment to community-based management
Mar. 22, 2013	Hawaii Leeward Planning Conference; OMKM stewardship
Apr. 9, 2013	Rotary Club of Pahoa; OMKM stewardship and UH commitment to community-based management
May 10,2013	Board of Land and Natural Resources; update on CMP implementation & OMKM stewardship



- May 16, 2013 Rotary Club of Volcano; OMKM stewardship and UH commitment to community-based management
- May 20, 2013 Lions Club of Kona; OMKM stewardship and UH commitment to community-based management
- Jun. 5, 2013 Rotary Club of North Hawaii; OMKM stewardship and UH commitment to community-based management
- Jun. 8, 2013 Keawe Vredenburg, Hui Kako`o; Decommissioning Plan
- Jun. 19, 2013 Rotary Club North Hawaii; OMKM stewardship and UH commitment to community-based management
- Jul. 22, 2013 Keawe Vredenburg; OMKM stewardship and UH commitment to community-based management
- Jul. 24, 2014 UHH Astronomy and Physics Department; OMKM stewardship
- Aug. 14, 2013 David Tarnas; OMKM stewardship and UH commitment to community-based management
- Sept. 18, 2013 Keaukaha Community Association; update on OMKM activities
- Sept. 20, 2013 Kiwanis; OMKM Stewardship and commitment to community-based management
- Nov. 3, 2015 TMT Pacific Astronomy & Engineering Summit; summit of local and international students; OMKM stewardship of Maunakea.
- Nov. 12, 2013 Association of Hawaiian Civic Club Convention; OMKM Presentation
- Nov. 13, 2013 Keaukaha Community Association; OMKM up dates
- Nov. 13, 2013 Association of Hawaii Civic Club Hawaii Council; Decade of Stewardship
- Dec. 5, 2013 Rotary Club of Kona; OMKM Stewardship and commitment to community-based management
- Dec. 7, 2013 Pi'ihonua Hawaiian Homestead Association; update on OMKM stewardship activities
- Apr. 1, 2014 Rotary Club of Pahoa Sunset; OMKM Stewardship
- May 9, 2014 Board of Land and Natural Resources; update of CMP implementation; OMKM stewardship



Oct. 27, 2014	Association of Hawaiian Civic Club Convention Waikoloa; educational display
Nov. 16, 2014	Department of Hawaiian Homelands; partnership proposal Humuula sheep station and shuttle program involving beneficiaries' participation
May 2, 2015	Kau Coffee Festival; OMKM Outreach table ongoing stewardship efforts on Maunakea
May 19, 2025	Hamakua Development Corporation; series of presentation during the TMT protest; OMKM stewardship
Jun. 12, 2015	Board of Land and Natural Resources, update of CMP implementation; OMKM stewardship
Sept. 9, 2015	Community meeting with the Governor; Community involvement with Maunakea Management and OMKM stewardship
Jan. 28, 2016	Association of American University Women; OMKM stewardship
Apr. 1, 2016	Hawaii Leeward Planning Conference; update on OMKM activities
Mar. 16, 2016	Presentation on resources and stewardship of Maunakea to Hawaii Community College "Forest Team" class
Mar. 23, 2016	Japanese Chamber of Commerce & Industry Hawaii General Membership Meeting; expo display
Mar. 26, 2016	Panaewa Hawaiian Home Lands Community Association; update on OMKM stewardship activities
Mar. 30, 2016	Rotary Club of North Hawaii; OMKM stewardship activities
Apr. 1, 2016	Hawaii Leeward Planning Conference; OMKM stewardship activities
Apr. 5, 2016	Kona Kohala Chamber Luncheon with Mayor Kenoi and Business Expo; Informational booth
Apr. 22, 2016	UH Hilo Earth Day OMKM Booth Coloring station centered on native plants and animals.
May 02, 2016	Maunakea site tour Tom Callis, Hawaii Tribune-Herald; environmental resources; cultural connections, OMKM stewardship activities
May 17, 2016	Rotary Club of Kona Mauka; OMKM stewardship activities
May 19, 2016	Rotary Club of Kona; OMKM stewardship activities
May 20, 2016	Rotary Club of Hilo; OMKM stewardship activities
May 24, 2016	Native Hawaiian Presentation; Keahi Warfield, Patrick Kahawaiolaa, Bill Brown, Mapuana Waipa - Pueo committee; Herc Freitas Beneficiary; Bill Walter, Kama'aina/business; Mike Kaleikini, Hawaiian/business; Kirstin Kahaloa, Hawaiian /business; Kalepa Babayan, Hawaiian/navigator; Newton Chu, PUEO attorney; Jacque Hoover, Hawaiian/business; Greg Mooers, Maunakea Management Board (MKMB); Greg Chun, MKMB; Leningrad Elarinoff former County Councilman; Rich Matsuda, local community/astronomy; Paul Coleman, Hawaiian/astronomy, Heather Kaluna, Hawaiian/astronomy; Mailani Neal Hawaiian/astronomy; Mary Begier, business; Barry Taniguchi, community/business; Ron Terry, community/environment; Hannah Springer, MKMB
May 26, 2016	Rotary Club of Kona; OMKM stewardship activities
May 27, 2016	Rotary Club of Hilo; OMKM stewardship activities
Jul. 14, 2016	Community meeting with the Governor; Paul Coleman, Heather Kaluna, Mike Kaleikini, Nikki Thomas (student), Dash Stevens, Kevin Silva (student), Devin Chu (grad student),



Ron Terry, Hannah Springer, Myles Yoshioka, Russell Arikawa, Marianne Takamiya, Pierre Martin, Thayne Curry

Jul. 19, 2016	Rotary Club of South Hilo; OMKM stewardship
Jul. 29, 2016	Rotary Club of Hilo; OMKM stewardship
Sept. 15, 2016	Meeting with Mayor Kim; OMKM stewardship
Sept. 26, 2016	Rotary Club of Kona ; OMKM stewardship activities
Oct. 3, 2016	State Legislative visit to Maunakea; OMKM stewardship
Oct 12, 2016	Senator Kai Kahele; Senator Lorraine Inouye, Representative Mark Nakashima; Representative Cindy Evans; Representative Cliff Tsuji; Representative Richard Onishi; Governor's East Hawaii Liaisons, Will Oakbe and Susan Kim
Oct. 13, 2016	Legislative visit to Maunakea; OMKM stewardship
Jan. 8, 2017	Media site visit to Mauna Kea with Tom Callis
Mar. 2, 2017	Kona-Kohala Chamber of Commerce Mayor's Luncheon; OMKM Outreach table ongoing stewardship efforts on Maunakea
Aug. 28, 2017	Regent Higaki, briefing on UH's proposed Administrative Rules
Sept. 7, 2017	Hawaii Business Roundtable, Honolulu; OMKM Stewardship
Sept. 27, 2017	Hawaii Island Chamber of Commerce Board of Directors: history of astronomy and UH process for review of astronomy projects and limiting impacts, such as the TMT project
Oct. 3, 2017	Hawaii Island Chamber of Commerce Government Affairs Committee; Ongoing stewardship efforts on Maunakea
Oct. 24, 2017	Sherry Bracken interview with Stephanie Nagata talks in-depth about OMKM and its day-to-day management of Maunakea Science Reserve. Engaging 30-minute interview.
Nov. 7, 2017	House Finance Committee; OMKM stewardship
Nov. 14, 2017	Rotary Club of Kona Mauka; ongoing stewardship on Maunakea
Nov. 17, 2017	State House Finance Committee visit to Maunakea; OMKM stewardship
Dec. 1, 2017	Hilo Kiwanis; OMKM stewardship
Dec. 5, 2017	Wendy Laros, Executive Director Kona Kohala Chamber of Commerce; briefing on OMKM stewardship
Dec. 5, 2017	Susan Kim, Governor's Hawaii Island Liaison; briefing on update on OMKM stewardship
Dec. 5, 2017	Jacqui Hoover, Executive Director for Leeward Planning Conference and Hawaii Island Economic Development Board; update on OMKM stewardship
Dec. 14, 2017	DLNR Admin staff: OMKM Stewardship
Dec. 20, 2017	Mayor Kim; Barry Taniguchi, former chair of MKMB and Stephanie Nagata, Director of OMKM on the management of Maunakea and the Mayor's vision for Maunakea
Jan. 16, 2018	Board of Land and Natural Resources; update on OMKM stewardship
Feb. 20, 2018	Kona Kohala Chamber of Commerce; update on stewardship of Maunakea





Mar. 2, 2018	Waimea Community Association Presentation; ongoing stewardship efforts on Maunakea
Mar. 6, 2018	Hawaii Island Chamber of Commerce; General membership meeting, OMKM's long-term management milestones and stewardship
Mar. 29, 2018	Visitor Information Station staff; OMKM stewardship
Apr. 7, 2018	Hawaii Leeward Planning Conference; legislative update
Apr. 23, 2018	Arcadia Retirement Residence, Honolulu; OMKM stewardship
May 14, 2018	Japanese Chamber of Commerce & Industry of Hawaii; OMKM update of stewardship of Maunakea
Sept. 4, 2018	RCUH Board; OMKM stewardship
Sept. 18, 2018	Kona Lions, OMKM update of stewardship of Maunakea
Oct. 11, 2018	Hawaii County Administration Cabinet; presentation to Mayor Kim's cabinet about OMKM long-term stewardship of Maunakea
Oct. 16, 2018	Maunakea Observatories Outreach Committee: OMKM stewardship of Maunakea
Oct. 24, 2018	Kiwanis Club Kona; OMKM briefing, OMKM stewardship
Oct. 26, 2018	Speaker Saiki visit to Maunakea; briefing on start of astronomy on Maunakea, creation of OMKM and OMKM's stewardship of Maunakea
Nov. 8, 2018	West Hawaii Community Forum; panel discussion and Q & A about stewardship of the mountain. Panelists: Stephanie Nagata, Director, OMKM; Greg Chun, Maunakea Management Board; Fritz Klasner, Natural Resources Program Manager, OMKM, Wally Ishibashi, Senior Advisor, OMKM; Scotty Paiva, Chief OMKM Ranger
Nov. 9, 2018	Rotary Club of Hilo; update on OMKM stewardship of Maunakea
Nov. 13, 2018	Maunakea Task Force; update on OMKM stewardship of Maunakea
Nov. 27, 2018	Business law class, UH Hilo. Peter Kubota instructor; OMKM stewardship role and responsibilities, commitment to community-based management
Nov. 28, 2018	Dru Kanuha; briefing on OMKM stewardship of Maunakea
Dec. 14, 2018	Maunakea Management Board; OMKM presentation to board members on Management of Maunakea, UH commitment to community-based management
Dec. 19, 2018	Rotary Club of Hilo Bay; update on OMKM's management of Maunakea
Feb. 7, 2019	Rotary Club of Kona; OMKM Stewardship
Jan. 25, 2019	Board of Land and Natural Resources: updated on OMKM stewardship
Feb. 5, 2019	Waikoloa Lions; OMKM stewardship
Jan. 16, 2019	Leimomi Kahn, President, Hawaiian Affairs Caucus of the Democratic Party; briefing on OMKM stewardship
Feb. 19, 2019	Hawaiian Affairs Caucus, Democratic Party; overview of OMKM's stewardship of Maunakea
Mar. 5, 2019	Hawaii Electric Light Company; OMKM stewardship
Mar. 15, 2019	Kona-Kohala Chamber of Commerce Luncheon with Mayor Kim; OMKM information table and display on stewardship
Apr. 2, 2019	Hawaii Island Portuguese Chamber of Commerce: OMKM stewardship

Apr. 4, 2019	Carpenters Union; OMKM stewardship
Jul. 3, 2019	Staff for US. Congresswoman, Tulsi Gabbard; briefing on OMKM's stewardship of Maunakea
Jul.19, 2019	Pohakuloa Advisory Council (PAC) at Pohakuloa Training Area; OMKM stewardship and admin rules
Jul. 30, 2019	Rotary Club of Kona Mauna; OMKM stewardship
Aug. 27, 2019	Board of Regents; OMKM stewardship
Oct. 16, 2019	House Higher Education Committee; OMKM stewardship
Jan 4-8, 2020	American Astronomical Society convention; OMKM outreach booth display and materials on OMKM's stewardship activities on Maunakea
Mar.11, 2020	Rotary Club of North Hawaii; OMKM stewardship of Maunakea and misinformation about management of the mountain.

## COMMUNITY OUTREACH EVENTS (CMP CR- 3 and EO-6)

- Sep. 1, 2012 Universe Tonight presentation at the Onizuka Center for International Astronomy Visitor Information Station, on arthropods and stewardship.
- Mar. 4, 2013 Presentation to UH Hilo undergraduate astronomy class on Maunakea's resources, stewardship and heritage.
- Mar. 19, 2013 Support a "Flat Stanley" traveling primary school visit to Maunakea Observatory base facilities and OMKM.
- Jul. 11, 2013 Presentation to visiting University of Victoria, Canada graduate biology class on Maunakea biology.
- Nov. 27, 2013 Permafrost presentation at Hilo Intermediate School by Dr. Kenji Yoshikawa of University of Alaska-Fairbanks; including discussion of permafrost on Maunakea and installation of soil-temperature probe network in the school-yard.
- Dec. 7, 2013 OMKM participated in the 'Imiloa Palila Palooza with displays on resources and provided youth activities.
- Mar. 25, 2014 Hawai'i Academy of Arts and Sciences (HAAS) presentation on Maunakea's resources.
- Oct. 24, 2014 Permafrost presentation at Hilo Intermediate School by Dr. Kenji Yoshikawa of University of Alaska-Fairbanks.
- Dec. 13, 2014 Waikoloa Elementary and Middle School Winter Festival. Children's science activities and stewardship display
- Apr. 23, 2015 Kealahou Elementary School Science Showcase; coordinated with OMKM researchers, other state agencies and Maunakea children activities related to native plants and animals including coloring activities, natural resources trading cards, science stations
- May. 16, 2015 Hawai'i Volcanos National Park 'BioBlitz; provided entomological technical support
- May 28, 2015 OMKM Open House at Halepōhaku on OMKM stewardship for those protesting the TMT project a total of 22
- Jun. 8, 2015 OMKM sponsor Mike Lee's presentation on Kilo Hōkū
- Aug. 2, 2015 Organized and sponsored "Aloha Art Festival at 'Imiloa; event organized by OMKM's PIPES intern as a way of bringing together stakeholders on Maunakea in midst of the TMT protest
- Aug. 14, 2015 Permafrost presentation at Hilo Intermediate School by Dr. Kenji Yoshikawa of University of Alaska-Fairbanks
- Feb. 26, 2016 16<sup>th</sup> Annual Dryland Forest Symposium; display and educational booth on OMKM stewardship
- Apr. 21, 2016 Kealahou Elementary School Science Day; coordinate with other State agencies on



- Apr. 22, 2016 Earth Day at UH Hilo; youth activities and information on OMKM stewardship
- Apr. 22, 2016 Presentation at Ke Ana La'ahana PCS career day on resource management careers and Maunakea.
- Apr. 26, 2016 Panaewa and Keauhaka Homestead Associations Prince Kuhio Day Celebration; OMKM and Maunakea Observatories provide children's science activities, display of Maunakea arthropods and coloring activities and solar telescopes booth displays, science and children activities
- Apr. 30, 2016 AstroDay, an annual science and astronomy education event sponsored by the Maunakea Astronomy Outreach Committee (MKAOC); OMKM stewardship display and children's activities
- Jun. 28, 2016 Jessica Kirkpatrick presents "Endemic Insects of Maunakea" at Lyman Museum
- Jul. 12, 2016 OMKM UH Hilo sponsored research graduate students "What's Bugging the Mountain", entomological research on Maunakea; as part of the Hawai'i Volcanoes National Park "After Dark in the Park" series.
- Aug. 27, 2016 Hawai'i Volcanoes National Park "BioBlitz" citizens science effort; provided entomological technical support.
- Sept. 1-5, 2016 Volunteer support at the IUCN World Conservation Congress in Honolulu.
- Sept. 15, 2016 Presentation and demonstration at UH Hilo on non-intrusive geophysical techniques, such as permafrost measurements, by Dr. Matthias Leopold (University of Western Australia).
- Sept. 24, 2016 PUEO-KOYD Hōkūalaka'i Work Day, Sea-Sky event; youth activities; OMKM stewardship
- Feb. 23, 2017 Kealakehe Elementary School Science Day; children science activities, coloring station and trading cards featuring native plants and animals.
- Mar. 21, 2017 Auntie Mimi's AstroBash at Kailua-Kona Library; educational table with children's natural resources activities.
- Apr. 8, 2017 Presentation at Hawaii Academy of Arts & Sciences elementary school on Maunakea resources.
- Apr. 8, 2017 Tropical Living Festival, Hawaii Academy of Arts and Sciences; Children's natural resources coloring and trading card activities.
- Apr. 11, 2017 Presentation to Dept. of Education staff on Maunakea stewardship, organized by Gemini Observatory.
- Apr. 21, 2017 Earth Day at UH Hilo; OMKM Outreach table ongoing stewardship efforts on Maunakea
- May 6, 2017 Visitor Information Station Universe tonight series at Halepōhaku on OMKM stewardship
- May 6, 2017 AstroDay Event in Hilo; OMKM kids activities table and OMKM stewardship information
- July 8, 2017 Hawai'i Volcanoes National Park "BioBlitz" citizens science effort; provided entomological technical support.



- Oct. 14, 2017 Presentation to volunteer appreciate dinner for volunteers of the Visitor Information Station on Maunakea resources.
- Oct. 21, 2017 Na Kilo Palekai, Keaukaha community wa'a, science, navigation event; OMKM exhibit and educational display
- Nov. 4, 2017 Inaugural AstroDay Kona; OMKM stewardship and educational display
- Dec. 8, 2017 Presentation to Dept. of Education staff on Maunakea stewardship, organized by Gemini Observatory
- Mar. 1, 2018 Kealakehe Elementary School Science Day; children science activities, coloring station and trading cards featuring native plants and animals
- Mar. 9, 2018 Mountain View Elementary Open House; displays
- Mar. 28, 2018 Waikoloa Elementary School presentation on the wēkiu bug
- Apr. 20, 2018 UH Hilo Earth Day; OMKM Outreach table ongoing stewardship efforts on Maunakea
- Apr. 26, 2018 Keaukaha Elementary School Ohana Night; OMKM exhibit on stewardship and educational display



May 5, 2018 Astroday Hilo; annual event sponsored by the Maunakea Observatories Outreach Committee featuring children's science activities; OMKM stewardship exhibits and natural resources displays

Jun. 30, 2018 Presentation on Science Camps of American as part of weed pull event

Sept. 17, 2018 Volcano School of Arts and Sciences presentations on entomology.

Nov. 26, 2018 Windward Community College geology class, presentation on vegetation of Maunakea.

