County of Maui
Department of Water Supply

WATERSHED PROTECTION GRANTS PROGRAM

Accomplishment Report
Fiscal Year 2017

By Water All Things Find Life

INTRODUCTION

Watershed protection and restoration is the key to keeping our streams, wetlands and aquifers safe and clean. Its main purpose is to protect the quality of our drinking water sources. How we treat our watershed can make a difference.

Resolution No. 09-101, entitled "Supporting the Protection and Long-term Management of Maui County's Watersheds" was adopted by the County Council on November 6, 2009. It states that as an **'aina momona** (land of abundance), Maui Nui provided for all residents, water, food and material cultural needs and was managed to ensure plentiful resources and held in trust for future generations. Hawaiians had a deep understanding and respect for their natural capital, especially, water resources, evident in their word for wealth, **waiwai**, which was derived from the word for fresh water, **wai**.

The greatest threats to our watershed are feral angulates and invasive weeds. Feral animals eat native vegetation, facilitate non-invasive plant invasion and hasten soil erosion. Invasive plants out-compete native plants for space, sunlight, water and nutrients as well as alter soil chemistry, change fire regimes, affect soils stability, use more water, increase surface water runoff and decrease aquifer recharge. Left unchecked and coupled with lack of management and monitoring of these threats will ultimately alter the entire structure of Maui County's watersheds.

Aware of the aforementioned threats, the Department of Water Supply continuous to provide financial support to Watershed Partnerships and community organizations aimed at protecting and preserving Maui County's watersheds for current and future generations. From mid-1990s to 2017, the department provided a total of **$16.6M** to the following organizations:

- East Maui Watershed Partnership – University of Hawaii (EMWP – UH)
- East Maui Watershed Partnership (Waikamoi Source Protection and Waikamoi Watershed Preserve Management) – The Nature Conservancy (Waikamoi – TNC)
- Leeward Haleakala Watershed Restoration Partnership - (LHWRP – UH)
- Auwahi Forest Restoration Project) – University of Hawaii (AFRP – UH)
- West Maui Mountains Watershed Partnership – University of Hawaii (WMMWP –UH)
- Maui Invasive Species Committee – University of Hawaii (MISC – UH)
- Honokowai-Wahikuli Source Protection – The Nature Conservancy
- East Molokai Watershed Partnership – The Nature Conservancy (EMoWP - TNC)
- Pu'u Kukui Watershed Preserve – Tri-Isle Resource Conservation and Development Council (PKW - Tri_Isle RC&D)
- Hawaii Agriculture Research Center (HARC)

These partnerships and organizations work collaboratively with more than 54 private and public partners to protect over 249,000 acres of vital forested watershed lands

SUMMARY OF WATERSHED PARTNERSHIP SUCCESS

I. **Total number of acres of watershed area managed (Maui and Molokai) - ~249,000**

II. **Total number of fence constructed (in miles) – 137 miles**

III. **Number of acres actively managed for invasive species - ~119,500**

IV. **Number of invasive species removed (FY 17) – ~90,000**

V. **Number of ungulates removed (FY 17) – 2,106**

VI. **Number of native and endangered species planted (FY 17) – ~22,380**

VII. **Number of staff funded by DWS(FY 17) – 23.6 FTE (from 15% - 100% of salary)**

VIII. **Funds leveraged (FY 2016) - $2.8M**

IX. **Research work being undertaken by the watershed partnerships**

- Research on the effects of restoration on hydraulic properties at Auwahi by assessing effects of reforestation on soil moisture dynamics and aquifer recharge
- Cooperative study is to assess the impacts of land-cover changes on past and future groundwater recharge
- Cooperative study to establish a framework for evaluating the hydrologic effects of watershed restoration programs on the islands of Maui and Moloka'i
- Contract with the University of Hawai‘i Economic Research Organization (UHERO) to quantify the return on investment of watershed management in East Maui.

