The Rain Follows The Forest

A Plan to Replenish Hawaii's Source of Water

January 8, 2014

HISC Briefing

Photo: Air Maui

Hawaii's Water Supply is at Risk

- Long-term decline in rainfall and streamflows
- Hotter temperatures and more drought
- Half of Hawaii's native forests lost


`ohia – to gather

Solution

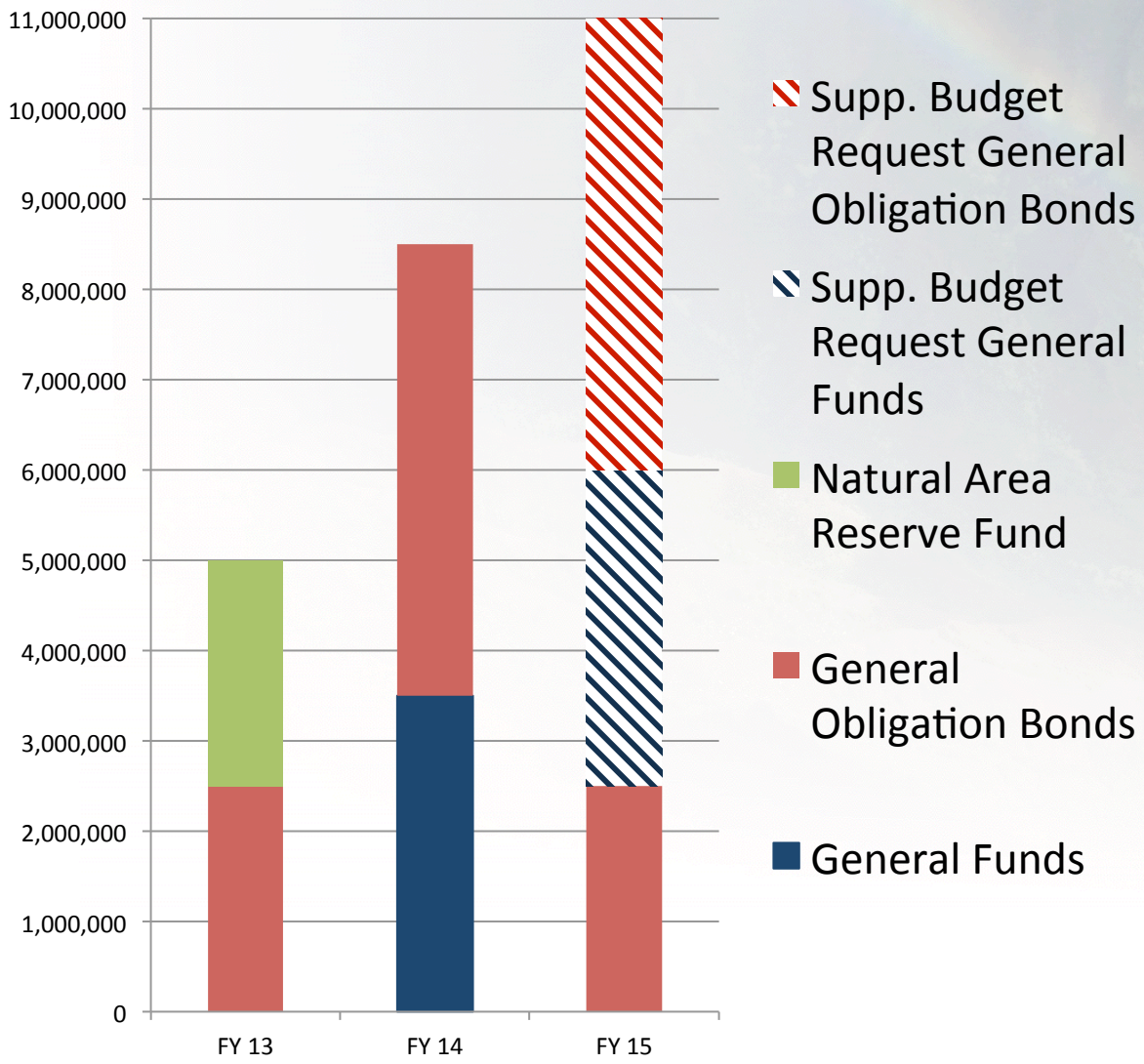
- Native forests can increase water capture by up to 50% over rainfall by collecting cloudwater and reducing erosion