- Dec.12, 2018 IfA hosts PUEO Open House; OMKM Outreach table ongoing stewardship efforts on Maunakea
- Jan. 14, 2019 Present to TCBES graduate course in Organizational Management and Logistics as related to Natural Resource Management on Maunakea.
- Mar. 1, 2019 DLNR's Division of Forestry and Wildlife's Napu'u Conservation Project Bio-Cultural Festival at Pu'uwa'awa'a; mini arthropod trapping and identification field activities for elementary students
- Apr. 11, 2019 Kealakehe Elementary School Science Night; OMKM table and display on stewardship.
- Apr. 18, 2019 Mountain View Public Library; Bug-ology for school grade school kids; display of Maunakea bugs
- Apr. 23, 2019 Keaukaha Science Technology Engineering Art Math (STEAM) night; OMKM outreach table ongoing stewardship efforts on Maunakea; activities for kids



- Apr. 26, 2019 UH Hilo Earth Day; OMKM outreach table ongoing stewardship efforts on Maunakea
- May 4, 2019 AstroDay, an annual science and astronomy education event sponsored by the Maunakea Astronomy Outreach Committee (MKAOC); OMKM stewardship display and children's activities
- Jun. 5, 2019 Wēkiu bug presentation and interactive activity for 'Imiloa's Insect Camp
- Jul. 24, 2019 Wēkiu bug presentation and interactive activity for 'Imiloa's Insect Camp
- Oct. 25, 2019 Imiloa Halloween event; theme cool, creepy, and crawly insects of Maunakea, youth activities
- Oct. 25, 2019 Presentation to Institute for Astronomy graduate student seminar on Maunakea stewardship
- Oct. 27, 2019 HE'E Hawaii Explorations Expo; Information booth at Afook-Chinen Civic Auditorium on OMKM stewardship of Maunakea
- Nov. 2, 2019 Presentation at 'Imiloa teachers workshop on Maunakea stewardship
- Feb. 14, 2020 Mountain View Elementary School visit/Open House at Institute of Astronomy in Hilo; Wēkiu bug life cycle, bug headbands, arthropod collection
- Feb. 23, 2020 'Imiloa Astronomy Center birthday celebration; Theme: Reduce, Reuse, Recycle, Refuse, Re purpose; OMKM display related to stewardship and critters found on Maunakea.
- Apr. 13, 2020 Presentation on resources and stewardship of Maunakea to Hawaii Community College "Forest Team" class.
- May 6 2020 Record a video session for upcoming "'Imiloa @ Home" series on the wēkiu bug.



## CMP CULTURAL POLICIES OUTREACH (CMP: CR-1, , 5, 6, 7, 8, 9, and 12)

Kahu Kū Mauna through OMKM invites the community to talk story. Ads were run for several months in the *Hawaii Tribune Herald*, *West Hawaii Today*, *Honolulu Star Advertiser*, and Office of Hawaiian Affairs' *Ka Wai Ola*. to reach a wide as possible audience. Pursuant to the CMP, Kahu Ku Mauna also met with the Office of Hawaiian Affairs and the Royal Order of Kamehameha to discuss cultural matters related to Maunakea.

- Oct. 13, 2010 Meeting with representatives of the Royal Order of Kamehameha regarding care taking of the summit lele.
- Oct. 18, 2011 Presentation to OHA trustees and staff on OMKM's stewardship role and responsibilities while on their visit to Maunakea
- Feb. 4, 2013 Presentation given OHA trustees and staff on OMKM's stewardship role and responsibilities on their visit to Maunakea.
- Dec. 17, 2020 Kahu Kū Mauna met with OHA representatives to discuss ahu building and removal on Maunakea.
- May 21, 2016 Kahu Kū Mauna convenes a talk session with members of Native Hawaiian community to discuss Cultural Resources management actions regarding setting polices and/or guideless related to cultural activities. Attendees included representatives from DLNR, OHA, DHHL, petitioners of the TMT contested case, and others from the Hawaiian community.
- Dec.2016 - May 2017 Ads were run in the following newspapers and OHA's *Ka Wai Ola* newsletter inviting members of the community to talk story.



Date of Ad	Hawaii Tribune Herald	Honolulu Star Advertiser	West Hawaii Today	Office of Hawaiian Affairs Ka Wai Ola
Dec. 11, 2016	X	X		Dec. 2016
Dec. 16, 2016	X	X		
Jan. 5, 2017			X	Jan. 2017
Jan. 15, 2017	X	X		
Feb. 12, 2017	X	X	X	Feb. 2017
Mar. 19, 2017	X	X	X	Mar. 2017
Apr. 16, 2017	X	X	X	Apr. 2017
May 7, 2017	X	X	X	May 2017

Nov. 19, 2019 Correspondence with the Royal Order regarding the caretaking of the summit ahu.

## **SYMPOSIUMS, CONFERENCES AND SPECIAL EVENTS (CMP EO-3)**

- Jun. 6, 2012 Transit of Venus viewed from Maunakea; OMKM and Maunakea Observatories Support Services coordinated anticipated heavy public attendance to view the rare transit of Venus event. Organized commercial tour operators to provide free public transportation to the summit; police and emergency services.
- Aug. 4-8, 2012 OMKM sponsored and hosted an international scientific symposium titled "Vulnerable Islands in the Sky: Science and Management of Tropical Island Alpine & Sub-Alpine Ecosystems". Symposium was co-coordinated by UH Hilo Professor Jim Juvik. Symposium site was Hawaii Pacific Academy in Waimea. Symposium participants came from England, Scotland, Canary Islands, South Africa, Australia, Japan, and the US, including Hawaii. Symposium was funded in part by the Gordon and Betty Moore Foundation
- Nov. 27, 2012 National Park Service climate change scenario planning workshop for Hawai'i Island parks and protected areas; participated in workshop activities.
- May 20, 2014 Hawaii Geographic Information Coordinating Council Geospatial Expo. Presentation by Amber Stillman on "3D Landscape Maps for University Managed Lands on Maunakea".
- Jun. 3-4, 2014 West Hawai'i Science Technology Engineering & Math (STEM) camp. Present on maps and drones to primary schools students at summer camp. A partnership with STEM Works and Kealakehe Robotics.
- Jun. 25, 2014 Hawai'i Ecosystem Meeting. Rapid-presentation on Arthropod Monitoring on Maunakea.
- Jul. 15, 2014 Hawaii Conservation Conference, presentations by Jessica Kirkpatrick (Monitoring Arthropod Communities on Maunakea) and Amber Stillman (3D Landscape Maps for University Managed Lands on Maunakea).
- Nov. 1, 2014 Special issue of Arctic, Antarctic, and Alpine Research, Volume 46, No. 4 (2014 University of Colorado) on "Losing the High Ground: rapid transformation of tropical island alpine and subalpine environments". This issue is devoted to the proceedings of the 2012 symposium, "Vulnerable Islands in the Sky: Science and Management of Tropical Island Alpine & Sub-Alpine Ecosystems" sponsored by OMKM.
- Nov. 17, 2014 Entomological Society of America, presentation by Dr. Jesse Eiben with Jessica Kirkpatrick as co-author. "Life tables and population growth modeling guide conservation actions for an alpine restricted rare insect, the wēkiu bug, *Nysius wekiuicola*, in Hawai'i"
- Apr. 4, 2015 Pacific Entomology Conference in Honolulu, presentation titled "The Variability in Taxa, Distribution, and Abundance of Species on Maunakea: Comparing 3 years of data: 2013 -2015"
- Apr. 20, 2015 Attend UH Hilo TCBES Research Symposium, presentations titled "Maunakea Natural Resource Program" and "The Variability of Taxa, Distribution, and Abundance of Arthropods on Maunakea: Comparing 2 years of data – 2013 & 2014".
- Apr. 5, 2016 Pacific Entomology Conference in Honolulu with poster titled "Arthropod Monitoring on Maunakea: Biodiversity & Threats" and presentation titled "Intra- and inter-annual distribution and density fluctuations of high alpine restricted arthropods on the summit of Maunakea, Hawaii"
- Jan. 9, 2017 Pacific Islands Climate Change Cooperative's multi-year Hawaiian Islands Terrestrial Adaptation Initiative—Hawai'i Vulnerability Assessment & Scenario Planning Workshop: participate to contribute to discussions on high-elevation habitats.



- Feb. 15, 2017 Big Island Weed Management Forum; presentation on the OMKM's Maunakea Invasive Species Management Plan.
- Jun. 20, 2017 American Association for the Advancement of Science (AAAS) Pacific Division meeting in Waimea: OMKM sponsored session on High Altitude Climate Change Trends and Alpine Ecosystem Impacts in Hawai'i
- Jun. 20, 2017 American Association for the Advancement of Science (AAAS) Pacific Division meeting in Waimea: OMKM sponsored session: "Student Science Conference" for middle and High School student science projects. A partnership which also included the Hawaii Science and Technology Museum, AAAS, and Mary Begier Realty.
- Jul. 18, 2017 Hawaii Conservation Conference, presented poster titled "Collaborative and Integrative Management of Invasive and Rare Species on UH Managed Lands of Maunakea".
- Jul. 10, 2018 Hawaii Conservation Conference, presented poster titled "An Assessment of Wēkiu Bug Populations on Cinder Cones of the Maunakea Volcano, Hawai'i Informs Habitat Restoration and Conservation Efforts".
- Nov. 19, 2019 Entomological Society of America; presented: "Describing two diurnal Agrotis species (Lepidoptera: Noctuidae) in the subalpine and alpine regions (3000-4205m) on Hawai'i Island, Hawai'i".

## COMMUNITY VOLUNTEERS MĀLAMA MAUNAKEA (CMP EO-8)

The monthly Mālama Maunakea campaign focuses to protect the fragile resources on the mountain from the gravel road section of the Mauna Kea Access Road from the approximate 9,000' to 12,000' elevation.

The volunteer day begins with project orientation and acclimation to the high elevation. From 10 am until 12 noon volunteers pull fireweed along the Mauna Kea Access Road followed by lunch. Wrap up fireweed pulling and a brief tour of Mauna Kea resources completes this fulfilling day on the mountain.



In 2013, OMKM and volunteers assisted DLNR's Division of Forestry and Wildlife with planting several hundred 'Ahinahina (silversword) in the Mauna Kea Forest Reserve.



### ***Mālama Maunakea Volunteer Weed Pull and Planting Facts***

- Invasive species weed pull Mālama Maunakea campaign began in 2012 in an effort to protect the mountain's native resources and landscape
- Held generally on a Saturday morning
- While volunteers acclimate, they are given a project orientation, before pulling weeds for about two-hours.
- They are given an interpretive walk pointing out native plants and discussion on the native ecosystem
- Weed pull help prepare areas for future native plan restoration projects
- 58 separate weed pull events
- 1,493 community volunteers
- 10,457 volunteer hours
- 2,414 garbage bags of weeds pulled
- Planted than 300 native plants near Halepōhaku
- OMKM is propagating plants for future restoration efforts in the Halepōhaku area

### ***Volunteer Groups***

Volunteer groups who participated in the OMKM's weed pull and planting events:

- Hawaii Island Chamber of Commerce
- Circle K (Kiwanis youth)
- Interact (Rotary Youth)
- Hawaii National Guard Youth Challenge Academy
- Pōhakuloa Training Area staff
- UH Hilo classes and groups
- Observatory staff
- Commercial Tour permittees
- Hawaii Government Employees Association



- University faculty and staff
- school groups (Ke Ana La'ahana, Waiakea High School, Hilo High School, Christian Liberty Academy)
- members of the general community



Year	No. of Projects	No. of Volunteers	Hours	Bags of Weeds
2012	8	114	873	205
2013	8	236	1747	363
2014	9	283	1,945	392
2015	7	228	1,710	442
2016	8	200	1,500	300
2017	6	165	1238	271
2018	8	200	1,080	323
2019*	3	44	308	75
2020**	1	23	58	43

\* Road closed to public access from mid-July to late December due to protest activity

\*\* Only one event held due to the Covid-19 pandemic

## ORIENTATION (CMP EO-2)

Consistent with an orientation plan prepared with input from Kahu Kū Mauna and the Maunakea Management Board, and approved by DLNR, OMKM conducts orientations relating to the cultural and environmental significance to those who work on UH's managed lands including observatory and UH personnel, contractors and vendors, and commercial tour operators. Sessions are usually held in Hilo, with rotating visits by presenters to West Hawai'i tour companies and observatories.

In 2016 OMKM launched an online video version of the orientation as a more efficient means of reaching contractors, vendors, visiting staff, or other interested parties.

Regular feedback is solicited from Kahu Kū Mauna and attendees. A three-year refresher interval requirement has been adopted unless otherwise mandated by permit.

Currently there are approximately 1,500 individuals with a current, valid orientation certificate.

### Orientation Sessions

2012	6 successfully completed orientations Sessions held: 2 November
2013	568 successfully completed orientations Sessions held: 22 April, 6 June, 21 15 July, August, 27 August, 5 September, 10 September, 19 September, 1 October, 9 October, 23 October, 1 November, 5 November, 8 November, 14 November, 18 November, 26 November, 9 December, 13 December, 16 December, 19 December
2014	361 successfully completed orientations Sessions held: 13 March, 21 March, 24 March, 31 March, 14 April, 16 May, 18 June, 11 July, 6 August, 12 August, 14 August, 15 August, 26 August, 4 September, 15 September, 29 September, 27 October, 20 November, 12 December
2015	561 successfully completed orientations Sessions held: 13 January, 9 February, 19 February, 23 February, 2 March, 5 March, 9 March, 16 March, 23 March, 30 March, 13 April, 28 April, 11 May, 26 May, 5 June, 29 June, 14 July, 27 July, 24 August, 2 September, 17 September, 1 October, 14 October, 21 October, 6 November, 10 November, 3 December, 17 December
2016	429 successfully completed orientations Sessions held: 8 January, 25 January, 9 February, 25 February, 8 March, 24 March, 14 April, 26 April, 9 May, 10 May, 12 May, 16 May, 25 May, 9 June, 23 June, 12 July, 27 July, 11 August, 29 August, 7 September, 21 September, 12 October, 14 October, 25 October, 7 November, 29 November, 2 December, 15 December.
2017	528 successfully completed orientations Sessions held: 11 January, 18 January, 8 February, 7 March, 18 March, 24 March, 24 April, 8 May, 17 May, 22 June, 12 July, 22 September, 10 October, 15 November, 11 December
2018	498 successfully completed orientations Sessions held: 16 January, 14 February, 6 March, 12 April, 23 May, 13 June, 2 July, 13 July, 6 August, 10 August, 12 September, 16 October, 29 October, 8 November, 4 December
2019	786 successfully completed orientations Sessions held: 9 January, 13 February, 8 April, 15 May, 15 August, 7 November, 3 December
2020	217 successfully completed orientations as of 31 May 2020 Sessions held: 22 January, 6 February, 19 March, 15 April, 5 May

### Maunakea User Orientation & Assessment

To receive credit for the Maunakea User Orientation with the Office of Maunakea Management (OMKM):

- 1) Watch the video below (or at <https://youtu.be/3dhu2jF6e88>)
- 2) Complete the assessment quiz below, answering all questions. You must correctly answer at least 75% of the questions to receive credit.
- 3) OMKM staff will review your assessment quiz score and either issue a certificate or notify you if the assessment needs to be retaken (in which case we'll email you a new quiz link). Certificates are typically issued within two (2) working days after the assessment is completed.

The Maunakea Comprehensive Management Plan includes a requirement of an orientation for all observatory staff, tour operators, support staff, contractors, vendors, Rangers, etc. prior to working on or in support of activities on UH Managed lands (see page 7-22, Management Action EO-2 for details, [http://www.malamamaunakea.org/uploads/management/plans/CMP\\_2009\\_PDF#page=131](http://www.malamamaunakea.org/uploads/management/plans/CMP_2009_PDF#page=131)). This orientation must be repeated every three (3) years, more frequently if required by a permit, or as directed by the Maunakea Management Board.

To attend an orientation session in person, see the Office of Maunakea Management calendar at: <http://www.malamamaunakea.org/about-us/calendar>

Email [maunakea-orientation@pshawaii.edu](mailto:maunakea-orientation@pshawaii.edu) if you have questions.

\* Required

#### Maunakea User Orientation video





## INFORMATION MATERIALS (CMP EO-3)

OMKM developed and prints brochures and other printed materials for distribution at community and are available for public distribution at the VIS, 'and other public venues, or distributed at public and outreach events

2002 – ongoing Visiting Maunakea Safely and Responsibly brochure.

“What is OMKM” brochure role and responsibility of OMKM and community-based management

2012 OMKM social media presence initiated with a Facebook page.

2013 Maunakea Resource brochure

2015 Social media posts (Instagram, Twitter and Facebook) about resources of Maunakea, issues and relevant science

Line art of Maunakea flora and fauna prepared for use as “coloring” sheet with youth activities.

Temporary tattoos of Maunakea resources prepared for public distribution.

Trading cards of the wēkiu bug, māmane, Palila, 'Ahinahina, and cydia moth prepared.

Life Cycle of a Wēkiu bug! Wheel diagram prepared in partnership with DLNR's Division of Forestry and Wildlife

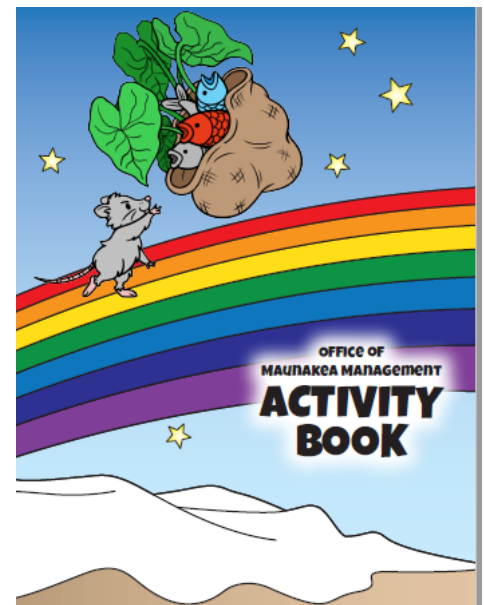
2016 - ongoing. Update of resource brochure containing information about the resources and significance of Maunakea incorporating community and Kahu Kū Mauna input. The revised brochure is entitled “Maunakea Heritage and Natural Resource Guide” and is available both online, in print, and in Japanese courtesy of translation support provided by Subaru Telescope. The back side is also available as a poster.

2016 Maunakea 'Ahinahina (silversword) postcard produced for public distribution

2016 YouTube video: Maunakea 3D perspective flyover animation: <https://youtu.be/6Guol97jftM>

2017-ongoing Youth activity book prepared. Updated and reprinted in 2019.