BENEFITS TO MAUI COUNTY

- Improved water quality and quantity through effective management of our native forests and watersheds. Effective watershed management helps limit turbidity and animal born disease in surface waters. Sediments and total suspended solids from surface water is reduced which in turn limits the maintenance of water delivery systems and treatment costs.
- Reduced non-point source pollution down streams and to the near-shore environment.
- Improved groundwater recharge ability through protection and enhancement of native canopy and ground cover
- Potential recovery of listed endangered plant and animal species through the protection of intact native montane forest systems
- Climate change adaptation ability enhanced by maintaining ecosystem resilience.
- Protecting key recharge areas ensures a sustainable source of water for businesses, agriculture, residents and visitors on Maui and Molokai
- Protection of native Hawaiian ecosystems that perpetuate cultural traditions and enrich the unique and beautiful backdrop that is cherished by residents and visitors alike.
- Invasive plants out-compete native plants for space, sunlight, water, and nutrients. They alter soil chemistry, change fire regimes, affect soil stability, use more water, increase surface water runoff, and decrease aquifer recharge. Left unchecked, invasive plants will ultimately alter the entire structure of our watersheds.
- Investing in the future of watershed protection by providing resources for teachers to educate students in the classroom and in the field about Hawaii's watersheds. Educating the community about their local watershed and the important role it plays in fresh water retention.
- Leveraging of funds to ensure State and Federal resources contribute to watershed protection.

Background Information – Watershed Partnerships

1. East Maui Watershed Partnership (EMWP) – University of Hawaii

Created in 1991, East Maui Watershed Partnership (EMWP) was the first watershed partnership formed in Hawai'i, and served as a model for all watershed partnerships formed in the state thereafter. EMWP was born out of the need recognized by government, private landowners and other stakeholders to effectively preserve, protect and sustain Maui's water supply for current and future generations. EMWP's mission is *to protect East Maui's primary water source, including, but not limited to, the native forested watershed, by significantly reducing targeted threats*

The East Maui watershed consists of approximately 120,000 acres located on the windward slopes of Haleakalā. The watershed's annual rainfall has been estimated to have a 30-year mean of 404.4 inches per year at one rain gauge, and it provides the largest harvested source of surface water in the state with current infrastructure collecting an average of more than 60 billion gallons of water per year.

The Maui County Department of Water Supply (DWS) Waikamoi water collection system services Upcountry residents and farmers from Hā'iku to Kanaio. Water collected from the East Maui watershed recharges aquifers below DWS wells in Hā'iku, Pa'ia, Keanae and Hāna. Other water collected from the East Maui watershed supplies Central Maui's large-scale agricultural industry. Adhering to the view that even any percentage reduction in ground water recharge will be costly by leading to increased pumping costs, new wells, and longer transportation systems, EMWP seeks to mitigate the most important threats to the watershed.

2. Waikamoi Upcountry East Maui Source Protection Program - The Nature Conservancy

The areas in this project include the majority of East Maui's most important and pristine headwaters that supply upcountry Maui with much of its freshwater needs. This encompasses significant portions of the Upper Kula water system drainage area, and abuts the larger 12,000 acre core area of native-dominant watershed on Maui. This project not only benefits the thousands of acres that already have been fenced, but also the entire 12,000 acre core East Maui watershed and water collection area.

The greatest threats to Maui's watersheds and biodiversity are feral ungulates and invasive weeds. The estimated value of services that the Ko'olau watershed on Oahu loses unless protected is 7.4-14 billion dollars. The East Maui watershed is at least as valuable as the Ko'olau, as Maui relies to a great extent on surface water, and East Maui protects Hawaii's largest concentration of endangered forest birds and intact natural communities.

3. Leeward Haleakala Watershed Restoration Partnership (LHWRP) - University of Hawaii

The Leeward Haleakalā Watershed Restoration Partnership (LHWRP) is a coalition of the eleven landowners (both private and public agencies) of leeward Haleakalā volcano from Makawao to Kaupō. At its formation in 2003, LHWRP landowners and partners came together with a unified mission of collaborative watershed management of 43,175 contiguous acres of mountain watershed lands between 3,500-6,500 ft. elevation to benefit the current and future inhabitants of Maui. LHWRP's priority action items as outlined in the LHWRP Management Plan are to protect remaining native forest on leeward Haleakalā with fencing and ungulate removal, control priority habitat-modifying invasive species, develop restoration methods for regional watershed forest restoration, collect regional native seed, and implement restoration through outplanting native species.