Department of Land and Natural Resources
State of Hawai'i

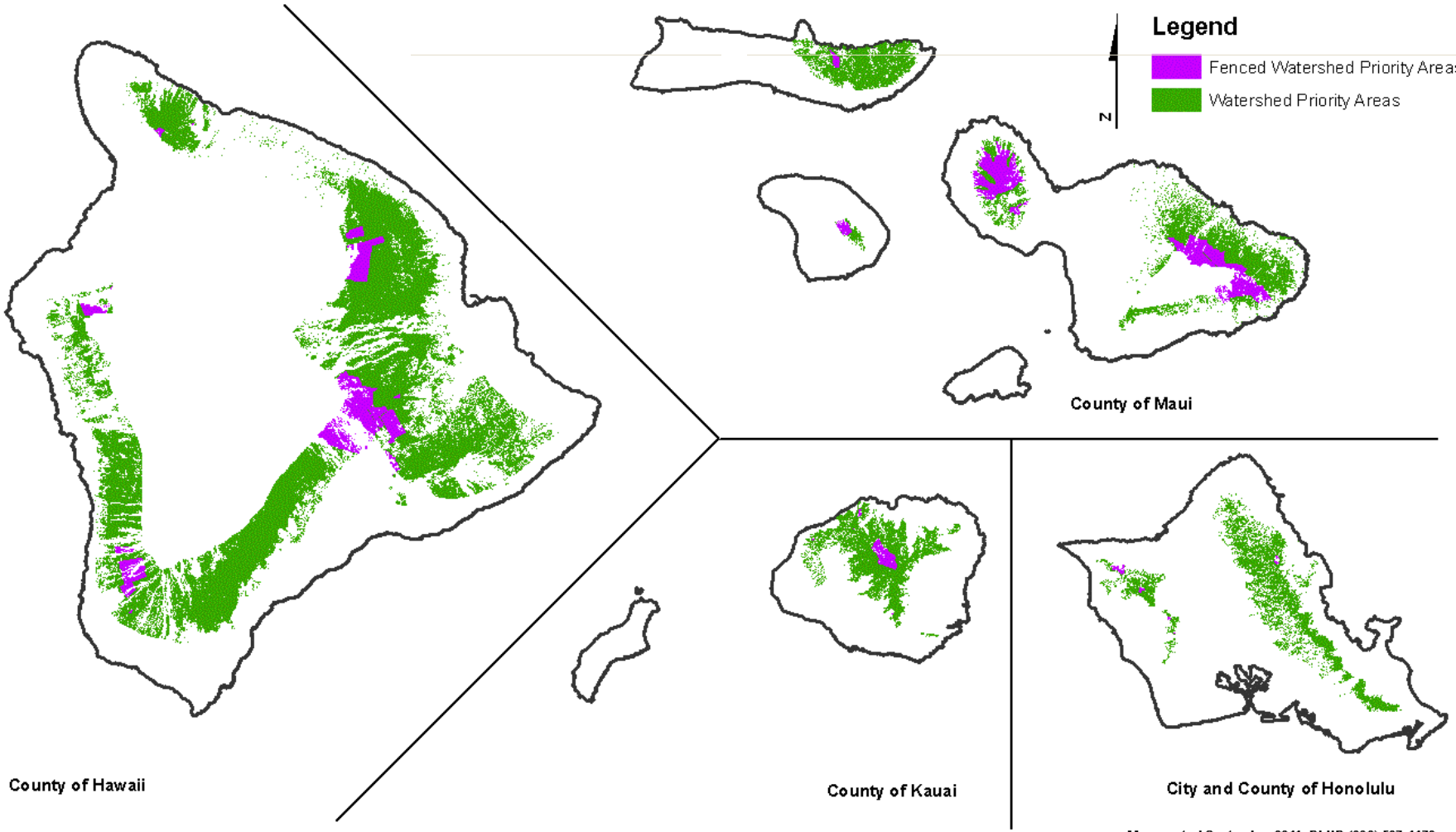
Action Plan

- DLNR's Goal
  - Double acreage protected in next 10 years
  - Requires investment of approximately $11 million per year
  - Fund approximately 150 FTE natural resource careers
  - This level of effort, or more, needed in perpetuity to stabilize Hawaii's water source