2019 Book published: The Hawaiian Wēkiu Bug - Laurie Waite Flores. A bilingual non-fiction book written in both English and Hawaiian on the Hawaiian Wēkiu Bug. Illustrations by children of Hawaii



Social media posts begins emphasizing public events and news releases, minimizing “attractive” element that would tend to draw additional visitors to Maunakea

## EDUCATIONAL PROGRAMS (CMP EO-6)

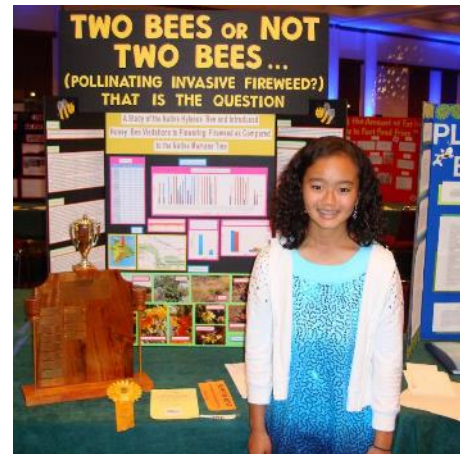
### Science Fair/Project mentoring support

2012-2013 Anne Nakamoto, Waiakea Intermediate School student. Project titled “Two Bees or Not Two Bees... (Pollinating Invasive Fireweed?), That is the Question.”

2013-2014 Anne Nakamoto, Waiakea Intermediate School student. Project titled “Ant Appetites: A study of the Food Preferences of the Recent Invader *Cardiocondyla kagutsuchi* in Hale Pōhaku”.

2014-2015 Israel Stillman, Kamehameha Schools Senior Legacy Project. Halepōhaku area native plant documentation and restoration.

2016-2017 Megan Nakamoto, Waiakea Intermediate School student. Project titled “The Itsy Bitsy Spider—That Lives on Mauna Kea”.



### **Class Project**

- Jan- Jul, 2013 UH Hilo Computer Science class project “Team Poliahu” won the 2013 U.S. Imagine Cup and competed in the worldwide finals in Russia. Dr. Keith Edwards was the class instructor, Dr. Don Thomas and Fritz Klasner provided assistance in developing a project proposal. They initially developed a software app that could track native and invasive plant species using smart phones and GPS functionality.
- Feb. 2013 UH Hilo graduate entomology class visited Halepōhaku to learn about arthropod collecting methods.
- Jun. 2018 Christian Liberty School, 7<sup>th</sup> grade Environmental Science class visited Maunakea and assisted with arthropod collections, learned about analyzing data, presenting results, and Maunakea stewardship.

### **Research**

In order to gain a better understanding and to develop management programs to protect the resources it is necessary to first identify and study the resources. OMKM funded numerous studies utilizing the expertise within the University System. These studies engaged a principal research investigator and graduate students. The following graduate students and internships are or were engaged to research or assisted OMKM with its stewardship responsibilities:

### **PhD Graduates/Candidates**

- Jesse Eiben UH Mānoa; Entomology. 2012. Applied conservation research of the wēkiu bug in Hawai‘i: Life table analysis, population genetics, and phylogenetics create a holistic view of a rare and unique species
- Brad Reil UH Mānoa; Entomology. In Progress. Food web study in the summit ecosystem
- Heather Stever UH Mānoa; Entomology. In Progress. Study of diet and parasite loads in alpine arthropods

### **Master’s Degree Graduates/Candidates**

- Sarah da’Cote UH Mānoa. Meteorology. 2006. Climatological Analysis of Meteorological Observations at the Summit of Mauna Kea.
- Leigh Anne Eaton UH Mānoa. Meteorology. 2011. Modeling the Ecology of the Wēkiu Bug’s Mauna Kea Environment.
- Heather Stever UH Hilo. Tropical Conservation Biology and Environmental Science. 2016. Arthropod Diversity Estimates for Three Native Subalpine Plant Species on the Maunakea Volcano of Hawai‘i Island.  
In 2016 Ms. Stever was awarded first place in the 15-minute graduate student oral competition at the 2016 International Congress of Entomology in Orlando, Florida.
- Nathan Stephenson UH Hilo. Tropical Conservation Biology and Environmental Science. 2016. High Resolution Habitat Suitability Modeling for a Narrow-Range Endemic Alpine Hawaiian Species.
- Marie McKenzie UH Mānoa. Geography. 2016. Regional Temperature Trends in Hawai‘i: A Century of Change, 1916-2015.
- Jessica Kirkpatrick UH Hilo. Tropical Conservation Biology and Environmental Science. 2018. An Assessment of *Nysius wekiuicola* Populations and Thermal Microhabitat Conditions on Cinder Cones of the Maunakea Volcano, Hawai‘i.

Jorden Zarders	UH Hilo. Tropical Conservation Biology and Environmental Science. 2018. Invasive Arthropod Monitoring Assessments of Construction and Facility Activities on Maunakea, Hawai'i.
Bret Mossman	UH Hilo. Tropical Conservation Biology and Environmental Science. In progress. Seabird and bat inventory

### **Interns**

2012	Jessica Kirkpatrick – arthropod monitoring (partnered with Dr.J.Eiben, UH Hilo)
2013:	Kerri Nakatsu – invasive species plan development (partnered with Hawaii Ant Lab)
2013:	Amber Stillman – spatial data support (partnered with Dr.R.Perroy, UH Hilo)
2014:	Darcy Yogi – invasive species plan development (partnered with Hawaii Ant Lab)
2014:	Margaux Mellot – erosion monitoring (partnered with Dr.R.Perroy, UH Hilo)
2015:	Christian Kaponu – Aloha Art Festival (partnered with 'Imiloa)
2015:	Tisha Piilani-Pelanca – monitoring implementation (partnered with HCC Forest Team)
2015:	Sean Kirkpatrick – erosion monitoring (partnered with Dr.R.Perroy, UH Hilo)
2016:	Ku'upua Kiyuna – review of draft administrative rules
2016:	Kialoa Mossman – erosion monitoring (partnered with Dr.R.Perroy, UH Hilo)
2016:	Koa Akima – monitoring implementation (partnered with HCC Forest Team)
2017:	Jake Martin – snowcover and permafrost (partnered with Dr.N.Schorghofer, UH Mānoa)
2017:	Shola Kahiapo – vegetation restoration
2018:	Sebastian Wells – bird, bat, and arthropod monitoring (partnered with Dr.P.Hart, UH Hilo)
2018:	Uli'i Miyajima – permafrost and snow-cover (partnered with Dr.N.Schorghofer, UH Mānoa)
2018:	Timothy Aaron Medina – erosion monitoring at Halepōhaku (partnered with Dr. R.Perroy, UH Hilo)
2019:	Pili Quinories – information sheets of Maunakea plant species
2020:	To Be Determined – Summer 2020 intern for the seabird and bat acoustic data analysis project (partnering with Dr. P.Hart, UH Hilo)



## MAUNAKEA SPEAKER SERIES (CMP EO-3)

OMKM in collaboration with 'Imiloa Astronomy Center and the Department of Physics and Astronomy, University of Hawai'i Hilo. Launched a monthly lecture series giving community members unprecedented access to scholars and their knowledge-based work.

The Maunakea Speakers Series brings scholars to Hilo to present on diverse subjects including culture, fauna, biodiversity, climate change, botany, geophysics and other topics; all components of the immense resource diversity found on Maunakea.

Oct. 24, 2014: K.Yoshikawa, University of Alaska-Fairbanks. Tropical Mountain Permafrost

Nov. 20, 2014: N.Schorghofer, UHM. The History of Snow & Ice on the Summits of Hawai'i

Feb. 9, 2017: R.Fleischer, Smithsonian. Birds of Paradise Lost: Evolution, Extinction and Conservation of Hawai'i's Birds

Mar 23, 2017: JB Friday, UH Mānoa CTAHR. Raising Awareness of Rapid 'Ōhi'a Death

Apr. 20, 2017: H.Stever, UH Hilo TCBES. Arthropod Diversity in the Subalpine Region of Maunakea

May 18, 2017: J.Licata, Rutgers U. A Study of a Tropical Alpine Lake, Past and Present

May 31, 2017: N.Stephenson, UH Hilo TCBES. Using Environmental Data to Model Habitat Suitability on Maunakea

Jun. 15, 2017: M.B.Laycheck & D.Simons, CFHT. Maunakea Scholars Share their Observation Experience

Aug 24, 2017: P.Mills. Tracing the Movement of Ancient Hawaiian Adzes through the Islands

Sept. 26, 2017: S.Businger. Past and Future Climate on Maunakea

Oct. 17, 2017: K.Hon. Growth and Evolution of Maunakea Volcano, A Geologic Story of Sibling Rivalry

Nov. 17, 2017: K.Baybayan. He Lani Ko Luna, A Sky Above, "In losing the sight of land, you discover the stars"

Jan. 11, 2018: Big Island High School Students: insights from Science Fair Projects

Feb. 1, 2018: E.Schmidt. 10 Years of Lunar Eclipse Photometry

Feb. 22, 2018: R.Lyman. Maunakea Weather Center More than Forecasting Passing Showers

Mar.14, 2018: M.Chun.Maunakea – What Makes it the Best Astronomical Site in the World

Apr. 26, 2018: R.Perroy. Mapping Changes at the Maunakea Summit

May 10, 2018: R.Hart. Keeping up with the Coast: Quantifying Shoreline Change on Hawai'i Island

June 21, 2018: D.Thomas. New Insights into the Groundwater Hydrology of Mauna Kea and Hawaii Island

Jul. 19, 2018: M.B. Laychack & D.Simons. Dark Nebula, Dwarf Galaxies from Students who explore them, Honoka'a Maunakea Scholars

**MAUNAKEA SPEAKER SERIES**  
A Monthly Scholar-Focused Presentation  
In Partnership with Office of Maunakea Management,  
'Imiloa Astronomy Center and UH Hilo Dept. of Physics & Astronomy

**HE LANI KO LUNA, A SKY ABOVE**  
"IN LOSING THE SIGHT OF LAND, YOU DISCOVER THE STARS"

Presented by Kalepa Baybayan  
Navigator in Residence, 'Imiloa Astronomy Center of Hawai'i

**Thursday, November 30 • 7pm to 8pm**  
UH Hilo, Wentworth Hall • Room #1

Kalepa Baybayan will share his knowledge of deep-sea voyaging and oceanic wayfinding, the indigenous system of orientation and navigation at sea. His talk will also cover the recently completed Malama Honua Worldwide Voyage and the epic journey of the iconic double-hulled sailing canoe, Hukule'e, which traveled 42,000 nautical miles over 3 years, visiting 150 ports in over 20 countries, while training a new generation of navigators, educators, scientists, and community stewards.

**'IMILOA**  
Astronomy Center of Hawai'i

**UNIVERSITY OF HAWAII**  
HILO

**OMKM**  
Office of Maunakea Knowledge Management

**MAUNAKEA SPEAKER SERIES IS FREE AND OPEN TO THE PUBLIC.**  
On-campus parking is open and available without charge after 4:00pm.

- Sept. 20, 2018: M.Montgomery. Managing Ants on the Big Island: How to keep the Beasts at Bay
- Oct. 18, 2018: S.Cordell. USFS/IPIF/HETF, The Hawaii Experimental Tropical Forest
- Nov. 15, 2018: G.Gerrish. The Plants and Vegetation of Maunakea from Tree-line to Summit
- Dec. 20, 2018: J.Eiben. What's Up on Maunakea? Insect diversity and Ecosystem Monitoring for Conservation and Land Management
- Jan. 10, 2019: Hilo School Students, Sharing Science Fair Projects
- Mar. 21, 2019: J.Juvik. The Only Way is Up? How are Mauna Kea and Mauna Loa Alpine Plants Responding to Rapid Climate Change?
- Apr. 4, 2019: E.Rehm. What's Slowing Forest Restoration at Hakalau Forest National Wildlife Refuge?
- May 30, 2019: H.Stever/J.Eiben. Evolution of an Oddity: An Exploration of the Wēkiu Bug's Isolation and Adaptations on Maunakea
- June 19, 2019: L.Hunter. Tapping into Local Science and Technology Talent—The Akamai Internship Program
- Jul 3, 2019: M.B. Laychak & D.Simons. Hot Stars and Dark Matter from the students of Maunakea Scholars



## OMKM AND ASTRONOMY Enewsletters (CMP EO-3)

### OMKM eNews

In 2012 OMKM began publishing an eNewsletter about OMKM activities. The eNews is distributed to about 3,500 individuals. Our newsletters are reviewed by approximately 32% compared to open industry rate of 12%.

OMKM eNewsletters	Date Sent
OMKM Volunteer Call	July, 2012
OMKM Symposium	Sept, 2012
Hawaii Island Realtors Trade Show	Sept, 2012
Maunakea Safety	Nov, 2012
New MKMB Members (Chun & Springer)	Dec, 2012
OMKM Volunteer Call	Jan, 2013
Invasive Species Mgt Plan in Progress	Jan, 2013
Armandroff Appointed	Feb, 2013
Science Project (Ann Nakamoto)	Mar, 2013
OMKM Cultural Mission	April, 2013
OMKM Community Hero Award	April, 2013
OMKM Volunteer Call	May, 2013
Volunteers Plant Silverswords	May, 2013
Hawaii Island Students Earn National Distinction	June, 2013
Babayan Viewpoint and Kahu Ku Mauna chair	June, 2013
OMKM Volunteer Call	Sept, 2013
Maunakea Wekiu Bug	Oct, 2013
OMKM Volunteer Call	Oct, 2014
Setting the Record Straight	Oct, 2014
Sponsored Talk "History of Snow & Ice	Nov, 2014
Volunteer Hours Spent Recap	Dec, 2014
Alpine Study Released	Dec, 2014
Master Lease EIS Call for Comments	Jan, 2015
Completion of MKISP	March, 2015
Kealakehe School Science Fair	May, 2015
OMKM Rule Making Open House	May & June, 2015
OMKM Volunteer Call	Nov, 2015
OMKM Volunteer Call	Jan, 2016
OMKM Hire (Ruddle)	Feb, 2016
UH OpEd "On Track"	Feb, 2016
OMKM Volunteer Call	April, 2016
OMKM Panaewa Community Outreach	April, 2016
OMKM Kealakehe Elementary School Outreach	May, 2016
OMKM, A Decade Plus of Stewardship	June, 2016
Kirkpatrick Lecture	June, 2016

OMKM eNewsletters	Date Sent
Kona Kohala Chamber of Commerce Pualu Award	June, 2016
OMKM Heritage Guide Brochure	July, 2016
OMKM Volunteer Call	August, 2016
OMKM Volunteer Saturday	August, 2016
Draft rules for Maunakea lands	October 10, 2016
Stever Wins Competiion	October 21, 2016
Advancing the Mission of OMKM: A Look Back	December 20, 2016
West Hawaii today balance article	January 2017
Volunteer Call	March 11, 2017
Announces a Public Comment Period	March 8, 2017
EnVisioning Maunakea's Future	March 17, 2017
Alpine Lake Atop Mauna Kea (WHT article)	March 20, 2017
Astro Bash	March 24, 2017
Kealkehe Science Day	March 30, 2017
OMKM Honored by HHF	April 19, 2017
Fostering Science Discoveries in Young Students	April 24, 2017
Lassner Recognizes OMKM Award	April 27, 2017
Graffiti Damage	May 9, 2017
OMKM Volunteer Summer	June 30, 2017
OMKM Chamber Award	July 3, 2017
OMKM Successful Management	August 28, 2017
Final EA on VIS Improvements	Sept. 6, 2017
OMKM PIPES Yogi	Sept. 27, 2017
Last Permafrost in Hawaii	October 18, 2017
OMKM on LAVA 105 Community Corner	October 24, 2017
OMKM Successful Management (Repeat)	November 9, 2017
OMKM 2017 Weed Pull Review	November 30, 2017
OMKM CSO Decommission	December 4, 2017
Preserving and Protecting Cultural Resources	Jan. 30, 2018
Public Hearing on Proposed Land Use within the Conservation District	Feb 14, 2018
Honolulu Star Advertiser Poll	Feb 23, 2018
ESPIN Maunakea Land Authorization	March 6, 2018
EnVision Maunakea Report Released	April 5, 2018
Rep Nakashima letter of recommendation	April 17, 2018
OMKM PIPES Kiyuna	April 30, 2018
A New Era of Stewardship on Maunakea	May 24, 2018
Volunteer Call	June 15, 2018
Update on University's Administrative Rules Process for Maunakea	August 1, 2018
UH Asking for Public Input on Maunakea Rules for Public and Commercial Activities	August 20, 2018

OMKM eNewsletters	Date Sent
Honolulu Star Advertiser Article	August 31, 2018
Hawaii Business magazine's article on the economic and educational contributions of astronomy to Hawai'i Island	Sept. 17, 2018
UH BOR approved the appointments of six members of the community-based Maunakea Management Board	Sept. 21, 2018
UH Asking for Public Input on Maunakea Rules for Public and Commercial Activities	Sept. 24, 2018
UH BOR approved the appointments of six members of the community-based Maunakea Management Board	Sept. 29, 2018
Help Mālama Maunakea	Oct. 30, 2018
MAUNAKEA: Stewardship of the Mountain Forum	Nov. 1, 2018
Maunakea Visitor Information Station begins improvements; stargazing and operating hours impacted	Nov. 28, 2018
Internal Audit Finds No Irregularities	Dec. 18, 2018
Honolulu Star Advertiser Viewpoint	Dec. 27, 2018
The University of Hawai'i is asking for public comment on the latest draft of the proposed administrative rules for public and commercial	Feb. 13, 2019
Greg Chun In the News	Feb. 25, 2019
Imiloa Turns 13!	Mar. 8, 2019
Maunakea Permafrost	Mar 11, 2019
The University of Hawai'i is asking for public comment on the latest draft of the proposed administrative rules for public and commercial	Mar. 13, 2019
OMKM joins DLNR DOFAW's Nāpu'u Conservation Project Bio-Cultural Blitz at Pu'uwa'awa'a	Mar 25, 2019
Volunteer Call	April 9, 2019
Volunteer Call	April 11, 2019
UH Hilo professor names black hole capturing world's attention	April 11, 2019
UH Hilo requesting second round of public hearings for Maunakea administrative rules	April 17, 2019
The University of Hawai'i invites the public to provide feedback on the latest draft of the proposed administrative rules to govern public and commercial activities on UH -managed lands on Maunakea	April 29, 2019
Board of Regents to consider proposed Maunakea administrative rules at August meeting	July 12, 2019
OMKM Conducting Maunakea Public & Commercial Tour Capacity Study	Aug. 9, 2019
Two Maunakea Observatories Support Services vehicles vandalized	Sept. 12, 2019
Statement on the passing of Barry Taniguchi	Sept. 23, 2019
Regents Consider Rules	Nov. 1, 2019
Maunakea Rules Show Good Faith	Nov. 5, 2019
Regents approve proposed Maunakea administrative rules	Nov. 12, 2019
The University of Hawai'i Board of Regents approved a draft of the administrative rules	Nov. 26, 2019
Gov. Ige Approves Regulations	Jan. 14, 2020

OMKM eNewsletters	Date Sent
Volunteer Call	Jan 30, 2020
A Highlight of Administrative Rules for Public Activities	Feb 3, 2020
Malama Maunakea Mahalo	Feb 14, 2020
Decommissioning of two telescopes on University of Hawai'i-managed lands	Mar 2, 2020
Volunteer Call	Mar 9, 2020
Maunakea visitor center closing temporarily	Mar 16, 2020





OFFICE OF MAUNAKEA MANAGEMENT NEWS

March 2,



UNIVERSITY of HAWAII NEWS

Academic Research People Community Athletics Administrative By Cam

decommissioning of 2 Maunakea telescopes expected to be complete by 20

decommissioning of two scopes on University of Hawai'i-  
aged lands on Maunakea is  
actively scheduled to be  
pleted by 2023. This is  
ording to an update provided by  
iversity to the UH Board of  
ents (BOR) at the board's  
uary 20 meeting  
H West O'ahu. The California  
tute of Technology (Caltech)  
millimeter Observatory and the UH Hilo Hoku Ke'ateaching telescope  
making progress in the extensive decommissioning process, according  
H Executive Director of Maunakea Stewardship Greg Chun, who  
ided the update to the regents.