4. Auwahi Forest Restoration Project (AFRP) - University of Hawaii

In 1997, `Ulupalakua Ranch, regional scientists, and community volunteers began a collaborative effort evaluating the potential of restoration of non-native pastoral lands back to native watershed forest at Auwahi. Watershed restoration at Auwahi forest is intended to enhance regional water resources by moderating the drastic annual fluctuations of water availability characteristic of southern Haleakalā, as well as to protect biological and cultural resources.

Over the last two decades, the Auwahi Forest Restoration Project has developed novel techniques to restore native Hawaiian watershed forests. Due to successful ecological restoration and site accessibility, Auwahi now serves as an important demonstration site for watershed forest restoration projects statewide. Auwahi is regarded by many natural resource managers as one of the most successful reforestation effort in the Hawaiian Islands. In addition, Auwahi also serves as a critical educational bridge to the Maui community and Maui schools by holding outreach events, offering guided tours, and involving the local community in forest restoration efforts at Auwahi. Monthly volunteer trips give context to Hawaiian natural history, biology, and culture and directly involve participants in the process of restoring Maui's watershed areas.

5. West Maui Mountains Watershed Partnership (WMMWP) - University of Hawaii

The West Maui Mountains Watershed Partnership (WMMWP) was created in 1998, making it the second oldest Watershed Partnership in the State. The mission of WMMWP is to protect and preserve the island's water supply through collaborative forest management—because a healthy native forest yields abundant fresh water. The priority actions undertaken includes fencing, animal control, invasive weed control, watershed and water quality monitoring, and public education. These activities have helped protect more native forest that sustain our water supply.

WMMWP manages 47,321 acres across Mauna Kahalawai. Native Hawaiian forests dominate about 33,051 acres, roughly 70 percent of this area, some of which has yet to be protected behind ungulate fence.

As such, the West Maui watershed is a key recharge area, producing 70 million gallons of water per day (MGD) of sustainable yield. This water feeds 76 percent of DWS customers, serving the Lahaina System (over 3,350 customers) and the Central and South Maui systems (over 20,260 customers). In addition, WMMWP's public outreach and education efforts have extended into the community to draw the link between healthy watersheds and our faucets.

6. Maui Invasive Species Committee (MISC) - University of Hawaii

The purpose of the Maui Invasive Species Committee (MISC) is to protect the forested watersheds of Maui and Molokaʻi from the damage caused by the invasive plant species that pose the greatest risks. Work focused on controlling miconia (Miconia calvescens), pampas grass (Cortaderia spp.), and other priority species by systematically surveying suitable habitat and treating all known plants.

Work is conducted by staff from MISC and the Molokai Invasive Species Committee (MoMISC). MISC and MoMISC are projects of the University of Hawaiʻi, Pacific Cooperative Studies Unit and receive guidance from a broad coalition of public and private partners.

7. Honokowai and Wahikuli Source Protection Program - The Nature Conservancy

The Nature Conservancy's Kapunakea Preserve on West Maui is home to Kapāloa and Honokōwai streams, and the pristine mauka headwaters of the Honokōwai and Wahikuli watersheds. Honokōwai stream has a natural median discharge of 5.4 cubic feet per second, producing on average approximately 3.5 million gallons per day of fresh water for agricultural and potentially domestic use.

The native-dominant forests of West Maui and Kapunakea Preserve act like giant sponges gradually absorbing rain, mist and fog that slowly percolate into the ground and feed our streams and ground water. Maui's native rain forests and the fresh water they capture sustain our residents, agriculture, tourism, Hawaiian culture, and world-renowned biodiversity.