State Legislative Funding

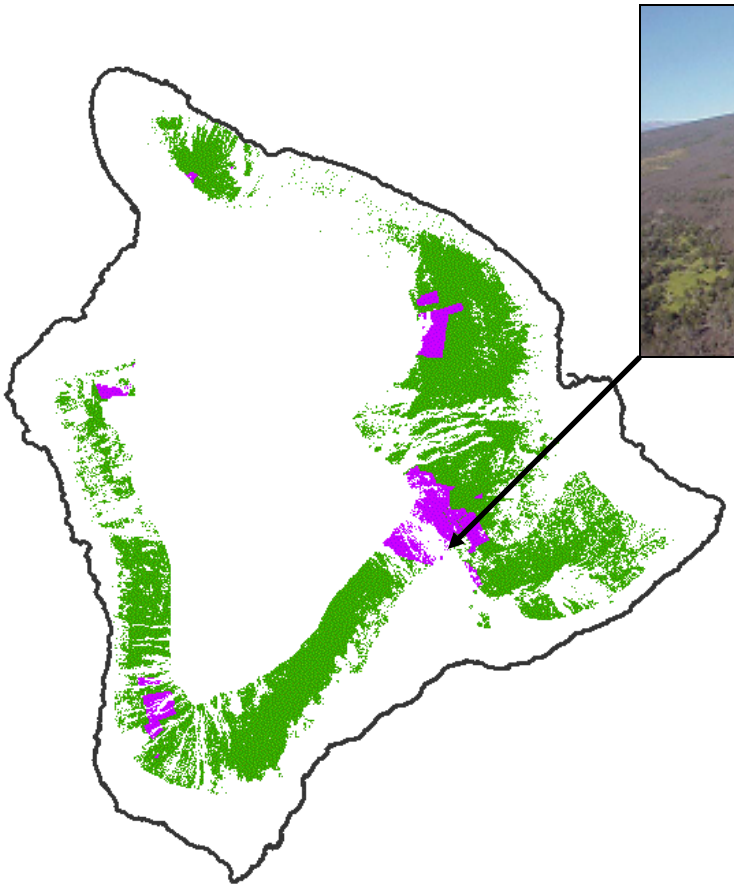


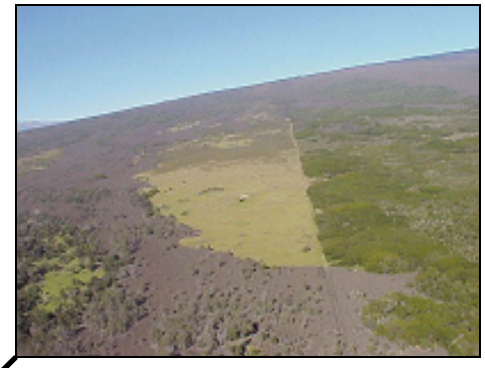
Watershed Priority Areas

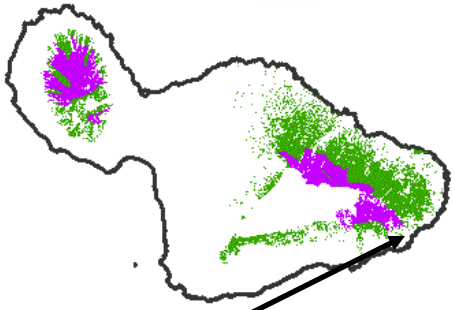


Map created September 2011. DLNR (808) 587-4170.