Decommissioning of 2 Maunakea telescopes  
expected to be complete by 2023

BOR adopted a resolution in November 2019 directing UH leadership  
ngthen its stewardship of Maunakea and report back regularly on the  
press of 11 action items. The first action item in the resolution is the



MAUNAKEA ASTRONOMY NEWS

January 17, 2020



W. M. KECK OBSERVATORY

Astronomers Discover Class Of Strange Objects Near Our  
Galaxy's Enormous Black Hole

Posted January 15, 2020

**Maunakea, Hawaii** - Astronomers from UCLA and W. M. Keck Observatory have discovered four  
more bizarre objects at the center of our galaxy, not far from the supermassive black hole called  
Sagittarius A\*, that are now forming a class of their own.

The study, which is part of UCLA's Galactic Center Orbits Initiative, consists of 13 years of data  
taken from Keck Observatory on Maunakea in Hawaii; the results published online today in the  
journal Nature.

"These objects look like gas but behave like stars," said co-author Andrea Ghez, UCLA's Lauren  
B. Leightman and Arthur E. Levine Professor of Astrophysics and director of the UCLA Galactic  
Center Group.

This new class of objects, called G objects, look compact most of the time and stretch out when  
their orbits bring them closest to the black hole. Their orbits range from about 100 to 1,000 years,  
said lead author Anna Ciurlo, a UCLA postdoctoral researcher.

[Click here to read the full article in Keck Observatory's Visitor's Science Program and](#)



MAUNAKEA ASTRONOMY NEWS

April 12, 2018



W. M. KECK OBSERVATORY

Maunakea, Island of Hawai'i

**Dark Matter is a No Show in  
Ghostly Galaxy**

**Maunakea, Hawaii** -Galaxies and dark matter go hand in hand; you typically don't find  
one without the other. So when researchers uncovered a galaxy, known as NGC1052-  
DF2, that is almost completely devoid of the stuff, they were shocked.

"Finding a galaxy without dark matter is unexpected because this invisible, mysterious  
substance is the most dominant aspect of any galaxy," said lead author Pieter van  
Dokkum of Yale University. "For decades, we thought that galaxies start their lives as  
blobs of dark matter. After that everything else happens: gas falls into the dark matter  
halos, the gas turns into stars, they slowly build up, then you end up with galaxies like  
the Milky Way. NGC1052-DF2 challenges the standard ideas of how we think galaxies  
form."




(Left) The ultra-diffuse galaxy is rich with globular  
clusters, which hold the key to understanding this  
mysterious object's origin and mass. (Right) A  
closer look at one of the globular clusters within the  
galaxy, which are all much brighter than typically  
seen, with the brightest emitting almost as much  
light as the brightest globular cluster within the  
Milky Way. The spectrum, obtained by Keck  
Observatory, shows the calcium absorption lines  
used to determine the velocity of this object. 10  
clusters were observed, providing the information  
needed to determine the mass of the galaxy,  
revealing its lack of dark matter.

CREDIT: W. M. KECK OBSERVATORY/GEMINI  
OBSERVATORY/NSF/AURA/J. MILLER/J. POLLARD



OFFICE OF MAUNAKEA MANAGEMENT NEWS

December 20, 2016

**Advancing the Mission of OMKM: A Look Back**  
by Stephanie Nagata, OMKM Executive Director

As 2016 comes to a close, I thought I would take this time to reflect on how the Office of  
Maunakea Management (OMKM) has advanced its mission since our formation in 2000.  
The priority at OMKM has, and continues to be the protection of Maunakea's unique  
cultural, natural and scientific resources for generations to come. The successful  
management of the large, diverse and remote acreage on Maunakea under OMKM's care is  
the result of a deliberate process involving the Hawaii Island community.




At the time of our formation in 2000, one of OMKM's first priorities was to identify the  
resources and establish baseline data to be used to assess the status of the resources over  
time. Surveys, each involving multiple years of field work, were put into action. We now  
have baseline data for archaeological sites, wēkiu bug, other native arthropods, botanical  
resources, climate, and weathering/erosion processes.

BLNR 2020 Annual Report: Appendix C

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July 2020

### **Astronomy eNews**

The Astronomy e-news focuses on discoveries and scientific advances made by observatories on Maunakea. The newsletter is distributed to approximately 2,500 individuals with an open rate of 27% compared to the 12% open rate industry average.

Astronomy eNewsletters	Publication Date
50 Years of Astronomy	February 25, 2015
Journey Through the Universe Celebrating Exploration and The Joys of Science and Astronomy	February 26, 2015
Mauna Kea Telescopes: The Business of Astronomy Is Not an Easy One	May 5, 2015
Statewide Economic Impact of Astronomy Tops \$168 Million	March 23, 2015
Students Seek Maunakea Observatories' Internships and Job Opportunities At UH Hilo Career Expo	October 15, 2015
W. M. Keck Observatory Celebrates 25 Years Since First Light	Nov. 24, 2015
Island Voices: UH engaged in positive stewardship of Mauna Kea for generations to come	December 9, 2015
NASA Honors Keck Observatory for Opening its Archive to the Public	December 14, 2015
2016 Akamai Summer Internship Program	Feb 5 2016
Stargazing at Imiloa Astronomy Center	February 24, 2016
Maunakea Scholars, a new programs being launched	March 4, 2016
Kapolei Students chosen for telescope time	March 7, 2016
Governor Ige proclaims "Journey through the Universe Week" in support of Maunakea Observatories	March 9, 2016
Waiakea High Students Win Opportunity to Use Mauna Kea Telescope	March 17, 2016
HI STAR Astronomy Camp Celebrates 10 Years of Success Weeklong Residential Camp Mentors High School Students	March 18, 2016
Camp 'IMI-Possible: Mapping the Night Time Sky with Keiki Explorers	March 28, 2016
UH Hilo undergraduate Jasmin Silva conducting astronomy research on structure of galaxies	April 28, 2016
UH Hilo undergraduate Derek Hand Conducting Astronomy Research on Merging Galaxies	May 4, 2016
AstroDay	May 10, 2016
Akamai Workforce Initiative Announces 2016 Summer Interns	May 25, 2016
Maunakea Scholars Program Wraps Up Its First Year	June 1, 2016
Pioneering Education Through Innovative Partnerships	June 18, 2016
Earth-like planets among 100+ identified by UH, astronomers and NASA	July 18, 2016
Working Together, Mauna Kea Observatories Help Discover More Than 100 New Planets	July 28, 2016
More students to view the stars; UH-Hilo undergrads allotted telescope time	August 2, 2016
Astronomy Benefits Hawaii	September 9, 2016
Imiloa Presents Dr. Richard Green, Director of UKIRT Observatory	September 16, 2016
Daniel K. Inouye Solar Telescope on track to be operational in 2019	October 10, 2016
Solar System Walk Canada-France-Hawai'i Telescope and W.M. Keck Observatory host beloved annual event	November 2, 2016
Maunakea Scholars To Provide More Hawai'i Students With World-Class Telescope Time	November 9, 2016
CFHT Producing Great Science Since 1979	December 2, 2016
Summer 2017 Akamai Internship Program Application Process Opens	December 19, 2016
Three Kalani High School students were awarded time; Mauna Kea Scholars program	December 28, 2016



Astronomy eNewsletters	Publication Date
Maunakea Observatories Award Nanakuli and Kapolei High School Students With Research Time	February 8, 2017
The arrival of SCEXAO at Subaru	February 17, 2017
Some of the most amazing discoveries are being made from the telescopes on Maunakea.	March 8, 2017
Aunty Mimi's Astro Bash	March 17, 2017
Free stargazing program at the Maunakea Visitor Information Station (VIS)	April 5, 2017
Dr. Brittany Kamai Presents "Catching Waves from Black Holes" Tonight at UH Hilo Science and Technology!	April 17, 2017
W. M. Keck Observatory Achieves First Light with New Instrument	April 21, 2017
Celebrate Hawai'i Astronomy at AstroDay	April 26, 2017
W. M. Keck Observatory Hosts Quadruple Whammy	May 11, 2017
UH Institute for Astronomy Open House Highlights	May 8, 2017
Student at Kea'au High School Wins 2017 Maunakea Coin Contest!	May 26, 2017
Astronomy Shines at 16th Annual Hilo AstroDay	June 1, 2017
UH News	June 2, 2017
W. M. Keck Observatory data leads to first of its kind test of Einstein's theory of General Relativity	June 16, 2017
Maunakea Skies	July 18, 2017
Research Team Using Data from James Clerk Maxwell Telescope Makes Discoveries	July 28, 2017
Could they be a future target for interstellar colonization?	August 10, 2017
Akamai Internships Produce Successful Astronomy Projects	August 29, 2017
Hawaii Students Participate in Summer HI STAR Program	August 30, 2017
Canada France Hawaii Telescope to Host Manufacturer Open House Oct. 6 Call to Big Island Manufacturing Network!	September 26, 2017
Astronomy to be Featured at Hawaii Innovation Initiative Forum in Honolulu	October 2, 2017
Maunakea Scholars	October 26, 2017
AstroDay is Coming to Kona	October 23, 2017
UH News	October 30, 2017
First AstroDay in West Hawaii a Success!	November 7, 2017
Celebration of Fifty Years of Astronomy on Maunakea	November 13, 2017
Akamai	November 29, 2017
Astronomy Student Stars Kick Off Maunakea Scholars Awards Season	December 1, 2017
Unexpected Discovery	December 28, 2017
W. M. Keck Observatory Awarded NSF Grant	January 5, 2018
Presentation by Dr. Kip Thorne, Nobel Prize Winner and World-Renowned Astrophysicist	January 2, 2018
A discovery made by a Hilo High School alumnus	March 8, 2018
Applications are now being accepted for the 2018 Women's STARS (STEM Aerospace Research Scholars) Program,	March 30, 2018
Dark Matter is a No Show in Ghostly Galaxy	April 12, 2018
Celebrate Science at AstroDay!	April 25, 2018
Andrea Ghez, Director of the UCLA Galactic Center Group Presents "The Monster at the Heart of our Galaxy	July 24, 2018
UH Asking for Public Input on Maunakea Rules for Public and Commercial Activities	August 21, 2018
AstroDay Returns to Kona	September 21, 2018
Hawaii High School Student scores highly coveted telescope time to study 'Tatooine' at Keck Observatory	November 30, 2018
Selection of Hawaiian names for two major astronomical discoveries.	January 29, 2019
UH News: Manoa Academy teams up with Maunakea scholars	January 11, 2019
Submillimeter Array (SMA) Call for Standard Proposals	February 12, 2019

Astronomy eNewsletters	Publication Date
Unusual Galaxies Defy Dark Matter Theory	March 28, 2019
Astronomers this morning are set to unveil the first image of a black hole using the combined power of a global network of telescopes,	April 10, 2019
Was Einstein Right? Hawaii and the Event Horizon Telescope	April 12, 2019
The 18th Annual AstroDay Comes to Hilo Saturday, May 4!	April 17, 2019
Pōwehi Day Proclamation	April 19, 2019
Mt. View Elementary School Visits Institute for Astronomy Hilo	April 23, 2019
Keck Observatory Welcome Riley Atkinson	June 18, 2019
Remembering the Father of Keck Observatory	June 21, 2019
UH News UH team successfully locates incoming asteroid	June 26, 2019
Two UH astronomers part of international team that agrees on a natural origin for 'Oumuamua	July 8, 2019
Hawai'i Astronomer Wins Canadian Award	July 15, 2019
W.M. Keck Observatory presents A Primitive Planetesimal In The Kuiper Belt Explored By New Horizons	July 18, 2019
Astronomers to deploy breakthrough technology at UH telescope	August 15, 2019
Critical observation made on Maunakea during first night of return to operations	August 20, 2019
Two Maunakea telescopes were part of an international collaboration that won the \$3 million 2020 Breakthrough Prize in Fundamental Physics award	September 6, 2019
UCLA astronomers notice brightest light in 24 years of observations	September 13, 2019
AstroDay West Hawaii	October 22, 2109
NASA Scientists Confirm Water Vapor on Europa	November 19, 2019
W.M. Keck Observatory Astronomy Talk	January 3, 2020
Astronomers from UCLA and W. M. Keck Observatory have discovered four more bizarre objects at the center of our galaxy	January 17, 2020
W.M. Keck Observatory Astronomy Talk	February 26, 2020
Maunakea Observatories launch virtual outreach program during suspension of telescope operations	March 26, 2020
Astronomy Rebuilt Hawai'i Island's Economy After 1960 Tsunami	April 6, 2020
Hawaii Astronomer Discovers Massive Extrasolar Planet with Maunakea Telescope	April 29, 2020
Maunakea Observatories Reopen	May 15, 2020
New Direct Images Captured with W. M. Keck Observatory's Upgraded Adaptive Optics System Lead to First Independent Confirmation of PDS 70 Protoplanets	May 19, 2020
Astronomers See Cosmic Ring of Fire	May 28, 2020

## STEWARDSHIP RECOGNITION

Mar. 6, 2013 Mary Begier awarded the *Community Hero Award* by the Hawaii Invasive Species Council as a shining example of dedication to prevent invasive species. Ms. Begier assisted OMKM in developing and implementing the volunteer weed pull program



Jun. 24, 2016 Kona Kohala Chamber of Commerce. OMKM awarded Pualu Award for Environmental Awareness



May 19, 2017 Historic Hawaii Foundation; OMKM recognized with Preservation Commendation Award for its Long-term Historic Property Monitoring Plan for UH Managed Lands on Maunakea



Jun. 30, 2017 Kona Kohala Chamber of Commerce; OMKM awarded the Pualu Award for Culture and Heritage.



## **Appendix D: Visitor Management (HAR 20-26)**

Hawai'i Administrative Rules, Chapter 20-26

Approved rules are available online at <https://www.hawaii.edu/offices/bor/adminrules/chapter26.pdf>.

## **ADMINISTRATIVE RULES (HAR 20-26)– (CMP P-3)**

In the 1998 audit report on the management of Maunakea, the State Auditor recommended that the University develop administrative rules to address public activities including access to protect the resources. Development of rules was one of the first matters addressed by OMKM during the month the MKMB was established in October 2000. In early 2001 OMKM began drafting rules, but later discovered UH did not have legal authority to promulgate rules. It took several years, until 2009 when the Legislature granted UH rule making authority. The 2010 BLNR approved CMP supplemental Public Access Plan provided principals and policies for the development of the rules. In January 2020, Governor Ige approved the rules.

Administrative rules “provide for the proper use, management, and protection of cultural, natural, and scientific resources of the UH management areas; to promote public safety and welfare by regulating public and commercial activity within the UH management areas; to ensure safe and appropriate access to the UH management areas for the public; and to foster co-management with the Department of Land and Natural Resources in UH management areas.”

## **COMMUNITY ENGAGEMENT AND OUTREACH**

Oct. 10, 2000    Maunakea Management Board (MKMB) begin drafting rules

Mar. 13, 2001    MKMB update: OMKM drafting rules

Mar. 29, 2001    Kahu Kū Mauna update: OMKM drafting rules

July 22, 2003    MKMB update: OMKM requests review whether UH has statutory authority to promulgate administrative rule making

Oct. 28, 2003    MKMB update: OMKM and UH System discuss UH’s process for rule making

Aug. 31, 2005    MKMB update: UH was unsuccessful in obtaining legislative authority to promulgate rules

Nov. 15 2005    Kahu Kū Mauna update: UH was unsuccessful in obtaining legislative authority to promulgate rules; will go back to the legislature seeking statutory authority

Jan. 21. 2007    Kahu Kū Mauna update: suggested rules of conduct for visitors and rangers

Sept. 11, 2007    MKMB update: UH to review making rule making as part of the Comprehensive Management Plan development process

Sept. 25, 2007    Kahu Kū Mauna update: reported that DLNR believed UH had authority to develop rules but that authority was unclear

Feb. 5, 2009    MKMB update: Again seeks legislative authority to promulgate rules

June 25, 2009    Kahu Kū Mauna update: Governor Lingle approved Act 132 granting UH authority to promulgate rules

May 19, 2010    MKMB update: UH legal counsel to assist OMKM with the development of rules and establish procedures for handling fines

Feb. 9, 2011    Kahu Kū Mauna update: consultant Jeff Melrose provided a summary of the draft rules

Mar. 22, 2011    Consultation with OHA

Mar. 2011    Note: rule making put on hold due to concerns of ex parte communication between UH and DLNR while UH was involved in a contested case proceeding

Apr. 13, 2011    Kahu Kū Mauna update: Council members raised concerns, including ensuring commercial tour providing passengers with correct information

May 19, 2011    Consultation with OHA

June 6, 2013:    Big Island Legislative Briefing; OMKM briefing on rule making

June 17, 2013: Big Island Legislative Briefing; Representatives Mark Nakashima, Richard Onishi, and Clift Tsuji; OMKM briefing on rule making

June 19, 2013: Big Island Legislative Briefing; Senator Malama Solomon and Representative Cindy Evans; Discussion Topic: OMKM briefing on rule making

July 29, 2013: Big Island Legislative Briefing; Senator Russell Ruderman and Representative Faye Hanohano; OMKM briefing on rule making

Aug. 1, 2013 Ross Birch, Executive Director Big Island Visitors Bureau; OMKM briefing, rule making

Aug. 14, 2013 MKMB update: Rule making will resume following issuance of permit to the TMT.