8. East Molokai Watershed Partnership (EMoWP) – The Nature Conservancy:

The East Molokaʻi Watershed Partnership (EMoWP) was formed in November 1999, to protect the best remaining native forest watershed areas on the East Molokaʻi mountains. A grass roots community effort which eventually led to Moloka`i being designated an USDA "Enterprise Community (EC)", which played a key role in the formation of the partnership. The EC, also called "Ke Aupuni Lokahi" (KAL), helped kick off the partnership's first project, the Kamalo/Kapualei Watershed Project. The Nature Conservancy (TNC) Molokaʻi Program is the coordinator of the EMoWP.

Controlling threats such as hoofed animals and invasive weeds are key strategies to protecting the best remaining native forest areas and to increase vegetation to the highly denuded, eroding mid-elevation slopes and thus reducing the sedimentation rate that severely impacts the adjacent fringing reefs.

The combined landscapes of EMoWP encompass about 22,500 acres with forest ecosystems ranging from native montane wet forest at the summit (4,000' elevation and above) to montane mesic forest and shrublands (2,500'-4,000' elevation) below to dry altered lands (500'-2,500' elevation). Associated with the landscape is Moloka'i's south shore fringing reef (includes the east slope reefs), the longest continuous fringing reef in the United States.

9. Pu'u Kukui Watershed (PKW) – Tri-Isle Resource Conservation and Development Council:

The Pu'u'kukui Watershed Preserve is a significant source of water for Maui residents, farmers and commerce. Pu'u'kukui, the summit of Mauna Kahalawai (West Maui Mountains) is one of the wettest places on Earth averaging over 360 inches annually, second only to Mount Wai'ale'ale in the state of Hawaii. The primary source of water for the Mahinahina Water Treatment Plant originates in the Pu'u Kukui Watershed; currently the plant produces 2.4 million gallons per day. This watershed is a vast catchment that recharges the aquifer and ensures an adequate supply of water is available for agricultural and domestic uses from Mahinahina Water Treatment Plant and proposed county wells.

The 8,600-acre preserve was established by Maui Land & Pineapple Co. in 1988 to protect this vital watershed. In 1992, Pu'u Kukui Watershed (PKW) began management programs in partnership with The Nature Conservancy of Hawai'i (TNCH) and entered an agreement with the State of Hawai'i as a participant in the Department of Land & Natural Resources (DLNR) Natural Area Partnership Program (NAPP). Presently, PKW manages over 8,600 acres within this preserve.

10. Hawaii Agriculture Research Center (HARC):

Hawaii Agriculture Research Center (HARC) is a nonprofit organization with a long history of providing technical assistance to Hawaii's agricultural and natural resource sectors. HARC works extensively with koa due to its importance as a key stone native forest tree species and watershed health. In Hawaii, koa (*Acacia koa*) is a valuable tree species economically, ecologically, and culturally.

With major land use change and declines in sugarcane, pineapple, and cattle production, there is an opportunity and keen interest in utilizing native koa in reforestation and restoration efforts, especially in watershed rehabilitation. HARC, in collaboration with the USDA-Forest Service, has developed a screening protocol that can quickly assess koa seedlings for resistance to koa wilt. Specifically, HARC's methods are used to identify resistant koa seed sources for use in watershed restoration and reforestation on Maui. HARC has worked with the Department of Water Supply since 2012 to develop a network of sites on Maui to establish wilt resistant koa seed orchards in multiple eco-regions.

TASKS COMPLETED FOR FISCAL YEAR 2017

UNGULATE CONTROL

EMWP - 7.4 miles of fence checked quarterly; minor repairs made as necessary; additional traps completed in Upper Hana Forest Reserve which protects an additional 3,000 acres, existing transects checked, ungulate presence remained at near zero levels since 2009

WAIKAMOI - 19 miles inspected/ maintained (5 fence repairs); 298 miles scouted- 0 hunt; >1800 traps checked -no activity in the Waikamoi Preserve since 2014; 3.4 mile fence checked Deer Management Units (DMU) 3 hunts

LHWRP - 13.52 miles of fence inspected quarterly; no breaches of major repairs required; remaining 215 ac koa forest at Kaupo Ranch protected