Watershed Priority Areas



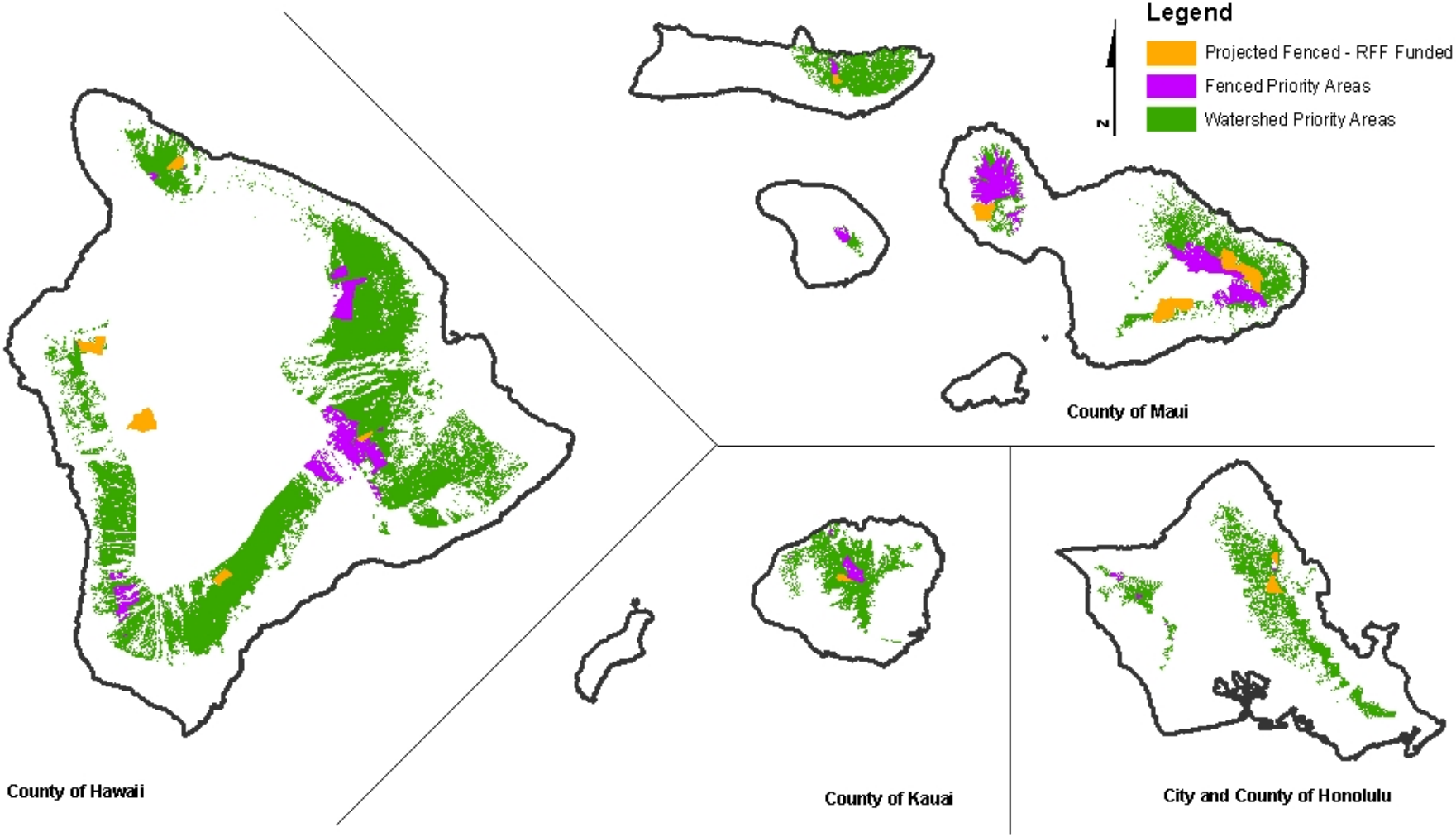




Legend

- Fenced Watershed Priority Areas
- Watershed Priority Areas

Watershed Priority Areas

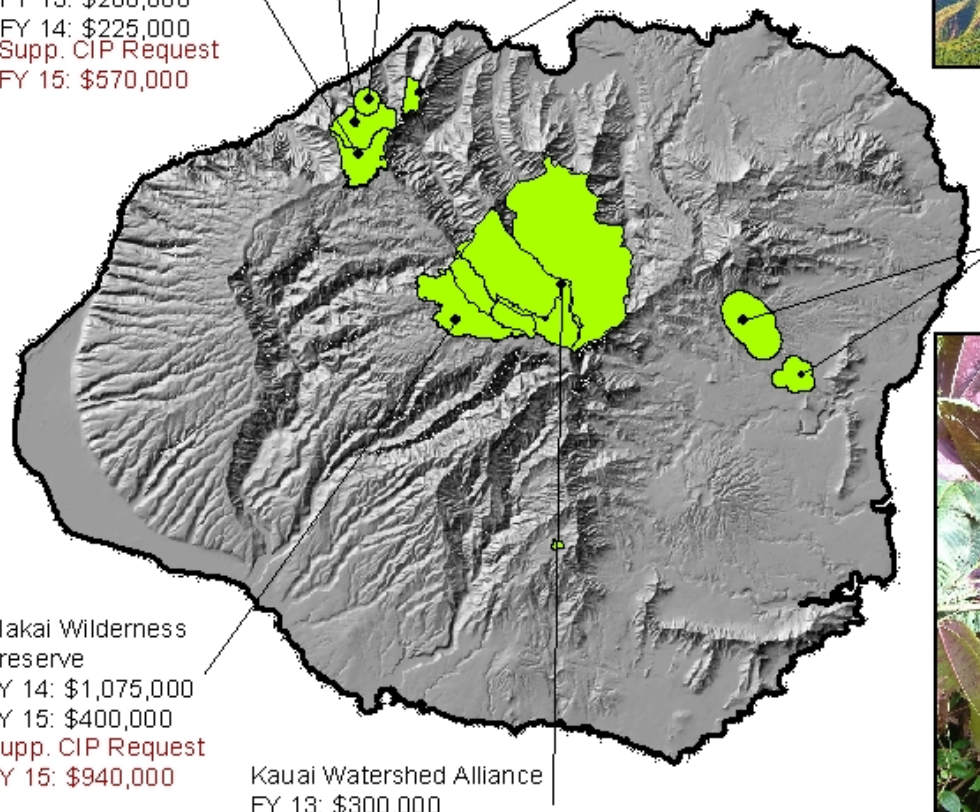


Kauai Watershed Projects
Fiscal Years 2013-2015

"The Rain Follows the Forest" initiative is working to ensure fresh water is available by protecting our forests. Hawaii's forests collect rain and fog, providing water for human use. Forests also prevent erosion that muddies beaches and reefs, and harbor unique plants and wildlife.

Fence construction, Alakai Wilderness Preserve

Invasive weed control, Hono O Na Pali Natural Area Reserve



Kauai Invasive Plant Control
FY 14: $50,000

Kauai Natural Area Reserves
FY 14: $95,000

Upper Limahuli Preserve
FY 14: $15,000

Hono O Na Pali Natural Area Reserve
FY 13: $200,000
FY 14: $225,000
Supp. CIP Request
FY 15: $570,000

Kauai Invasive Species Committee
FY 14: $30,000

Alakai Wilderness Preserve
FY 14: $1,075,000
FY 15: $400,000
Supp. CIP Request
FY 15: $940,000