Oct. 4, 2013: Keawe Vredenburg; OMKM briefing on rule making

Oct. 16, 2013: David Tarnas OMKM briefing on rule making

Nov 13, 2013: Rotary Club of North Hawaii; OMKM briefing on rule making

Mar. 12, 2014 Kahu Kū Mauna update: provided an overview of commercial tour permits and they addressed in the administrative rules

May 12, 2014 Kahu Kū Mauna update: reviewed a draft of the rules

June 19, 2014 OMKM rule making community outreach: Mike Kaleikini, Hawaii Island Chamber of Commerce; Jon Miyata, Hawaii Island Chamber of Commerce and Ivan Nakano, Japanese Chamber of Commerce & Industry of Hawaii

June 24, 2014 OMKM rule making community outreach; Mary Begier, Hawaii Island Realtors & Hawaii Island Chamber of Commerce; Bill Brown, Panaewa Hawaiian Homes Community Assoc.; Chuck Erskine, Hawaii Island Chamber of Commerce; David Honma, Japanese Chamber of Commerce & Industry of Hawaii; Lillian Kaeha, Panaewa Community Alliance; Ka'iu Kimura, 'Imiloa & Hawaii Island Chamber of Commerce; Susan Lee Loy, Hawaii Island Realtors; Toby Taniguchi, KTA Super Stores; Nico Verissimo, UH Foundation

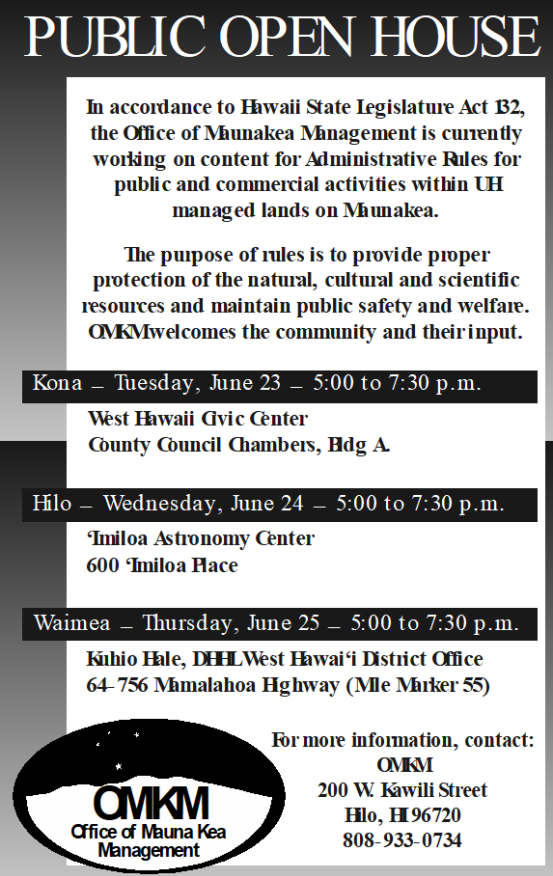

July 9, 2014 OMKM rule making community outreach; Bill Brown, Panaewa Hawaiian Homes Community Association, Roberta Chu, Hawaii Island Economic Development Board; Louis Hao, Dept. of Hawaiian Home Lands; Nani Kaeha, Panaewa Community Alliance; John McBride, Hawaiian Village Tours; Judi Meyers, ILWU & Hilo Pensioners' Club; Alike Toledo, Miles Yoshioka, Hawaii Island Chamber of Commerce

July 17, 2014 OMKM rule making community outreach; Thomas Anthony, Hui Pu Laka Hawaiian Civic Club; Dean Au, Carpenter's Union; Jo-Anna Herkes, SSFM International; Harvey Keliikoa, Hui Lu Laka; Kimo Lee, Kimo; Hawaii Island Chamber of Commerce; Mike Miyahira, Japanese Chamber of Commerce & Industry of Hawaii; Craig Shiroma, Japanese Chamber of Commerce & Industry of Hawaii; Barry Taniguchi, KTA Super Stores; Jere Usui, Japanese Chamber of Commerce & Industry of Hawaii

Aug. 1, 2014 OMKM rule making community outreach; Tracey Fosso, Kona-Kohala Chamber of Commerce; Vivian Landrum, Kona-Kohala Chamber of Commerce; Dale Suezaki, Kona-Kohala Chamber of Commerce

Aug. 13, 2014 OMKM rule making community outreach; Patrick Kahawaiola'a, Keaukaha Community Association; Laua'e Kekahua, Maku'u Farmers Assn.; Kekoa, Jeffrey, Ka'u Hawaiian Homelands Association ; Bea Iwalani Masoe, Panaewa Hawaiian Homelands Community Association; Howard Pe'a, Keaukaha-Panaewa Farmers Association; Shirley Pedro, Maku'u Farmers Assn.; Skylark Rossetti, Kaumana Hawaiian Homestead Association; Duncan Seto, Kaumana Hawaiian Homelands Association

- Aug. 20, 2014: OMKM rule making community outreach; Keaukaha Community Association: Alberta Andaya, Herks Freitas, Leife Hao, Louis Hao, Mike John, E Raynette Kahawaiola'a, Herring Kalua, John Kanui, Lillian Keliipio, Darren Lee, Darren, John McBride, Lorraine Medeiros, Lorena Nelson, Raynette Shibata, Herbert Suganuma, Nathan Suganuma. Panaewa Hawaiian Homes Community Association: Milton Kalai, Ronald Kodani, Elizabeth-Ann Kaeha, Nani Kaeha, Camille Mehau, Terri Napeahi, Marissa Harman, Kamehameha Schools; Aoloa Santos, Department of Hawaiian Homelands. Alikea Toledo
- Aug. 25, 2014 OMKM rule making community outreach; Krista Anderson, North Hawaii Community Hospital; Jim Du Pont, Department of Hawaiian Homelands, West Hawaii District; Jacqui Hoover, Hawaii Island Economic Development Board; Pete Lindsey, Retired Laborers' International Union, Local 368; Nancy Carr Smith, Waimea Community Association; Keawe Vredenburg, Hawaiian Historian.
- Aug. 28, 2014 OMKM rule making community outreach with UH permitted commercial tours: Doug Arnott, Arnott's Lodging & Hiking Adventures; Glory Guerpo, Arnott's Lodging & Hiking Adventures; Eldon Lindsey, Robert's Hawaii Tours; Aki Miyatani, Hawaiian Haoles dba Hawaiian Eyes; Kenji Mizoguchi, Meridian H.R.T.; Hiroko Monson, Robert's Hawaii Tours; Emmy Ogawa, Taikobo; Rob Pacheco, Hawaii Forest & Trail; Kasi Sagawa, Jack's Tours; Mike Sessions, Mauna Kea Summit Adventures; Sunny Takeishi, Taikobo; Pat Wright, Mauna Kea Summit Adventures
- Sept. 2, 2014 OMKM rule making community outreach; Tommy Hickcox, Ahuena Heiau Inc.; Shane Nelsen, Kuakini Hawaiian Civic Club, OHA & Kahu Ku Mauna; Chris Ramos, Kuakini Hawaiian Civic Club; Alana Yamamoto, Kuakini Hawaiian Civic Club
- Sept. 3, 2014 OMKM rule making community outreach; Maile David, Deputy County Clerk & Councilperson-Elect; Karen Eoff, HI County Council Dist. 8; David Kaapu, Kona Attorney/Commissioner Department of Hawaiian Homelands; Maurice Kahawaii, Kona Hawaiian Civic Club and Royal Order of Kamehameha; Dru Kanuha, HI County Council Dist. 7 – Kona; Nicole Lui, Cultural Consultant for La'aloa Ext.; Byron Moku, Hokuli'a Cultural Resources Management; Cindi Punihaole, The Kohala Center; James Resor, Pacific Media Group (KAPA); Sharon Sakai, Kohanaiki Marketing Director
- Sept. 9, 2014 Kahu Kū Mauna update: Council suggested restricting access to manage for safety and to have more on managing visitors
- Sept. 11, 2014 OMKM rule making community outreach; Colin Aspin, UH 2.2 Telescope; Lars Bergnut, NASA Infrared Telescope; Rob Christensen, Smithsonian Submillimeter Array; Diego Correa, Gemini Telescope; Sandra Dawson, Thirty-Meter Telescope; Richard Green, University of Arizona; Bill Hancock, Very Long Baseline Array; Kevin Ho, Canada-France-Hawaii Telescope; Stewart Hunter, Mauna Kea Observatories Support Services; Chris Laude, Chris, Joint Astronomy Center; Rich Matsuda, W.M. Keck Observatory; Joe McDonough, Visitor Information Station; Ralph Toyofuku, Subaru Telescope
- Sept. 16, 2014 MKMB update: OMKM conducts community engagement on rules; next step is to hold open houses
- Oct. 14, 2014 Kahu Kū Mauna update: draft rules update
- Nov. 18, 2014 Kahu Kū Mauna update: draft rules update

May 6, 2015	Kahu Kū Mauna update: timeline on rules development	 <p><b>PUBLIC OPEN HOUSE</b></p> <p>In accordance to Hawaii State Legislature Act B2, the Office of Maunakea Management is currently working on content for Administrative Rules for public and commercial activities within UH managed lands on Maunakea.</p> <p>The purpose of rules is to provide proper protection of the natural, cultural and scientific resources and maintain public safety and welfare. OMKM welcomes the community and their input.</p> <p><b>Kona – Tuesday, June 23 – 5:00 to 7:30 p.m.</b> West Hawaii Civic Center County Council Chambers, Bldg A</p> <p><b>Hilo – Wednesday, June 24 – 5:00 to 7:30 p.m.</b> Imiloa Astronomy Center 600 Imiloa Place</p> <p><b>Waimea – Thursday, June 25 – 5:00 to 7:30 p.m.</b> Kuhio Hale, DHHL West Hawai'i District Office 64-756 Mamalahoa Highway (Mile Marker 55)</p> <p>For more information, contact: <b>OMKM</b> 200 W. Kawili Street Hilo, HI 96720 808-933-0734</p> 
June 23, 2015	UH Administrative Rules Public Open House Kona; West Hawaii Civic Center; 35 signed in.	
June 24, 2015	UH Administrative Rules Public Open House, Hilo; Imiloa Astronomy Center in Hilo; 74 signed in	
June 25, 2015	UH Administrative Rules Public Open House; Waimea; Kuhio Hale; 28 signed in	
Jul. 16, 2015	Consultation with OHA	
Aug. 25, 2015	MKMB update: Report on open houses, including mini surveys taken by attendees	
Oct. 16, 2015	Kahu Kū Mauna update: reported OMKM consulting with OHA	
June. 2, 2016	Kahu Kū Mauna update: expressed concern on about enforceability	
June 22, 2016	MKMB update: Legal review of draft of rules completed	
Sept. 8, 2016	Kahu Kū Mauna update: update rules development	
Oct. 4, 2016	MKMB reviewed and approved draft of administrative rules and recommended that the BOR request the Governor to authorize holding public hearings	
Feb. 4, 2017	MKMB update: reported that the Governor requested the University not submit rules to him; he was working on a multi-stakeholder framework and he expressed working together on the rules that would help support the new framework	
Nov. 28, 2017	MKMB update: No word from the Governor on the rules. MKMB approved a motion seeking legal opinion on what authority OMKM has in the absence of rules	
Feb. 16, 2018	Consultation with OHA	
Jan 8, 2018	Consultation with OHA; President Lassner and J. Doane	
Jan. 30, 2018	MKMB update: Rules are going through another review by legal counsel	
Apr 13, 2018	Consultation with OHA	
May 22, 2018	MKMB update: Governor gives UH the go-ahead to proceed with rule making	
June 7, 2018	BOR approves request seeking Governor's approval to hold public hearings on draft rules	
July 23, 2018	Governor approves UH's request to hold public hearings	
Aug. 20, 2018	Consultation with OHA	
Aug. 28, 2018	Consultation with UH Permitted commercial tour operators	
Sept. 24, 25,	UH proposed administrative rules (Chapter 20-26, HAR) Public Hearings – Oahu:	



26 & 28, 2018 Cancer Center; Hawaii Island – Imiloa, Waikoloa Elementary and Middle School; and Maui – Maui College

Oct. 9, 2018 Kahu Kū Mauna update: Council reviews rules

Feb. 6, 2019 Community consultation on UH Administrative Rules

Feb. 8, 2019 Community consultation on UH Administrative Rules

Feb. 12, 2019 Kahu Kū Mauna update: summary of public hearings

Feb. 26, 2019 Consultation with staff of Kona Kohala Chamber of Commerce

Feb. 26, 2019 Consultation with staff of Island of Hawaii Visitors Bureau

Feb. 27, 2019 Consultation with Waimea Community Association

Mar. 3, 2019 Consultation with UH Manoa faculty

Mar. 4, 2019 Consultation with OHA

Mar. 27, 2019 Kahu Kū Mauna update: progress on development of rules

Apr. 2, 2019 MKMB update: Reviewed rule making development starting with the 1998 audit of the management of Maunakea; summarized the content of the current draft of the rules;

Apr. 4, 2019 Consultation with OHA

June 7, 2018 BOR approves request seeking Governor's approval to hold public hearings on draft rules

July 23, 2018 Governor approves UH's request to hold public hearings

Sept. 24, 25, 26 & 28, 2018 UH proposed administrative rules (Chapter 20-26, HAR) Public Hearings – Oahu: Cancer Center; Hawaii Island – Imiloa, Waikoloa Elementary and Middle School; and Maui – Maui College.

Oct. 18, 2018 BOR instructs administration to draft revisions to the rules and return with revisions for review

Feb.-Mar. 2019 Community consultation on rules are held; revisions are made based on testimony received in Sept. 2018 hearings and 2019 community consultation

Apr. 18, 2019 BOR approves request to hold a second round of public hearings

June 3, 4, 5, 7, 2019 UH proposed administrative rules (Chapter 20-26, HAR) Public Hearings – Oahu: Manoa Elementary & School; Hawaii Island – Waiakea Elementary School and Waikoloa Elementary and Middle School; and Maui – Pomaikai Elementary School

Aug. 13, 2019 MKMB update: reported changes were made to the rules based public comments during the September 2018 public hearings leading to a second round of public hearings

Sept. 17, 2019 Kahu Kū Mauna update: Suggested clarifying language for the rules; Council to draft statement supporting enforcement of rules

Sept. 27, 2019 MKMB update: reported minor clarifying changes are being made including those requested by Kahu Kū Mauna

Nov. 6, 2019 BOR approves to adopt rules, with deletion of section 20-26-62, HAR.

Jan. 13, 2020 Governor Ige approved rules. Rules became effective on January 23, 2020.

## **Appendix E: Permitting, Enforcement, and Facility Oversight**

Community project review and compliance

## **COMMUNITY PROJECT REVIEW (CMP OI-1 and IM-1)**

The foundation of the 2000 Maunakea Science Reserve Master Plan is community-based management of the University's managed lands on Maunakea. The Master Plan called for the establishment of the MKMB and Kahu Kū Mauna, two advisory boards comprised of volunteers from the Hawai'i Island community. Proposed projects are reviewed first by OMKM for compliance with the DLNR Conservation District Rules, and since 2009, the CMP. OMKM submits and reviews the projects with Kahu Kū Mauna whose views and suggestions are included in OMKM's report to the MKMB. The MKMB reviews projects in meetings that are publicly noticed according to Sunshine requirements, and approves, or in the case of major projects, makes recommendations to the University.

CMP OI-1 calls for maintaining "OMKM, MKMB and Kahu Kū Mauna in current roles, with OMKM providing local management of the UH Management Areas". In their capacity as advisory boards to the University, they review projects proposed projects. CMP IM-1, Operations, Monitoring and Maintenance Plan includes an annual reporting requirement by all observatories and Maunakea Observatory Support Services describing projects each facility anticipates will occur over the next 5-years.. Kahu Kū Mauna reviews the outlook plans and if they rate the project as having minimal impact or routine they do not need to review the project when it is submitted to OMKM. Those classified as "In Depth Consultation" require review by Kahu Kū Mauna. MKMB reviews all projects regardless of classification.

Since 2000, OMKM, Kahu Kū Mauna and MKMB have reviewed over 300 projects.

## **CDUP PERMIT INSPECTIONS (P-1 and P-7)**

The CMP calls for compliance with all applicable regulations, and permit conditions related to activities in the UH managed areas. These include compliance with the DLNR's permits. Since 2006, OMKM has been conducting biannual inspections of all facilities for compliance with DLNR's permits. If a facility is out of compliance it is required to take remedial action.

## **Appendix F: Implementation Status**

Implementation Status of Maunakea CMP Management Actions.