WMMWP - Inspected 28,031 meters (17.4 miles) of fence; 649 meters of fence were maintained; checked 3,626 traps; 269 removed; 24 transects read, fresh signs were recorded; DWS provided $80,000 in supplemental funding due to storm damages - WMMWP was able to repair 275 meters of fence and extracted ~150 meters of old fence

HONOKOWAI AND WAHIKULI - Inspected ~1800 meters of fence 5 times; 3 repairs done; 595 meters of fence rebuilt; 240 miles scouted; ~938 traps inspected multiple times; 200 ineffective traps removed; 2 transects (6.2 miles) monitored; no ungulate sign recorded; (additional 595 meters - 8 feet-fence installed using other funder's grant

PKW - 2,031 meters (~1.26 miles) of fence installed; 17,757 meters of fence checked and repaired as needed; 2,331 traps checked, 141 pigs removed

EMoWP - 63 sweeps, 13.31 miles surveyed - 1,965 ungulates removed

INVASIVE/WEED CONTROL

EMWP - 4997 acres - weeds removed or treated with herbicides across 4997 acres -. Emphasis was on aggressive control of Himalayan ginger on Koolau Gap unit; priority weeds regularly controlled along fence lines and on trails to prevent their spread

WAIKAMOI - ~77 acres swept for Himalayan ginger (2301 sq. meters removed); 4479 pines removed across 60-acre/380 remote pines aerially spot treated; 240 sq m gorse treated; 1,948 acacia trees treated

LHWRP - Controlled bocconia and pines across 927 acres

AFRP - Conducted systematic priority invasive species sweeps in and around Auwahi restoration areas

WMMWP - HBT - 27 targets were treated; ground survey- 61.38 acres, 3650 plants controlled

MISC - 45,234 acres surveyed, 39,677 invasive plants removed on Maui and Molokai

HONOKOWAI AND WAHIKULI - 50 acres surveyed for weeds; 1,184 invasive plants treated/removed; no incipient weeds detected

PKW - 49.8 acres surveyed, 4,620 plants removed; 2 transects completed

EMoWP - 11,406 acres surveyed; removed over 35,000 plants

REVEGETATION

WAIKAMOI - 62 rare species planted

LHWRP - Over 72M native seeds were scattered and 5,855 seedlings were planted at Nu'u Mauka Ranch

AFRP –Planted 3,496 natives; gathered and processed seeds for distribution to native plant propagators - seedlings available for outplanting in 12-18 months; collected 58 pounds of seeds from 13 native forest species

PKW - Volunteer trips conducted include native tree planting, forest restoration projects, invasive species removal, cultural workshops and trip to the summit; 6,467 native plants were planted (2.5 acres) in less than half a day at the "Plant 1,000 Canoes" event; in partnership with LHWRP and WMMWP, planted 5,000 native seedlings at the Preserve

EMoWP - Planted ~500 natives

HARC – Over 1,400 koa seedlings were distributed for restoration planting on the leeward slopes of Haleakala Crater to project partners

RESOURCE MONITORING

WAIKAMOI - Maintained and reads in-stream automated water quality monitoring device that measures turbidity and temperature in Waikamoi Stream (5X during the grant period); UHERO contract to quantify ROI on watershed management ongoing

LHWRP - Worked with the College of Tropical Agriculture and Human Resources (CTAHR) to install two climate monitoring stations at Nu'u Mauka Ranch; identified field site with USGS to conduct hydrologic studies at Ulupalakua Ranch to compare invasive and koa forest

WMMWP - Continue to observe forest health and monitor for early detection and response

HONOKOWAI AND WAHIKULI - Six additional transects stations were added, transects were monitored twice for ungulate sign and presence of weeds; vegetation plots were read

PKW - Checked 3 rain-gauges monthly in collaboration with USGS; participated in rare species protection project in coordination with other agencies

EMoWP - USGS reestablished Kawela stream flow gauging station and recording flow; documented all activities

HARC - Outbreak of koa rust and rat damage at the Mahanalua site, affected trees were removed from the site; monitoring for acacia rust and rat trapping are ongoing; first significant koa crop was harvested during the summer & fall of 2017 and Mahanalua site which represents a new improved disease resistant population of koa for windward Haleakala sites

COMMUNITY OUTREACH

EMWP – 26 presentations at K-12 schools and community groups, participated in 11 community events, led 17 hikes withK-12 schools and community groups and made 45 media releases for print and digital publication.