Kauai Watershed Alliance
FY 13: $300,000
FY 14: $295,000

Hono O Na Pali Natural Area Reserve

Miconia control, Wailua

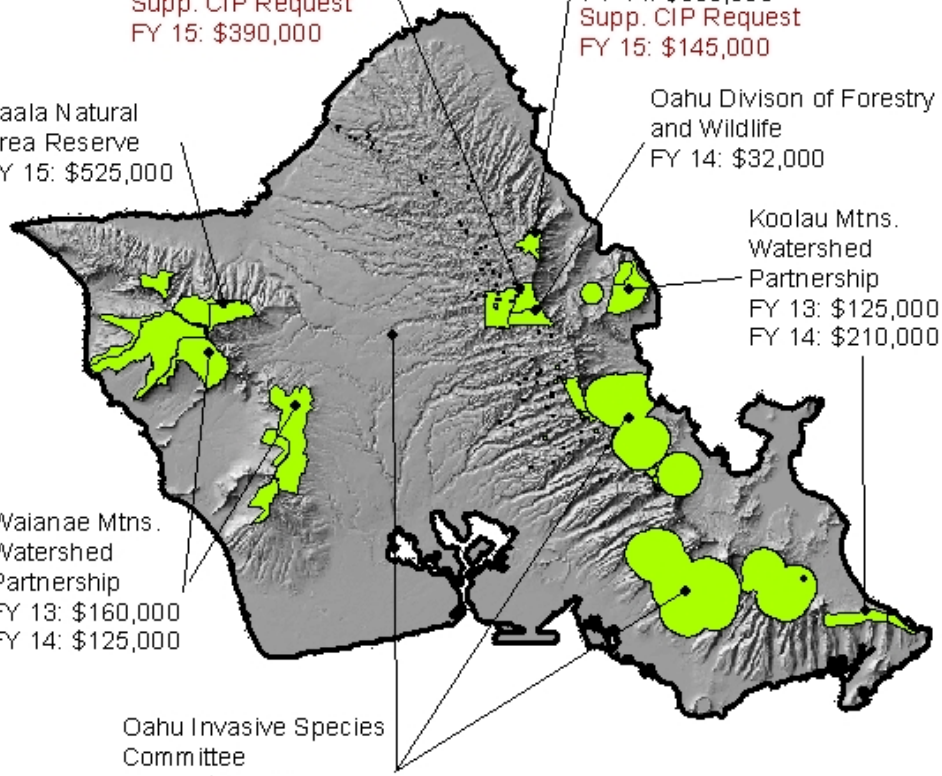
Features are subject to change. October 2013. (808) 587-4170.

Oahu Watershed Projects
Fiscal Years 2013-2015

"The Rain Follows the Forest" initiative is working to ensure fresh water is available by protecting our forests. Hawaii's forests collect rain and fog, providing water for human use. Forests also prevent erosion that muddies beaches and reefs, and harbor unique plants and wildlife.

Outplanting native species, Waianae Mtns. Watershed Partnership

Fence construction, Kaluanui Natural Area Reserve



Removing invasive weeds, Koolau Mtns. Watershed Partnership

Surveying invasive weeds, Oahu Invasive Species Committee

Features are subject to change. October 2013. (808) 587-4170.

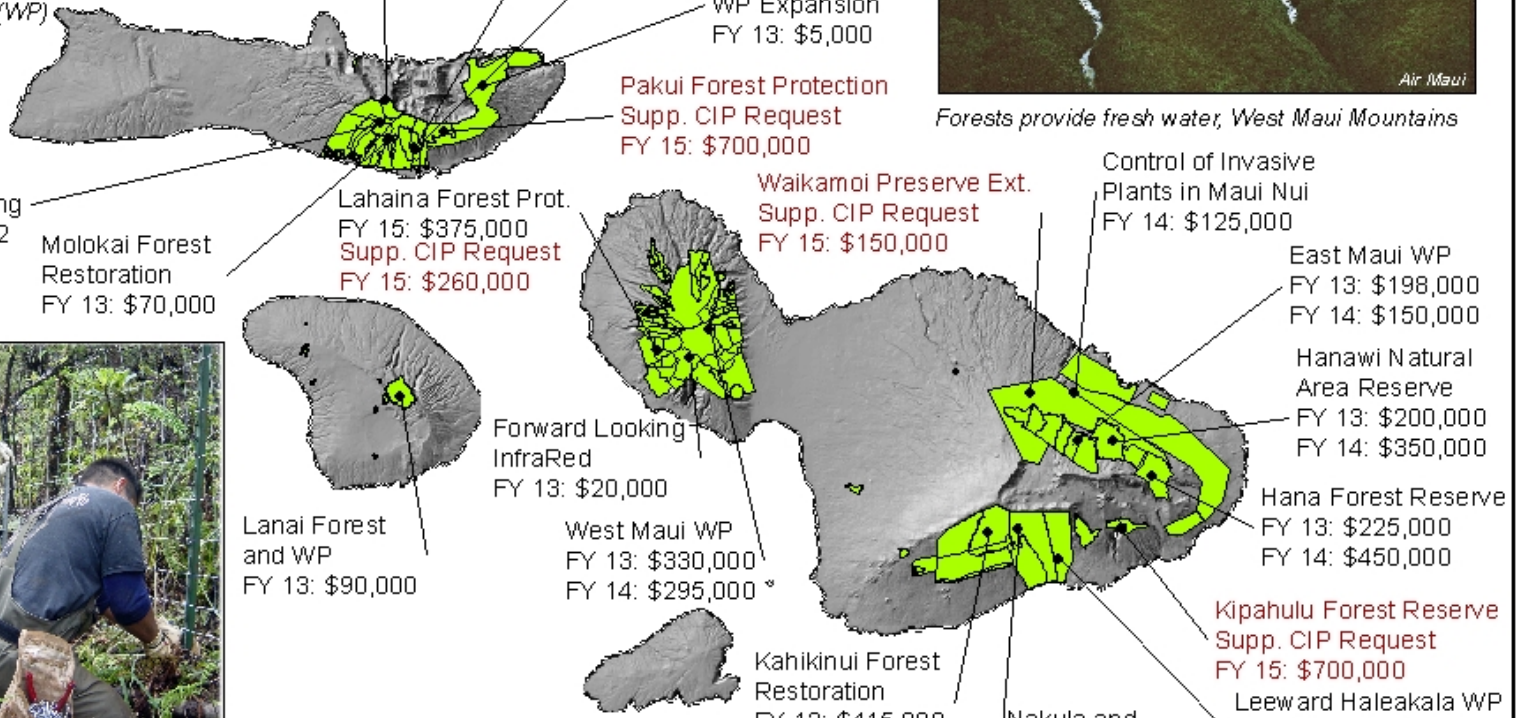
Maui County Watershed Projects
Fiscal Years 2013-2015