MKMB = Maunakea Management Board; MKSS = Maunakea Observatories Support Services; OMKM = Office of Maunakea Management; VIS = Visitor Information Station

COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES			
		Implementation Status	Comments
NATIVE HAWAIIAN CULTURAL RESOURCES			
Management			
CR-1	Kahu Kū Mauna shall work with families with lineal and historical connections to Maunakea, cultural practitioners, and other Native Hawaiian groups, including the Maunakea Management Board's Hawaiian Culture Committee, toward the development of appropriate procedures and protocols regarding cultural issues.	Ongoing	<p>Identification of lineal and historical connections was part of the development and State Historic Preservation division approval (2014) of the Burial Treatment Plan (see CR-13). Solicitations were made through announcements in the daily newspapers and the OHA newsletter.</p> <p>There were no responses to the solicitations but OMKM continues to seek out individuals as part of its interaction and relationship building with the community.</p> <p>Fall 2013 the Hawaii Island Burial Council officially recognized several individuals as cultural descendants of Ka'ohē Ahupua'a.</p> <p>OMKM places ads over a period of several months in <i>Hawaii Tribune Herald</i>, <i>West Hawaii Today</i>, <i>Honolulu Star Advertiser</i> and OHA's <i>Ka Wai Ola</i> inviting community to participate in talk story sessions. Kahu Kū Mauna. May 21, 2016, Kahu Kū Mauna hosts a talk story session on matters related to CMP management actions, representatives from DLNR DHHL OHA and members of the Native Hawaiian community attended.</p>
CR-2	Support application for designation of the summit region of Mauna Kea as a Traditional Cultural Property, per the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq. in consultation with the larger community.	Ongoing	An application for the designation of the summit region of Maunakea as a Traditional Cultural Property has not yet been prepared for filing by State Historic Preservation Division with the appropriate Federal agency.
CR-3	Conduct educational efforts to generate public awareness about the importance of preserving the cultural landscape.	Ongoing	<p>Rangers through their interactions with the visiting public help to educate and raise awareness about Mauna Kea.</p> <p>An informational brochure on cultural and natural resources was developed in 2014, revised in 2016, with periodic updates since then.</p> <p>OMKM sends out eNewsletters informing the public about OMKM and its activities.</p> <p>Resource orientation of those who work on the mountain including observatory personnel, VIS and MKSS staff, rangers, commercial tour operators and staff, and construction workers commenced in 2013. An online orientation is also available. A brief public / visitor orientation is complete and provided for scheduled group visits.</p>

**COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES**

		<b>Implementation Status</b>	<b>Comments</b>
<b>Cultural Practices</b>			
CR-4	Establish a process for ongoing collection of information on traditional, contemporary, and customary cultural practices.	Ongoing	Archival and oral history (Mauna Kea-Ka Piko Kaulana o Ka 'Āina); Cultural Resources Management Plan; various cultural analyses completed as part of Chapter 343 mandates; Maunakea topics included by related agencies such as USGS subject matter reviews; and other studies.
CR-5	Develop and adopt guidelines for the culturally appropriate placement and removal of offerings.	Completed	<p>In 2016, Kahu Kū Mauna reviewed and approved the wording of draft policy guidelines. Approval by MKMB occurred in early 2018 after additional consultation by Kahu Kū Mauna.</p> <p>Administrative rules for UH's managed lands, effective beginning January 2020, incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.</p> <p>Note: CR-5 overlaps with CR-7 (constructing new Hawaiian cultural features) being that offerings are usually associated with the construction of new features.</p>
CR-6	Develop and adopt guidelines for the visitation and use of ancient shrines.	Completed	In 2016 Kahu Kū Mauna drafted and the MKMB approved the policy. Administrative rules for UH's managed lands, effective beginning January 2020, incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
CR-7	Kahu Kū Mauna shall take the lead in determining the appropriateness of constructing new Hawaiian cultural features.	Completed	<p>In 2012, Kahu Kū Mauna reviewed a draft of a process. In 2016 Kahu Kū Mauna re-evaluated the policy and held a consultation session that included OHA. Approval by MKMB occurred in early 2018 after additional consultation by Kahu Kū Mauna.</p> <p>It is noted that the proposed policy acknowledges there are existing statutes and other agency rules governing this type of activity.</p>
CR-8	Develop and adopt a management policy for the UH Mgt. Areas on the scattering of cremated human remains.	Completed	<p>In 2012 Kahu Kū Mauna developed and approved a draft policy. In 2016 Kahu Kū Mauna re-evaluated the policy and held a consultation session that included OHA. Approval by MKMB occurred in early 2018 after additional consultation by Kahu Kū Mauna.</p> <p>Administrative rules for UH's managed lands, effective beginning January 2020, incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.</p>
CR-9	A management policy for the culturally appropriateness of building ahu or "stacking of rocks" will need to be developed by Kahu Kū Mauna who may consider similar policies adopted by Hawai'i Volcanoes National Park.	Completed	<p>In 2012 Kahu Kū Mauna approved a draft policy. In 2016 Kahu Kū Mauna re-evaluated the policy and held a consultation session that included OHA. Approval by MKMB occurred in early 2018 after additional consultation by Kahu Kū Mauna.</p> <p>CR-7 was combined with CR-9 under the guidance of Kahu Kū Mauna who pointed out that the "stacking of rocks" may be a cultural features.</p>

**COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES**

		<b>Implementation Status</b>	<b>Comments</b>
<b>Historic Properties</b>			
CR-10	Develop and implement a historic property monitoring program to systematically monitor the condition of the historic district and all historic properties, including cultural sites and burials.	Completed	SHPD approved OMKM's long term historic properties monitoring plan; monitoring is ongoing according to the plan's schedule.
CR-11	Complete an archaeological survey of the portions of the Summit Access Road corridor that are under UH management.	Completed	An archaeological survey of the Maunakea Science Reserve and summit access road was completed in 2009.
CR-12	Consult with Kahu Kū Mauna about establishing buffers (preservation zones) around known historic sites in the Astronomy Precinct, to protect them from potential future development.	Completed	In 2012 Kahu Kū Mauna determined that this should be reviewed on a case-by-case basis. They identified criteria for when to consult for routine (minimal impact) project proposals, as well as with future development.  In 2016, Kahu Kū Mauna revised their policy. MKMB approved their policy.
CR-13	Develop and implement a burial treatment plan for the UH Management Areas in consultation with Kahu Kū Mauna Council, MKMB's Hawaiian Culture Committee, the Hawai'i Island Burial Council, recognized lineal or cultural descendants, and SHPD.	Completed	SHPD reviewed and approved the Burial Treatment Plan for Mauna Kea in 2014.
CR-14	Immediately report any disturbance of a shrine or burial site to the rangers, DOCARE, Kahu Kū Mauna Council, and SHPD.	Ongoing	Rangers report disturbance to OMKM and OMKM in turn notifies other parties.

COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES			
		Implementation Status	Comments
NATURAL RESOURCES			
Threat Prevention and Control			
NR-1	Limit threats to natural resources through management of permitted activities and uses.	Completed/ Ongoing	<p>OMKM consulted with agencies on a draft of administrative rules governing public and commercial activities. Public hearings seeking public comments on a proposed draft were held in 2018. Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.</p> <p>An Operations, Monitoring and Maintenance Plan (OMMP) relating to the coordination of maintenance plans, activities and schedules was developed and approved by the MKMB, and is being implemented.</p>
NR-2	Limit damage caused by invasive species through creation of an invasive species prevention and control program.	Completed/ Ongoing	<p>The Maunakea Invasive Species Management Plan is approved and implemented. Additional topics are addressed as situations arise, and procedures are developed based on scientific, management board, and community feedback.</p> <p>A volunteer program was established to pull invasive weeds on UH's managed lands with emphasis in the Halepōhaku area.</p> <p>Beginning in 2007 OMKM conducted annual surveys of invasive arthropod species on UH's managed lands. This program was expanded to include monthly monitoring at the facilities at the 9,200 ft mid-level facilities, and quarterly monitoring of the summit facilities. Rapid response strategies were drafted as part of the Invasive Species Management Plan.</p> <p>Inspections of heavy equipment, construction material, and other items too large to be carried by an individual occur prior to coming on to UH's lands. Specific requirements are part of the Invasive Species Management Plan. A MS Student evaluated program efficacy as part of his 2018 thesis, with management recommendations incorporated into OMKM policies and procedures. Beginning in 2013 to July 2020, a total 808 large vehicles and loads were inspected. 782 passed initial inspection or following quick remediation and were approved, 17 were rejected and required re-inspection, and 9 were non-compliant, that is, no requests for inspections were made prior to proceeding to the mountain.</p>
NR-3	Maintain native plant and animal populations and biological diversity.	Ongoing	Non-native plants and arthropods are monitored. The Division of Forestry and Wildlife is completing a circum-Maunakea fence and ungulate removal from Palila critical habitat. OMKM staff investigated māmane leaf curl frequency at Halepōhaku (plant disease response) in coordination with UHH scientists. Arthropod food webs and parasites are being investigated.
NR-4	Minimize barriers to species migration to help maintain populations and protect ecosystem processes and development.	Ongoing	OMKM coordinates with Forest Reserve, Natural Area Reserve, and Department of Land and Natural Resources technical staff to identify issues, craft appropriate responses, and investigate concerns regarding ecosystems and populations.



NR-5	Manage ecosystems to allow for response to climate change.	Ongoing	OMKM coordinates with Forest Reserve and Natural Area Reserve staff to ensure management activities do not inadvertently impede natural ecosystem response. Research into climate change forecast downscaling and climate monitoring helps inform potential future management action. OMKM participated in Pacific Islands Climate Change Cooperative workshops on climate change to help identify mitigation and adaptation strategies. A climate monitoring sea level to summit network plan is in preparation.
NR-6	Reduce threats to natural resources by educating stakeholders and the public about Mauna Kea's unique natural resources.	Ongoing	Rangers help to educate visitors about Maunakea as part of their daily activities.  Resource orientation of those who work on the mountain including observatory personnel, VIS and MKSS staff, rangers, commercial tour operators and staff, and construction workers commenced in 2013. An online orientation is also available. A brief public / visitor orientation is complete and provided for scheduled group visits.  See also CR-3 and EO-2
<b>Ecosystem Protection, Enhancement &amp; Restoration</b>			
NR-7	Delineate areas of high native diversity, unique communities, or unique geological features within the Astronomy Precinct and at Hale Pōhaku and consider protection from development.	Ongoing	Botanical survey of UH managed lands is completed. Biodiversity, wēkiu bug, and erosion and surficial geology surveys are ongoing. A study and mapping of wēkiu bug habitat is completed. Surveys for birds and bats are ongoing.
NR-8	Consider fencing areas of high native biodiversity or populations of endangered species to keep out feral ungulates (applies to areas below 12,800 ft elevation).	Ongoing	Assisted DLNR with fencing natural population of Silverswords. Other areas will be fenced when areas are identified and needed.
NR-9	Increase native plant density and diversity through an outplanting program.	Ongoing	Māmane seedlings germinated from seeds found in the Halepōhaku area were planted near the VIS  Worked with DLNR and planted 200 Silversword seedlings in the Halepōhaku area.  Collaborated with Kamehameha Schools to build plant propagation benches and start seedlings for eventual habitat restoration and enhancement at Halepōhaku.  Germination of māmane seedlings continues.  The construction of a small greenhouse at Halepōhaku for growing native plants was approved by BLNR as part of a project to improve the ingress/egress and parking at the VIS. Planning for construction is ongoing. Over 200 native plants were planted under the ingress/egress improvements permit.
NR-10	Incorporate mitigation plans into project planning and conduct mitigation following new development.	Ongoing	Mitigation and best management practices plans are required for projects as appropriate.
NR-11	Conduct habitat rehabilitation projects following unplanned disturbances.	Ongoing	Damage assessments and rehabilitation following unplanned disturbances are conducted on a case-by-case basis as needed. Generally, unplanned disturbances, such as vehicle oil leaks, occur on previously disturbed areas such as roadways, where humans frequent.
NR-12	Create restoration plans and conduct habitat restoration activities, as needed.	Ongoing	A study of wēkiu bug habitat restoration was initiated in 2015. A study and mapping of wēkiu bug habitat has been completed. Restoration plans and greenhouse for long-term program use are part of a project to improve the ingress/egress and parking at the VIS.

# COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES

## Implementation Status

## Comments

### Program Management

NR-13	Increase communication, networking, and collaborative opportunities to support management and protection of natural resources.	Ongoing	OMKM has established and continues to establish working relationships with the community and DLNR through working groups such as the Maunakea Environment Committee and Big Island Invasive Species Committee, Maunakea Watershed Alliance, Hawaii Ant Lab, and OHA.
NR-14	Use the principles of adaptive management when developing programs and methodologies. Review programs annually and revise any component plan every five years, based on the results of the program review.	Ongoing	Potential CMP revisions are identified in annual program documentation. Program plans, such as the Maunakea Invasive Species Management Plan, are updated and communicated at MKMB meetings as issues are identified. Completion of Envision Maunakea project.

### Inventory, Monitoring and Research

NR-15	Conduct baseline inventories of high-priority resources, as outlined in an inventory, monitoring, and research plan.	Ongoing	Baseline surveys of wēkiu bugs, other arthropods, including invasive species have been completed or are continuing. A botanical survey was completed in the Summer of 2011 and published in 2013.  OMKM is funding a multi-year study on permafrost and working on designing a climate monitoring network. OMKM is also studying erosion to better understand surficial geology, cinder cone erosion, and characterize arthropod habitat. A bird and bat inventory commenced in 2017.
NR-16	Conduct regular long-term monitoring, as outlined in an inventory, monitoring, and research plan.	Ongoing	OMKM conducts annual wēkiu bug, alien and invasive species surveys. Botanical and arthropod surveys are conducted as part of the annual archaeological monitoring. Other monitoring plans to be developed following baseline surveys.
NR-17	Conduct research to fill knowledge gaps that cannot be addressed through inventory and monitoring.	Ongoing	OMKM funded a study to develop a long term model relating to climate change and potential impact to the summit ecosystem; a study of native arthropod habitats and vegetation association, arthropod food webs; analysis of historical weather climate conditions on the summit and meteorological and geological influences on insect and snowfall drops on the summit terrain to help inform wēkiu bug research; study to assess the presence and persistence of permafrost; surficial geology and erosion; and several studies related to the wēkiu bug including life history, genetics, habitat restoration, and habitat mapping.  OMKM funded an international symposium on Tropical Alpine Ecosystems. Invited speakers are experts in research and management of alpine ecosystems. OMKM hopes to develop a network with other researchers and managers to gain knowledge to better manage Maunakea.
NR-18	Develop geo-spatial database of all known natural resources and their locations in the UH Management Areas that can serve as baseline documentation against change and provide information essential for decision-making.	Ongoing	Wēkiu bug and botanical data, infrastructure and signs have been mapped. A GIS database of resources surveyed utilizing ArcGIS and distributed as GoogleEarth layers has been developed; new data as available is added to this database.

**COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES**

Implementation Status			
Comments			
EDUCATION AND OUTREACH			
<b>Program Development</b>			
EO-1	Develop and implement education and outreach program	Ongoing	<p>Volunteer, Orientation, Brochures (Safety, Culture, Resources, What is OMKM) are available. In-school visits (Hilo Inter, Hawaii Academy of Arts and Sciences PCS, Ke Ana La'ahana, Waiakea High, Kealakehe Elementary) occur regularly. Community organizations and members help support OMKM's volunteer program. Work with Kealakehe Elementary School to support their annual Science Showcase at the school.</p> <p>Outreach activities by researchers are conducted at various schools; OMKM research affiliate also helps advise young scientists with their science fair projects. Updates on OMKM activities are given to various community organizations. OMKM also participates in community events.</p> <p>The MKMB approved an Education and Outreach plan in July 2020. This plan addresses EO-1, 3, 5, 6, 7, and 8.</p>
<b>Education</b>			
EO-2	Require orientation of users, with periodic updates and a certificate of completion, including but not limited to visitors, employees, observatory staff, contractors, and commercial and recreational users.	Ongoing	<p>Resource orientation of those who work on the mountain including observatory personnel, VIS and MKSS staff, rangers, commercial tour operators and staff, and construction workers commenced in 2013. Orientation is available to all interested parties in-person or online.</p> <p>Proposed administrative rules include a provision for an orientation of visitors.</p>
EO-3	Continue to develop, update, and distribute materials explaining important aspects of Mauna Kea.	Ongoing	Materials on the cultural and natural resources, visiting safely and responsibly and Mauna Kea hazards are distributed at the VIS.
EO-4	Develop and implement a signage plan to improve signage throughout the UH Management Areas (interpretive, safety, rules and regulations).	Completed/ Ongoing	<p>A sign plan was approved by the MKMB in 2016 and implemented in 2017.</p> <p>An inventory of sign locations on UH's managed lands has been completed.</p> <p>Cultural and safety related signs have been installed.</p>
EO-5	Develop interpretive features such as self-guided cultural walks and volunteer-maintained native plant gardens.	In Progress	Included as part of ongoing CIP funded project. The MKMB approved an Education and Outreach plan in July 2020. This plan addresses EO-1, 3, 5, 6, 7, and 8.
EO-6	Engage in outreach and partnerships with schools, by collaborating with local experts, teachers, and university researchers, and by working with the 'Imiloa Astronomy Center of Hawai'i.	Ongoing	See EO-1

# COMPONENT PLAN: UNDERSTANDING AND PROTECTING MAUNA KEA'S RESOURCES

## Implementation Status

## Comments

### Outreach

EO-7	Continue and increase opportunities for community members to provide input to cultural and natural resources management activities on Mauna Kea, to ensure systematic input regarding planning, management, and operational decisions that affect natural resources, sacred materials or places, or other ethnographic resources with which they are associated.	Ongoing	OMKM through the MKMB, Kahu Kū Mauna, and Environment Committee provide opportunity for members of the community and other organizations to participate in the management activities of the mountain.  Bi-monthly volunteer activities provide an opportunity for the community to participate and share knowledge.  Meetings with community groups and open houses were conducted to give the public an opportunity to provide input and feedback on administrative rules being developed by OMKM. Public hearings seeking public comments on a proposed draft were held in 2018.
EO-8	Provide opportunities for community members to participate in stewardship activities.	Ongoing	OMKM through the MKMB, Kahu Kū Mauna, and Environment provide opportunity for members of the community to participate in the management activities of the mountain.  Bi-monthly volunteer activities provide an opportunity for the community to participate and share knowledge.  Student projects and mentoring provides opportunities (science fair, legacy, etc.) for one-on-one interaction and more in-depth efforts.

### ASTRONOMICAL RESOURCES

AR-1	Operate the UH Management Areas to prohibit activities resulting in negative impacts to astronomical resources.	Ongoing	Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
AR-2	Prevent light pollution, radio frequency interference (RFI) and dust.	Ongoing	Project proposals requesting the use of radio signals are reviewed by the Institute for Astronomy for potential interference with astronomical research activities.  At the State level, the Starlight Reserve Advisory Committee was active from 2010 to 2015. Efforts by UH and DBEDT .to make the committee permanent were unsuccessful at the 2015 and 2016 Legislature were unsuccessful. They will try again in 2107.  UH has been working closely with Hawaii County officials on outdoor lighting issues. This has resulted in the adoption of public-health, wildlife, and astronomy-friendly LED lights to replace the previous low-pressure sodium lights. UH and the County are now requesting the State to use similar lights at Hawaii Island airports and harbors. UH continues to provide advice on amendments to the Hawaii County lighting ordinance

# COMPONENT PLAN: MANAGING ACCESS AND USES

Implementation  
Status

Comments

## ACTIVITIES AND USES

### General Management

ACT-1	Continue and update managed access policy of 1995 Management Plan.	Completed Ongoing	The BLNR approved the Public Access Plan for UH Management Areas on Mauna Kea. This plan contains principals and policies regarding public access. Administrative rules will help define UH's public access policy. Public hearings seeking public comments on a proposed draft were held in 2018 and the rules implemented in January 2020. UH is in the process of updating the Master Plan and CMP that will address access policy
ACT-2	Develop parking and visitor traffic plan.	Ongoing	Capital improvement funds are being used to implement an Ingress/egress, and parking plan to address concerns of traffic flow and pedestrian safety. A CDUP was issued to implement the ingress/egress project commenced in late 2018.  OMKM Rangers assist staff at the VIS with the implementation of their interim parking plan to maintain order, accommodate as many vehicles as possible and to ensure the safety of visitors to the VIS.  An automated vehicle counter counts the number of vehicles (differentiating: public, commercial, tour, observatory, etc.) that drive above Halepōhaku.
ACT-3	Maintain a presence of interpretive and enforcement personnel on the mountain at all times to educate users, deter violations, and encourage adherence to restrictions.	Completed Ongoing	Mauna Kea Rangers are present year round from 7:15 am to 10:15 pm daily; DOCARE officers and Hawaii County Police are called for assistance on an as needed basis.
ACT-4	Develop and enforce a policy that maintains current prohibitions on off-road vehicle use in the UH Management Areas and that strengthens measures to prevent or deter vehicles from leaving established roads and designated parking areas.	Ongoing	OMKM prohibits the use of off-road vehicles on UH's managed lands. Vehicle access to the top of Pu'upoli'ahu has been blocked since 2001 at the request of Kahu Kū Mauna.  Commercial operators and film crews are required to stay on the road or within the footprint of existing facilities, unless granted permission by OMKM.  Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.