WAIKAMOI - 62 hikes conducted; 10 volunteer trips; 4 events; 1 presentation; over 1,000 people engaged

LHWRP - 7 group meetings/ presentations/events; conducted 4 volunteer work days for seedball making and pine control; 1,766 people reached

AFRP - 15 volunteer restoration trips; 299 volunteers contributed 2,238 hours; gave 11 public presentations on Hawaiian natural history, value of Maui's native watershed forests and responsibility as a community to protect and restore forests; 3 educational presentations; conducted 7 guided educational tours

WMMWP - 72 Facebook posts - 13,106 page views; website, 6,818 sessions; 54 Instagram posts with 362 followers; 8 presentations /4 water story (99 participants /students); 5 events - interacted with 392 people

MISC - conducted 34 school-based activities; 2 hikes; 2 presentations; 1 event with 2,622 students/participants

PKW - 12 rain gauge hikes; 98 volunteer service trips, 3,441 volunteers (volunteer groups were from Polynesian Voyaging Society, Mayor's Office, Kaanapali Beach Hotel, Andaz, Kamehameha Schools of Maui, etc); 5 events

EMoWP – several meetings, conducted 13 hikes, 552 volunteers/participants

HARC - presentation on "Expanding the Koa Network: An Eco-regional Approach to Deploying Disease Resistant Acacia Koa in Hawaii

WHAT COULD BE DONE IF THERE WERE MORE FUNDS

- Increased monitoring for and rapid response to Rapid Ohia Death Fungus, which could quickly decimate the function of East Maui's watershed and has reached the Kohala District of Hawaii island and could potentially spread by wind to East Maui.
- Increased monitoring along the fences.
- Speed the pace of ungulate Removal in the uppermost elevations of Hana Forest Reserve.
- Expand network of ungulate control scouting trails, with priority near unfenced natural barriers.
- Increased ability for rapid response to any storm related damage or observed ungulate activity.
- Increased monitoring below fences, potentially laying the groundwork for additional watershed protection projects above East Maui's water collection infrastructure.
- Expand efforts to map and control outlier populations of Himalayan ginger and invasive *Pinus* species, both of which pose an enormous threat to the health of our watershed. Recently discovered "outlier" populations of Himalayan ginger (i.e., found in unexpected areas beyond the "core" ginger population), that if left unchecked, could serve as points of expansion and spread that could impact thousands of acres of healthy watershed lands that are currently ginger-free
- Control the most invasive species of pines, with a concerted effort on pushing back their expansion into pristine subalpine habitat and forest where healthy East Maui stream headwaters lie.
- Promote and enhance wildfire preparedness and planning and implement the West Maui Community Wildfire Protection Plan to protect watershed resources.
- Create a nursery for out-plantings to rehabilitate fire scars and restore eroded areas.
- Increased aerial surveillance is needed for both miconia and pampas grass. Reduced helicopter budgets, especially due to decreased federal support, have resulted in decreased acreage covered compared to past years. The development and growth of nascent populations is likely to occur as a result of decreased surveillance.
- Payroll costs need to increase to ensure retention of highly trained staff, especially for field positions. Partnerships are losing staff to better paid job opportunities.
- Increased funding would allow additional screening of Maui koa populations for resistance to wilt. It would also allow for more orchards to be established and for the orchards to include more families. Additional families would improve the likelihood of finding families with a combination of multiple traits of commercial importance. Further, additional native forest species, such as sandalwood could be included in the seed for production areas.

CONSEQUENCES OF REDUCED FUNDING

A decrease or loss of funding would greatly impact not only the partnerships' our ability to get the work done, but also our ability to leverage funding from other sources. Even more devastating would be a reduction in our fence or ungulate trap check schedule – reducing our presence on our fencelines would result in pig and/or deer ingress into the watershed, losing the progress that partnerships have worked for decades to achieve and damaging vital watershed and healthy forest.