"The Rain Follows the Forest" initiative is working to ensure fresh water is available by protecting our forests. Hawaii's forests collect rain and fog, providing water for human use. Forests also prevent erosion that muddies beaches and reefs, and harbor unique plants and wildlife.

Volunteers planting trees, Leeward Haleakala Watershed Partnership (WP)

Forests provide fresh water, West Maui Mountains

Fence construction, Hana Forest Reserve



Puu Alii Natural Area Reserve
FY 15: $350,000
Supp. CIP Request
FY 15: $250,000

N. Shore Strategic Fencing
Supp. CIP Request
FY 15: $100,000

East Molokai WP
FY 13: $25,000
FY 14: $150,000

East Molokai WP Expansion
FY 13: $5,000

Pakui Forest Protection
Supp. CIP Request
FY 15: $700,000

Kamakou and Kahikinui Fencing
FY 14: $120,562

Molokai Forest Restoration
FY 13: $70,000

Lahaina Forest Prot.
FY 15: $375,000
Supp. CIP Request
FY 15: $260,000

Waikamoi Preserve Ext.
Supp. CIP Request
FY 15: $150,000

Control of Invasive Plants in Maui Nui
FY 14: $125,000

East Maui WP
FY 13: $198,000
FY 14: $150,000

Hanawi Natural Area Reserve
FY 13: $200,000
FY 14: $350,000

Hana Forest Reserve
FY 13: $225,000
FY 14: $450,000

Kipahulu Forest Reserve
Supp. CIP Request
FY 15: $700,000

Leeward Haleakala WP
FY 13: $185,000
FY 14: $190,000

Nakula and Kahikinui Reserves
FY 14: $105,000

Kahikinui Forest Restoration
FY 13: $415,000
FY14: $565,000

Forward Looking InfraRed
FY 13: $20,000

West Maui WP
FY 13: $330,000
FY 14: $295,000

Lanai Forest and WP
FY 13: $90,000

Features are subject to change. December 2013. (808) 587-4170.

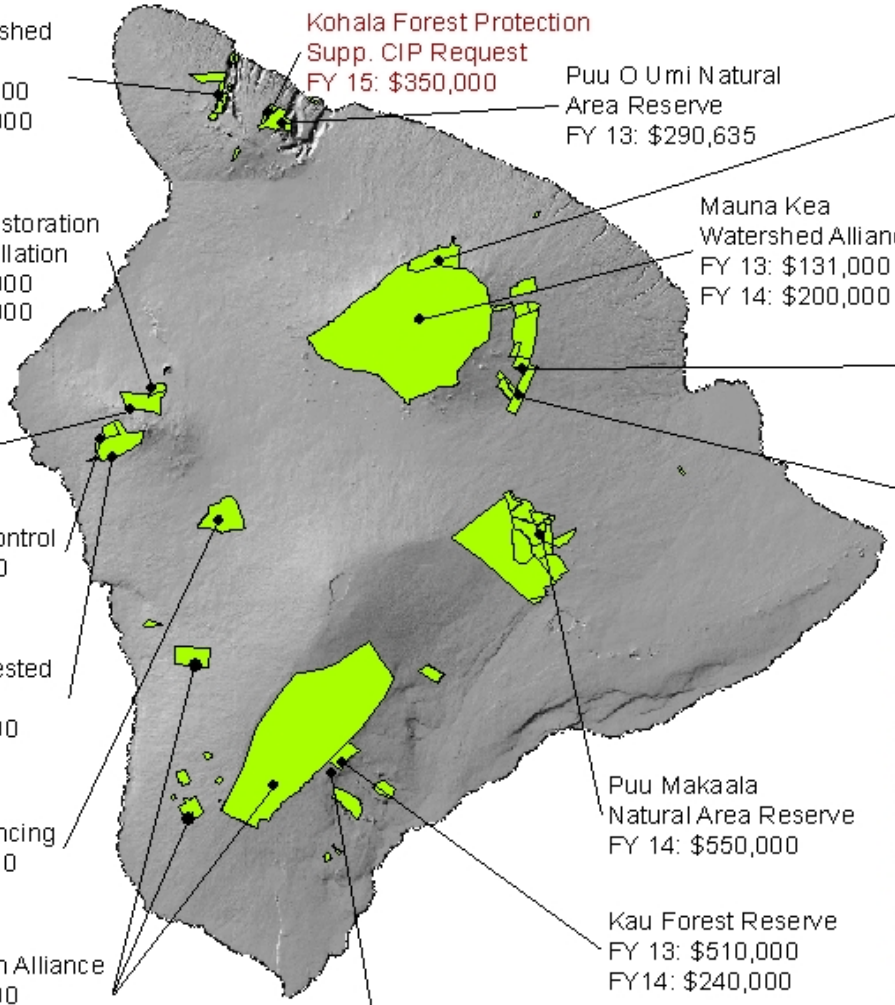
Hawaii Island Watershed Projects
Fiscal Years 2013-2015

The watershed initiative is working to ensure fresh water is available by protecting our forests. Hawaii's forests collect rain and fog, providing water for human use. Forests also prevent erosion that muddies beaches and reefs, and harbor unique plants and wildlife.