### Recreational

ACT-5	Implement policies to reduce impacts of recreational hiking	Completed Ongoing	Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices..
ACT-6	Define and maintain areas where snow-related activities can occur and confine activities to slopes that have a protective layer of snow.	Completed Ongoing	Generally, this is a self-regulated activity. People usually do not venture to areas where there is no snow. A map of areas where snow play generally occurs has been developed, but areas change depending on the weather and snow deposition. Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
ACT-7	Confine University or other sponsored tours and stargazing activities to previously disturbed ground surfaces and established parking areas.	Completed Ongoing	Star gazing activities on UH's lands are limited to parking lots, or in areas in close proximity to the VIS

ACT-8	Coordinate with DLNR in the development of a policy regarding hunting in the UH Management Areas.	Completed Ongoing	DLNR's hunting rules apply to UH's managed lands. UH administrative rules confirms application of DLNR's hunting rules to UH managed lands. Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
<b>Commercial</b>			
ACT-9	Maintain commercial tour permitting process; evaluate and issue permits annually.	Ongoing	UH oversees commercial tour permits, a responsibility transferred to UH from BLNR. Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices..
ACT-10	Ensure OMKM input on permits for filming activities	Completed Ongoing	Film permits are issued by the Hawaii Film Office of Department of Business Economic Development of Tourism. All film permits require OMKM's approval before they are issued.  Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
ACT-11	Seek statutory authority for the University to regulate commercial activities in the UH Management Areas.	Completed Ongoing	The function of commercial tour permitting was transferred by BLNR to UH. OMKM oversees commercial tour operations and film activities.  Statutory authority to promulgate administrative rules was granted by the Legislature in 2009. Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
<b>Scientific Research</b>			
ACT-12	Ensure input by OMKM, MKMB, and Kahu Kū Mauna on all scientific research permits and establish system of reporting results of research to OMKM.	Ongoing	All research proposals must be approved by OMKM. Proposals requiring ground disturbing activities or potential impact to the cultural and/or natural landscape are reviewed by Kahu Kū Mauna and MKMB. Permit by DLNR as appropriate.
<b>PERMITTING AND ENFORCEMENT</b>			
<b>Laws and Regulations</b>			
P-1	Comply with all applicable federal, state, and local laws, regulations, and permit conditions related to activities in the UH Management Areas.	Ongoing	This is a condition of UH's leases with DLNR. Rangers monitor activities. Regular communication with DLNR's Division of Conservation and Resources Enforcement, County of Hawaii police, and Sheriff's department continues as demonstrated during TMT protests.  Since 2006, OMKM rangers have been conducting biannual inspections of all facilities on UH's managed lands for compliance with their CDUPs.
P-2	Strengthen CMP implementation by recommending to the BLNR that the CMP conditions be included in any Conservation District Use Permit or other permit.	Ongoing	Relevant CMP management actions were incorporated into the CDUA for the Thirty Meter Telescope project.  The MKMB requires proposals for projects for Maunakea include a review and comments on how the proposer will comply with CMP action items relevant to the project.

P-3	Obtain statutory rule-making authority from the legislature, authorizing the University of Hawai'i to adopt administrative rules pursuant to Chapter 91 to implement and enforce the management actions.	Completed	The Legislature granted UH authority to promulgate administrative rules in 2009. Act 132.
P-4	Educate management staff and users of the mountain about all applicable rules and permit requirements.	Ongoing	Included as part of the orientation and with new project start-up meetings.  Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.

#### COMPONENT PLAN: MANAGING ACCESS AND USES

Implementation Status				Comments
Enforcement				
P-5	Continue coordinating with other agencies on enforcement needs.	Ongoing		OMKM coordinates with DOCARE on enforcement activities. Ranger observations are sent to DLNR, NAR, DOFAW, and US Fish & Wildlife Service.
P-6	Obtain legal authority for establishing, and then establish, a law enforcement presence on the mountain that can enforce rules for the UH Management Areas on Mauna Kea.	Completed		
P-7	Develop and implement protocol for oversight and compliance with Conservation District Use Permits.	Ongoing		Since 2006, OMKM rangers have been conducting biannual inspections of all facilities on UH's managed lands for compliance with their CDUPs
P-8	Enforce conditions contained in commercial and Special Use permits.	Ongoing		Rangers' responsibilities includes oversight of commercial tour activities and special use permits issued by OMKM.



**COMPONENT PLAN: MANAGING THE BUILT ENVIRONMENT  
INFRASTRUCTURE AND MAINTENANCE**

**Routine Maintenance**

IM-1	Develop and implement an OMMP.	Completed/ Ongoing	<p>An Operations Monitoring and Maintenance Plan (OMMP) was reviewed by Kahu Kū Mauna and approved by the MKMB.</p> <p>At the request of Kahu Kū Mauna, beginning in 2016 OMKM initiated a project review process that requires all observatories to submit annual 5-year outlook plans, that include projects the facilities plan on executing in the upcoming 5-years. Implementation is ongoing.</p>
IM-2	Reduce impacts from operations and maintenance activities by educating personnel about Mauna Kea's unique resources.	Ongoing	<p>A cultural and natural resources orientation program has been developed and is implemented.</p> <p>Orientation sessions on resources and safety are conducted for OMKM and Maunakea Observatory Support Staff.</p> <p>Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.</p>
IM-3	Conduct historic preservation review for maintenance activities that will have an adverse effect on historic properties.	Ongoing	<p>OMKM submits detailed proposals to DLNR for activities conducted infrequently. DLNR reviews and approves these as appropriate based on review by appropriate divisions.</p> <p>OMKM is also currently developing a Programmatic Agreement/MOU relating to maintenance activities that will be submitted to State Historic Preservation Division. A programmatic agreement may not be necessary being that activity that involves major ground disturbance involves a permit from DLNR and SHPD review. Routine activities do not involve major ground disturbance or occur on already disturbed land.</p>
IM-4	Evaluate need for and feasibility of a vehicle wash station near Hale Pōhaku, and requiring that vehicles be cleaned.	Completed/ Ongoing	OMKM funded a study to evaluate the efficacy current measures to prevent the introduction of invasive species, including vehicle and equipment wash practices.
IM-5	Develop and implement a Debris Removal, Monitoring and Prevention Plan.	Ongoing	<p>Trash from the HP facilities and VIS are removed daily. Each observatory removes trash from their respective facilities. Rangers routinely check for and pick up trash and debris while on their daily patrols.</p> <p>Rangers pick up and map the location of trash at the parking lot near the trail head to Lake Waiau (NAR). The amount of trash decreased following the installation of a portable toilet. A draft plan is under review.</p>
IM-6	Develop and implement an erosion inventory and assessment plan.	In Progress	OMKM partnered with UH Hilo geography department to study surficial geology and cinder cone erosion issues. It is anticipated the inventory will be completed in 2020
IM-7	Prepare a plan, in collaboration with the Department of Defense, to remove military wreckage from a remote area of the UH Management Areas, while ensuring protection of natural and cultural resources.	Ongoing	An inventory of all known aircraft and military wreckage was submitted to the Department of Defense for review and updating. OMKM is working with DOD, OCCL, and SHPD to determine appropriate plans for removal or preservation in place.

# COMPONENT PLAN: MANAGING THE BUILT ENVIRONMENT

## Implementation Status

## Comments

### Infrastructure

IM-8	Assess feasibility of paving the Summit Access Road.	Completed/ Ongoing	An engineering study related to the paving of the access road from Halepōhaku to the summit was completed in 1984. This study was the basis for paving the road from the summit to about the boundary of the Science Reserve. Another study was prepared in 2017 of the damage caused by large storms over the past 10 years. The report assessed repairs needed and potential cost.
IM-9	Evaluate need for additional parking lots and vehicle pullouts and install if necessary.	Ongoing	As part of the CIP ingress/egress project at the VIS, additional parking was assessed and parking added. With TMT a recreational parking plan for Batch Plant (Park 3) was submitted to DLNR and approved. A visitor study initiated in 2019 by UH Mānoa will further inform any future efforts.
IM-10	Evaluate need for additional public restroom facilities in the summit region and at Hale Pōhaku, and install close-contained zero waste systems if necessary.	Ongoing	Initial consideration of converting the presentation room building into a rest and eating stop for commercial tours as a means of reducing congestion at the VIS and providing greater access by the independent travelers, has been put on hold until completion of the ingress/egress project is completed, or if another solution presents itself.  MKSS is considering options for handling overcrowding at the VIS.  Additional portable toilets are available at the summit to address restroom facilities needs at the summit. Waterless urinals were installed in the VIS men's restroom.

### Sustainable Technologies

IM-11	Encourage existing facilities and new development to incorporate sustainable technologies, energy efficient technologies, and LEED standards, whenever possible, into facility design and operations.	Ongoing	The proposed Thirty Meter Telescope is incorporating energy efficiency in its design.  Maunakea Observatory Support Services installed a photovoltaic system at Halepōhaku; Gemini observatory installed, and Keck observatory is planning to install photovoltaic systems on their respective summit facilities.
IM-12	Conduct energy audits to identify energy use and system inefficiencies, and develop solutions to reduce energy usage.	Ongoing	Energy audits are part of the photovoltaic system design process, completed or in progress at Gemini, Keck, and Halepōhaku.
IM-13	Conduct feasibility assessment, in consultation with Hawaii Electric Light Company, on developing locally-based alternative energy sources.	Ongoing	MKSS installed a photovoltaic system at Halepōhaku. Additional energy conservation and sustainable generation possibilities are discussed by UHH, MKSS, and Observatories as opportunities arise.
IM-14	Encourage observatories to investigate options to reduce the use of hazardous materials in telescope operations.	Ongoing	With the development of new technology, observatories are beginning to reduce their need to use hazardous materials. An example, is the TMT observatory, which will not be using mercury.

# COMPONENT PLAN: MANAGING THE BUILT ENVIRONMENT

## Implementation Status

## Comments

### CONSTRUCTION GUIDELINES

#### General Requirements

C-1	Require an independent construction monitor who has oversight and authority to insure that all aspects of ground based work comply with protocols and permit requirements.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
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#### Best Management Practices

C-2	Require use of Best Management Practices Plan for Construction Practices.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA. A template for adaptation and use by others is also available.
C-3	Develop, prior to construction, a rock movement plan.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
C-4	Require contractors to provide information from construction activities to OMKM for input into OMKM information databases.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
C-5	Require on-site monitors (e.g., archaeologist, cultural resources specialist, entomologist) during construction, as determined by the appropriate agency.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
C-6	Conduct required archaeological monitoring during construction projects per SHPD approved plan	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
C-7	Education regarding historical and cultural significance	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
C-8	Education regarding environment, ecology and natural resources	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
C-9	Inspection of construction materials	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.

### SITE RECYCLING, DECOMMISSIONING, DEMOLITION AND RESTORATION

SR-1	Require observatories to develop plans to recycle or demolish facilities once their useful life has ended, in accordance with their sublease requirements, identifying all proposed actions.	Ongoing	This will be part of the TMT decommissioning plan, with the TMT decommissioning funding plan approved by the MKMB in 2014.
SR-2	Require observatories to develop a restoration plan in association with decommissioning, to include an environmental cost-benefit analysis and a cultural assessment.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.
SR-3	Require any future observatories to consider site restoration during project planning and include provisions in subleases for funding of full restoration.	Ongoing	Included as part of the proposed TMT Management Plan in its CDUA.

# COMPONENT PLAN: MANAGING THE BUILT ENVIRONMENT

## Implementation

### Status

### Comments

## CONSIDERING FUTURE LAND USE

### Facility Planning Guidelines

FLU-1	Follow design guidelines presented in the 2000 Master Plan.	Ongoing	The Design Review Process, which incorporated the 2000 Master Plan's design guidelines, were used in the review of the Thirty Meter Telescope project
FLU-2	Develop a map with land-use zones in the Astronomy Precinct based on updated inventories of cultural and natural resources, to delineate areas where future land use will not be allowed and areas where future land use will be allowed but will require compliance with prerequisite studies or analysis prior to approval of Conservation District Use Permit.	Ongoing	Areas previously mapped as off-limits for future land use through plans such as the Master Plan or CMP are used to limit any proposed activity. UH President Lassner confirmed that TMT was the last telescope to be built on undisturbed land. Resource data must be part of any proposal for major land use requests. HAR 13-5 allows for different types of land uses with each having its own requirements for preparing a land use application. Thus a single pre-prepared map cannot possibly address all potential scenarios.
FLU-3	Require cataloguing of initial site conditions for use when conducting site restoration.	Ongoing	TMT project completed a photo documentation of its site.
FLU-4	Require project specific visual rendering of both pre- and post-project settings to facilitate analysis of potential impacts to view planes.	Ongoing	TMT project completed a photo documentation.
FLU-5	Require an airflow analysis on the design of proposed structures to assess potential impacts to aeolian ecosystems.	Ongoing	Incorporated into the TMT project.
FLU-6	Incorporate habitat mitigation plans into project planning process.	Ongoing	Incorporated into the TMT project
FLU-7	Require use of close-contained zero-discharge waste systems for any future development in the summit region, from portable toilets to observatory restrooms, if feasible.	Ongoing	Incorporated into the TMT project

COMPONENT PLAN: MANAGING OPERATIONS			
		Implementation Status	Comments
OPERATION AND IMPLEMENTATION			
OI-1	Maintain OMKM, MKMB, and Kahu Kū Mauna in current roles, with OMKM providing local management of the UH Management Areas, and MKSS providing operational and maintenance services.	Completed	<p>The MKMB meets regularly, holding numerous public meetings; which includes consultation with Kahu Kū Mauna Council. OMKM continues to submit CMP management actions (such as the OMMP) to MKMB. MKSS continues to maintain the road and public services, financially supported by the Maunakea Observatories.</p> <p>Part of the role and responsibilities of OMKM, Kahu Kū Mauna Council and MKMB is the review of projects proposed for UH's managed lands, in particular for compliance with DLNR conservation district rules and since 2009, the CMP. To date over 300 projects have been reviewed by OMKM/Kahu Kū Mauna Council/MKMB.</p> <p>See Appendix H: Board &amp; Committee Composition.</p>
OI-2	Develop training plan for staff and volunteers.	Completed	OMKM requires all staff and volunteers to attend the Maunakea orientation. A training plan was submitted and approved by the MKMB; bi-monthly trainings of all staff is being conducted.
OI-3	Maintain and expand regular interaction and dialogue with stakeholders, community members, surrounding landowners, and overseeing agencies to provide a coordinated approach to resource management.	Ongoing	OMKM has frequent contact in particularly with its neighbor, DLNR on resource management issues. OMKM rangers report unusual or suspicious behavior observed on DLNR lands to DLNR including DOCARE.
OI-4	Establish grievance procedures for OMKM, to address issues as they arise.	Completed Ongoing	The public has the opportunity to address grievances at the MKMB publicly held meetings. Administrative rules, effective beginning January 2020, for UH's managed lands incorporate policies approved by the University President while ensuring protections afforded to Native Hawaiian traditional and customary practices.
OI-5	Update and implement emergency response plan.	Ongoing	Emergency response plan is reviewed annually.
MONITORING, EVALUATION AND UPDATES			
MEU-1	Establish a reporting system to ensure that the MKMB, DLNR, and the public are informed of results of management activities in a timely manner.	Ongoing	Reports are provided at the publicly held MKMB Meetings.
MEU-2	Conduct regular updates of the CMP that reflect outcomes of the evaluation process, and that incorporate new information about the resources.	Ongoing	Five-year CMP revision interval was initiated in 2014. EnVision Maunakea and administrative rules will play a role in the updating the CMP.
MEU-3	Revise and update planning documents, including the master plan, leases, and subleases, so that they will clearly assign roles and responsibilities for managing Mauna Kea and reflect stewardship matters resolved with DLNR.	Ongoing	<p>UH is preparing an EIS for a new land authorization for UH's lands on Maunakea. A Prep Notice was prepared and published in February 2018. UH is reviewing comments and is considering them in the development of the draft.</p> <p>The 2000 Master Plan is being replaced by a new version, with preparation ongoing.</p> <p>The 2009 CMP is being updated, with preparation of progress report and DLNR review ongoing.</p>

## **Appendix G: Cumulative Progression**

Cumulative Annual Progression of CMP Implementation Status.