Fence construction, Puu O Umi Natural Area Reserve

Invasive weed control, Kohala Watershed Partnership

Planting koa, Mauna Kea Forest Restoration Project



Kohala Watershed Partnership
FY 13: $115,000
FY 14: $226,000

Kohala Forest Protection
Supp. CIP Request
FY 15: $350,000

Puu O Umi Natural Area Reserve
FY 13: $290,635

Mauna Kea Forest Restoration Project
FY 13: $200,000
FY 14: $100,000
FY 15: $100,000
Supp. CIP Request
FY 15: $100,000

Puu Waawaa Henahena Restoration & Fence Installation
FY 14: $450,000
FY 15: $250,000

Mauna Kea Watershed Alliance
FY 13: $131,000
FY 14: $200,000

Waipahoehoe Forest Protection
Supp. CIP Request
FY 15: $525,000

Puu Waawaa Fencing
FY 13: $37,000

Hilo and Honuaula Forest Reserves
FY 15: $500,000
Supp. CIP Request
FY 15: $100,000

Feral Cattle Control
FY 13: $40,000

Protecting Forested Watersheds
FY 14: $125,000

Puu Makaala Natural Area Reserve
FY 14: $550,000

North Kona Fencing
FY 13: $100,000

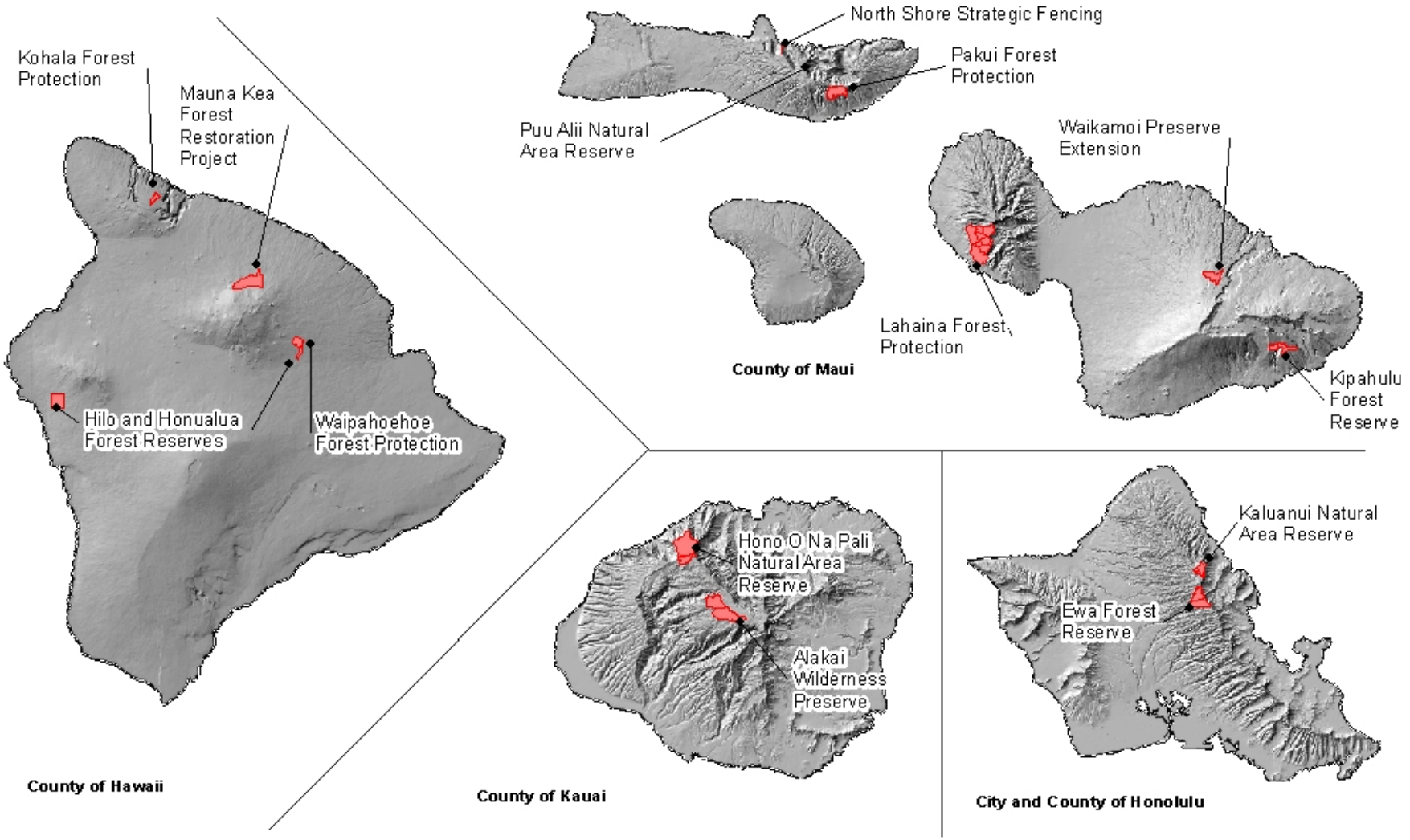
Kau Forest Reserve
FY 13: $510,000
FY14: $240,000