Management		CMP	Annual Implementation Status										
Action	Description	Implementation Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
Native Hawaiian Cultural Resources					.	.	.	.	.	.	.	.	.
Management					.	.	.	.	.	.	.	.	.
CR-1	Kahu Kū Mauna shall work with families with lineal and historical connections to Maunakea, cultural practitioners, and other Native Hawaiian groups, including the Maunakea Management Board’s Hawaiian Culture Committee, toward the development of appropriate procedures and protocols regarding cultural issues.	Immediate		Ongoing	In Progress		Ongoing						
CR-2	Support application for designation of the summit region of Maunakea as a Traditional Cultural Property, per the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq. in consultation with the larger community.	Short-term							Ongoing				
CR-3	Conduct educational efforts to generate public awareness about the importance of preserving the cultural landscape.	Immediate		Ongoing	In Progress		Ongoing						
Cultural Practices													
CR-4	Establish a process for ongoing collection of information on traditional, contemporary, and customary cultural practices.	Short-term									Ongoing		
CR-5	Develop and adopt guidelines for the culturally appropriate placement and removal of offerings.	Immediate			In Progress*						Completed		
CR-6	Develop and adopt guidelines for the visitation and use of ancient shrines.	Immediate			In Progress			Ongoing			Completed		
CR-7	Kahu Kū Mauna shall take the lead in determining the appropriateness of constructing new Hawaiian cultural features.	Immediate			In Progress*						Completed		
CR-8	Develop and adopt a management policy for the UH Management Areas on the scattering of cremated human remains.	Immediate		Ongoing	In Progress*						Completed		
CR-9	A management policy for the culturally appropriateness of building ahu or “stacking of rocks” will need to be developed by Kahu Kū Mauna who may consider similar policies adopted by Hawai’i Volcanoes National Park.	Immediate		Ongoing	In Progress*						Completed		
Historic Properties													
CR-10	Develop and implement a historic property monitoring program to systematically monitor the condition of the historic district and all historic properties, including cultural sites and burials.	Immediate		Ongoing	In Progress		Completed						
CR-11	Complete an archaeological survey of the portions of the Summit Access Road corridor that are under UH management	Completed											

Management		CMP Implementation Timeframe	Annual Implementation Status										
Action	Description		2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
CR-12	Consult with Kahu Kū Mauna about establishing buffers (preservation zones) around known historic sites in the Astronomy Precinct, to protect them from potential future development	Immediate		As needed	As needed	As needed	Ongoing				Completed		
CR-13	Develop and implement a burial treatment plan for the UH Management Areas in consultation with Kahu Kū Mauna Council, MKMB's Hawaiian Culture Committee, the Hawai'i Island Burial Council, recognized lineal or cultural descendants, and SHPD.	Immediate		Ongoing	In Progress	A burial treatment plan was approved by SHPD in July 2014. This was incorrectly reported as 'In Progress' in the previously submitted 2014 and 2015 narrative reports.	Completed						
CR-14	Immediately report any disturbance of a shrine or burial site to the rangers, DOCARE, Kahu Kū Mauna Council, and SHPD	Ongoing											
Natural Resources													
Threat Prevention and Control													
NR-1	Limit threats to natural resources through management of permitted activities and uses	Short-term			In Progress				Ongoing		Completed / Ongoing		
NR-2	Limit damage caused by invasive species through creation of an invasive species prevention and control program	Immediate		Ongoing	In Progress		Ongoing				Completed / Ongoing		
NR-3	Maintain native plant and animal populations and biological diversity	Mid and Long-term								Ongoing			
NR-4	Minimize barriers to species migration, to help maintain populations and protect ecosystem processes and development.	Mid and Long-term								Ongoing			
NR-5	Manage ecosystems to allow for response to climate change	Long-term								Ongoing			
NR-6	Reduce threats to natural resources by educating stakeholders and the public about Maunakea's unique natural resources.	Immediate		Ongoing									
Ecosystem Protection, Enhancement & Restoration													
NR-7	Delineate areas of high native diversity, unique communities, or unique geological features within the Astronomy Precinct and at Halepōhaku and consider protection from development.	Short and Mid-term					In Progress		Ongoing				



Management		CMP	Annual Implementation Status										
Action	Description	Implementation Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
NR-8	Consider fencing areas of high native biodiversity or populations of endangered species to keep out feral ungulates (applies to areas below 12,800 ft elevation).	Mid-term					Ongoing	Ongoing	Ongoing	Ongoing			
NR-9	Increase native plant density and diversity through an outplanting program.	Long-term							Ongoing				
NR-10	Incorporate mitigation plans into project planning and conduct mitigation following new development.	As needed					Ongoing						
NR-11	Conduct habitat rehabilitation projects following unplanned disturbances.	As needed					Ongoing						
NR-12	Create restoration plans and conduct habitat restoration activities, as needed.	As needed							In Progress	Ongoing			
Program Management													
NR-13	Increase communication, networking, and collaborative opportunities, to support management and protection of natural resources.	Immediate		Ongoing	In Progress	Ongoing							
NR-14	Use the principles of adaptive management when developing programs and methodologies. Review programs annually and revise any component plans every five years, based on the results of the program review.	Short-term / As needed					In Progress				Ongoing		
Inventory, Monitoring and Research													
NR-15	Conduct baseline inventories of high-priority resources, as outlined in an inventory, monitoring, and research plan.	Immediate		Ongoing									
NR-16	Conduct regular long-term monitoring, as outlined in an inventory, monitoring, and research plan	Ongoing			In Progress	Ongoing							
NR-17	Conduct research to fill knowledge gaps that cannot be addressed through inventory and monitoring.	Immediate		Ongoing									
NR-18	Develop geo-spatial database of all known natural resources and their locations in the UH Management Areas that can serve as baseline documentation against change and provide information essential for decision-making.	Ongoing				In Progress	Ongoing						
Education and Outreach													
Program Development													
EO-1	Develop and implement education and outreach program	Immediate and Short-term				Ongoing							Completed
Education													
EO-2	Require orientation of users, with periodic updates and a certificate of completion, including but not limited to visitors, employees, observatory staff, contractors, and commercial and recreational users.	Long-term			In Progress	Ongoing							

Management		CMP Implementation Timeframe	Annual Implementation Status										
Action	Description		2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
EO-3	Continue to develop, update, and distribute materials explaining important aspects of Maunakea.	Ongoing	Ongoing	Ongoing	In Progress	Ongoing							
EO-4	Develop and implement a signage plan to improve signage throughout the UH Management Areas (interpretive, safety, rules and regulations).	Immediate							In Progress	Ongoing	Completed / Ongoing		
EO-5	Develop interpretive features such as self-guided cultural walks and volunteer-maintained native plant gardens.	Mid-term							In Progress				
EO-6	Engage in outreach and partnerships with schools, by collaborating with local experts, teachers, and university researchers, and by working with the 'Imiloa Astronomy Center of Hawai'i.	Mid-term					Ongoing						
Outreach													
EO-7	Continue and increase opportunities for community members to provide input to cultural and natural resources management activities on Maunakea, to ensure systematic input regarding planning, management, and operational decisions that affect natural resources, sacred materials or places, or other ethnographic resources with which they are associated.	Ongoing											
EO-8	Provide opportunities for community members to participate in stewardship activities.	Ongoing											
Astronomy Resources													
Protection of Astronomical Resources													
AR-1	Operate the UH Management Areas to prohibit activities resulting in negative impacts to astronomical resources.	Ongoing			In Progress								Ongoing
AR-2	Prevent light pollution, radio frequency interference (RFI) and dust.	Ongoing											
Activities and Uses													
General Management													
ACT-1	Continue and update managed access policy of 1995 Management Plan.	Short-term			Completed Ongoing								
ACT-2	Develop parking and visitor traffic plan.	Immediate		Ongoing	In Progress						Ongoing		CDUP issued, construction completed in 2019
ACT-3	Maintain a presence of interpretive and enforcement personnel on the mountain at all times to educate users, deter violations, and encourage adherence to restrictions.	Completed Ongoing											
ACT-4	Develop and enforce a policy that maintains current prohibitions on off-road vehicle use in the UH Management Areas and that strengthens measures to prevent or deter vehicles from leaving established roads and designated parking areas.	Ongoing											

Management			CMP Implementation		Annual Implementation Status								
Action	Description	Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
Recreational													
ACT-5	Implement policies to reduce impacts of recreational hiking	Short-term			In Progress								Completed Ongoing
ACT-6	Define and maintain areas where snow-related activities can occur and confine activities to slopes that have a protective layer of snow	Ongoing											Completed Ongoing
ACT-7	Confine University or other sponsored tours and star-gazing activities to previously disturbed ground surfaces and established parking areas.	Ongoing											Completed Ongoing
ACT-8	Coordinate with DLNR in the development of a policy regarding hunting in the UH Management Areas.	Immediate		Ongoing	Completed Ongoing								
Commercial													
ACT-9	Maintain commercial tour permitting process; evaluate and issue permits annually.	Ongoing											
ACT-10	Ensure OMKM input on permits for filming activities	Ongoing										Completed Ongoing	
ACT-11	Seek statutory authority for the University to regulate commercial activities in the UH Management Areas.	Completed Ongoing											
Scientific Research													
ACT-12	Ensure input by OMKM, MKMB, and Kahu Kū Mauna on all scientific research permits and establish system of reporting results of research to OMKM.	Ongoing											
Permitting and Enforcement													
Laws and Regulations													
P-1	Comply with all applicable federal, state, and local laws, regulations, and permit conditions related to activities in the UH Management Areas.	Ongoing											
P-2	Strengthen CMP implementation by recommending to the BLNR that the CMP conditions be included in any Conservation District Use Permit or other permit.	As needed			Ongoing								
P-3	Obtain statutory rule-making authority from the legislature, authorizing the University of Hawai'i to adopt administrative rules pursuant to Chapter 91 to implement and enforce the management actions.	Completed											
P-4	Educate management staff and users of the mountain about all applicable rules and permit requirements.	Immediate		Ongoing									
Enforcement													
P-5	Continue coordinating with other agencies on enforcement needs.	Ongoing											

Management		CMP	Annual Implementation Status										
Action	Description	Implementation Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
P-6	Obtain legal authority for establishing, and then establish, a law enforcement presence on the mountain that can enforce rules for the UH Management Areas on Maunakea.	Completed / As needed		Completed									
P-7	Develop and implement protocol for oversight and compliance with Conservation District Use Permits.	Ongoing											
P-8	Enforce conditions contained in commercial and Special Use permits.	Ongoing											
Infrastructure and Maintenance													
Routine Maintenance													
IM-1	Develop and implement an OMMP.	Ongoing			In Progress	In Progress	In Progress	In Progress	Completed/Ongoing				
IM-2	Reduce impacts from operations and maintenance activities by educating personnel about Maunakea’s unique resources.	Immediate		Ongoing	In Progress	Ongoing							
IM-3	Conduct historic preservation review for maintenance activities that will have an adverse effect on historic properties.	Short-term			In Progress								Ongoing
IM-4	Evaluate need for and feasibility of a vehicle wash station near Halepōhaku, and requiring that vehicles be cleaned.	Short-term					In Progress			Completed/ Ongoing			
IM-5	Develop and implement a Debris Removal, Monitoring and Prevention Plan.	Immediate		Ongoing									
IM-6	Develop and implement an erosion inventory and assessment plan.	Long-term					In Progress					Estimated completion in 2020	
IM-7	Prepare a plan, in collaboration with the Department of Defense, to remove military wreckage from a remote area of the UH Management Areas, while ensuring protection of natural and cultural resources.	Mid-term							Ongoing				
Infrastructure													
IM-8	Assess feasibility of paving the Summit Access Road.	Long-term			In Progress				Completed/Ongoing				
IM-9	Evaluate need for additional parking lots and vehicle pullouts and install if necessary.	Mid-term							In Progress		Ongoing		
IM-10	Evaluate need for additional public restroom facilities in the summit region and at Halepōhaku, and install close-contained zero waste systems if necessary.	Immediate			In Progress				Ongoing				
Sustainable Technologies													
IM-11	Encourage existing facilities and new development to incorporate sustainable technologies, energy efficient technologies, and LEED standards, whenever possible, into facility design and operations.	As needed					Ongoing						

Management		CMP	Annual Implementation Status										
Action	Description	Implementation Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
IM-12	Conduct energy audits to identify energy use and system inefficiencies, and develop solutions to reduce energy usage.	Immediate							Ongoing				
IM-13	Conduct feasibility assessment, in consultation with Hawaii Electric Light Company, on developing locally-based alternative energy sources.	Mid-term							In Progress	Ongoing			
IM-14	Encourage observatories to investigate options to reduce the use of hazardous materials in telescope operations.	Short-term							Ongoing				
Construction Guidelines													
General Requirements													
C-1	Require an independent construction monitor who has oversight and authority to insure that all aspects of ground based work comply with protocols and permit requirements.	As needed					Ongoing						
Best Management Practices													
C-2	Require use of Best Management Practices Plan for Construction Practices.	As needed					Ongoing						
C-3	Develop, prior to construction, a rock movement plan.	As needed					Ongoing						
C-4	Require contractors to provide information from construction activities to OMKM for input into OMKM information databases.	As needed					Ongoing						
C-5	Require on-site monitors (e.g., archaeologist, cultural resources specialist, entomologist) during construction, as determined by the appropriate agency.	As needed					Ongoing						
C-6	Conduct required archaeological monitoring during construction projects per SHPD approved plan.	As needed					Ongoing						
C-7	Education regarding historical and cultural significance.	As needed					Ongoing						
C-8	Education regarding environment, ecology and natural resources.	As needed					Ongoing						
C-9	Inspection of construction materials.	As needed					Ongoing						
Site Recycling, Decommissioning, Demolition and Restoration													
SR-1	Require observatories to develop plans to recycle or demolish facilities once their useful life has ended, in accordance with their sublease requirements, identifying all proposed actions.	As needed					Ongoing						
SR-2	Require observatories to develop a restoration plan in association with decommissioning, to include an environmental cost-benefit analysis and a cultural assessment.	As needed					Ongoing						

Management		CMP	Annual Implementation Status										
Action	Description	Implementation Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
SR-3	Require any future observatories to consider site restoration during project planning and include provisions in subleases for funding of full restoration.	As needed					Ongoing						
Considering Future Land Use													
Facility Planning Guidelines													
FLU-1	Follow design guidelines presented in the 2000 Master Plan	As needed			Ongoing								
FLU-2	Develop a map with land-use zones in the Astronomy Precinct based on updated inventories of cultural and natural resources, to delineate areas where future land use will not be allowed and areas where future land use will be allowed but will require compliance with prerequisite studies or analysis prior to approval of Conservation District Use Permit	Short-term								Ongoing			
FLU-3	Require cataloguing of initial site conditions for use when conducting site restoration.	As needed					Ongoing						
FLU-4	Require project specific visual rendering of both pre- and post-project settings to facilitate analysis of potential impacts to view planes.	As needed					Ongoing						
FLU-5	Require an airflow analysis on the design of proposed structures to assess potential impacts to aeolian ecosystems.	As needed					Ongoing						
FLU-6	Incorporate habitat mitigation plans into project planning process.	As needed					Ongoing						
FLU-7	Require use of close-contained zero-discharge waste systems for any future development in the summit region, from portable toilets to observatory restrooms, if feasible	As needed					Ongoing						
Operations and Implementation													
Management													
OI-1	Maintain OMKM, MKMB, and Kahu Kū Mauna in current roles, with OMKM providing local management of the UH Management Areas, and MKSS providing operational and maintenance services.	Ongoing									Completed		
OI-2	Develop training plan for staff and volunteers	Ongoing			In Progress			Completed					
OI-3	Maintain and expand regular interaction and dialogue with stakeholders, community members, surrounding landowners, and overseeing agencies to provide a coordinated approach to resource management.	Ongoing											
OI-4	Establish grievance procedures for OMKM, to address issues as they arise.	Short-term			Ongoing								Completed Ongoing
OI-5	Update and implement emergency response plan.	Ongoing											
Monitoring, Evaluation, and Updates													

Management		CMP Implementation	Annual Implementation Status										
Action	Description	Timeframe	2010	2011	2012*	2013	2014	2015	2016	2017	2018	2019	2020
Management													
MEU-1	Establish a reporting system to ensure that the MKMB, DLNR, and the public are informed of results of management activities in a timely manner.	Immediate		Ongoing									
MEU-2	Conduct regular updates of the CMP that reflect outcomes of the evaluation process, and that incorporate new information about the resources.	Short-term / As needed					In Progress		In Progress		Ongoing		Designation reflects completion of Envision Maunakea process.
MEU-3	Revise and update planning documents, including the master plan, leases, and subleases, so that they will clearly assign roles and responsibilities for managing Maunakea and reflect stewardship matters resolved with DLNR.	As needed					In Progress						Ongoing

\*In 2012 the **Ongoing** category was divided into two groups, **Ongoing** and **In Progress**.

+ A lawsuit was filed in federal court which was dismissed without prejudice; the plaintiff may still seek further judicial relief

## **Appendix H: Board & Committee Composition**

Management board and committee composition, including the Maunakea Management Board, Kahu Kū Mauna Council, and Maunakea Environment Committee.



The following tables show the history of each Board, Council, or Committee by year. "X" indicates that an individual of the entity for at least some portion of the calendar year. "C" indicates that an individual was formally recognized as the Chair of the entity for at least some portion of the calendar year, shown only for the Maunakea Management Board. Kahu Kū Mauna Council members are all considered ex officio after their formal participation concludes.

### Maunakea Management Board Composition

Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Armandroff, Taft															X	X					
Bergin, Patricia						X	X	X	X	X	X	X	X	X	X						
Bergin, William																					X
Chu, Roberta																			X	C	C
Chun, Gregory															X	X	X	C	C	C	X
Cole, Heather	X	X	X	X	X																
Cross, John								X	X	X	X	X									
Hadway, Lisa								X	X	X	X	X	X	X	X						
Higaki, Wayne																					
Hoke, Arthur	C	C	C	C	C	X	X														
Imoto, Roger																X	X	X	X	X	
Kalua, Herring							X	X	X	X	X	X	X	X	X	X	X	X	X		
Kennedy, Jim	X	X	X	X	X	X	X														
Leialoha, Julie																			X	X	X
Maly, Kepa																			X	X	
Mooers, Gregory												X	X	C	C	C	X	X	X		
Nahale'a, Alapaki																			X		
Pacheco, Rob	X	X	X	X	C	C	C	C													
Robertson, Barbara	X	X	X	X	X	X															
Schinckel, Antony						X															
Simons, Douglas																X	X	X	X	X	X
Springer, Hannah K															X	X	X	X	X		
Taniguchi, Barry	X	X	X	X	X	X	X	X	C	C	C	C	C						X	X	
Terry, Ron					X	X	X	X	X	X	X	X	X								
Van De Car, Diana																					X
Veillet, Christian								X	X	X	X	X	X								
Veincent, Lehua M.															X	X	X	X	X		
Yada, Harry	X	X	X	X	X	X	X	X													

## Kahu Kū Mauna Council Composition

Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Chad Kālepa Baybayan							X	X	X	X	X	X	X	X	X			X	X	X	X
Thomas Chun														X	X	X	X	X	X	X	
Leningrad Elarionoff																X	X	X	X	X	X
Dale Fergerstrom													X	X	X	X	X				
Celeste Hao												X	X	X	X	X					
Arthur Hoke Jr.							X	X	X	X	X	X									
Wallace Ishibashi												X									
Tiffnie Kakalia							X	X	X	X	X	X	X	X	X						
Reynolds Kamakawiwo'ole	X	X	X	X	X	X	X	X													
Pualani Kanahele	X	X	X	X	X	X	X	X													
Niniau Kanahele	X	X	X	X	X	X	X														
Larry Kimura	X	X	X	X	X	X	X	X	X												
Kaleo Kualii	X	X	X	X	X	X	X	X													
Wally Lau																				X	X
Kimo Lee																				X	X
Antoinette Mallow							X	X	X	X	X	X	X	X	X						
U'ilani Naipo															X	X	X	X	X		
Sean Naleimaile						X	X	X	X	X	X	X	X								
Shane Palacat-Nelsen												X	X	X	X	X	X	X	X	X	X
Leilehua Omphroy						X	X	X													
Mikahala Roy	X	X	X	X	X	X	X														
Ululani Sherlock	X	X	X	X	X	X	X	X	X	X											
Hannah Kihilani Springer	X	X	X	X	X	X	X	X	X												
Edward Stevens	X	X	X	X	X	X	X	X	X	X											
Keahi Tajon														X							

## Maunakea Environment Committee Composition

The Maunakea Environment Committee primarily consists of current or former (including retired): adjacent land-owners or managers, non-profit cooperative partners for these same lands, management board/committee members, along with University, State and Federal agency scientists. Yet meeting attendance is less formal than either the Maunakea Management Board or Kahu Kū Mauna. While there is a standing list of individuals notified of meetings, those receiving the announcements may bring along or send (as a substitute) co-workers, colleagues, or friends depending upon the topic of interest. As such, only the current (early 2020) distribution list is included below.

Andrea Buskirk, Anya Tagawa, Casper Vanderwoude, Cheyenne Perry, David A. Phillips, Debbie Ward, Donald Thomas, Fritz Klasner, Grant Gerrish, Hannah Kihalani Springer, Ian Cole, Jackson Bauer, Jay Hatayama, Jesse Eiben, Jessica Kirkpatrick, Jim Kauahikaua, Joan Yoshioka, Joseph K Camara, Jordan Lee-Loy, Joy Yoshina, Kalā Asing, Nick Agorastos, Roger Imoto, Ron Terry, Springer Kaye, Stewart Hunter, Susan Cordell.