Three Mountain Alliance
FY 13: $180,000
FY 14: $280,000

Ungulate Control
FY 14: $7,000

Features are subject to change. December 2013 (808) 587-4170.

Supplemental Budget Request
Capital Improvement Project
Watershed Projects FY 15



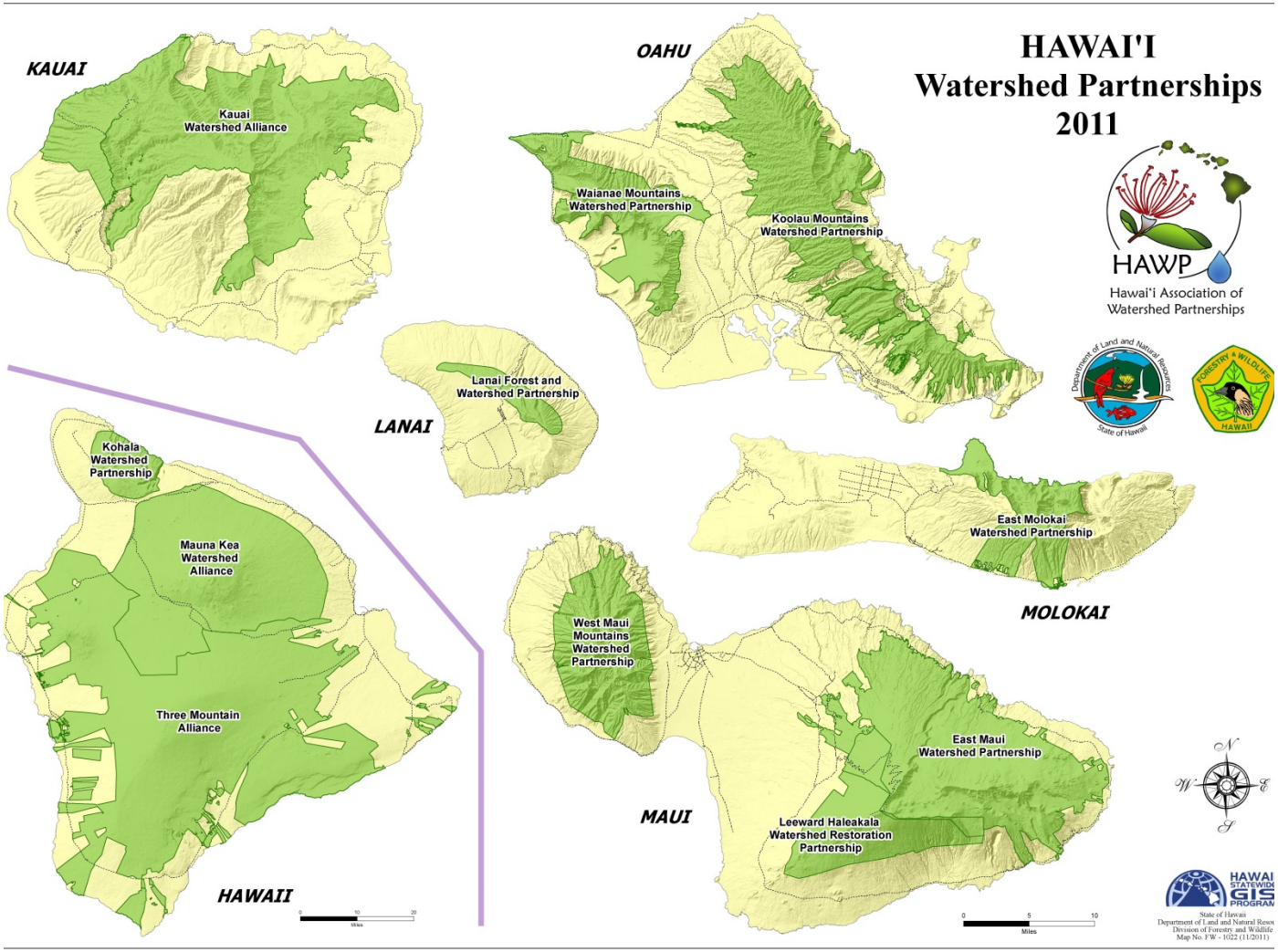
Features approximate and subject to change. October 2013 - DOFAW - 587-4170.

South Slope of Molokai, November 2001
Photo: USGS

Before and after pig removal, Pu`u Maka`ala Natural Area Reserve
Photo: T. Rubenstein


WASHINGTON

Invasive Species Control by Hawaii's Watershed Partnerships



11 Voluntary public-private associations

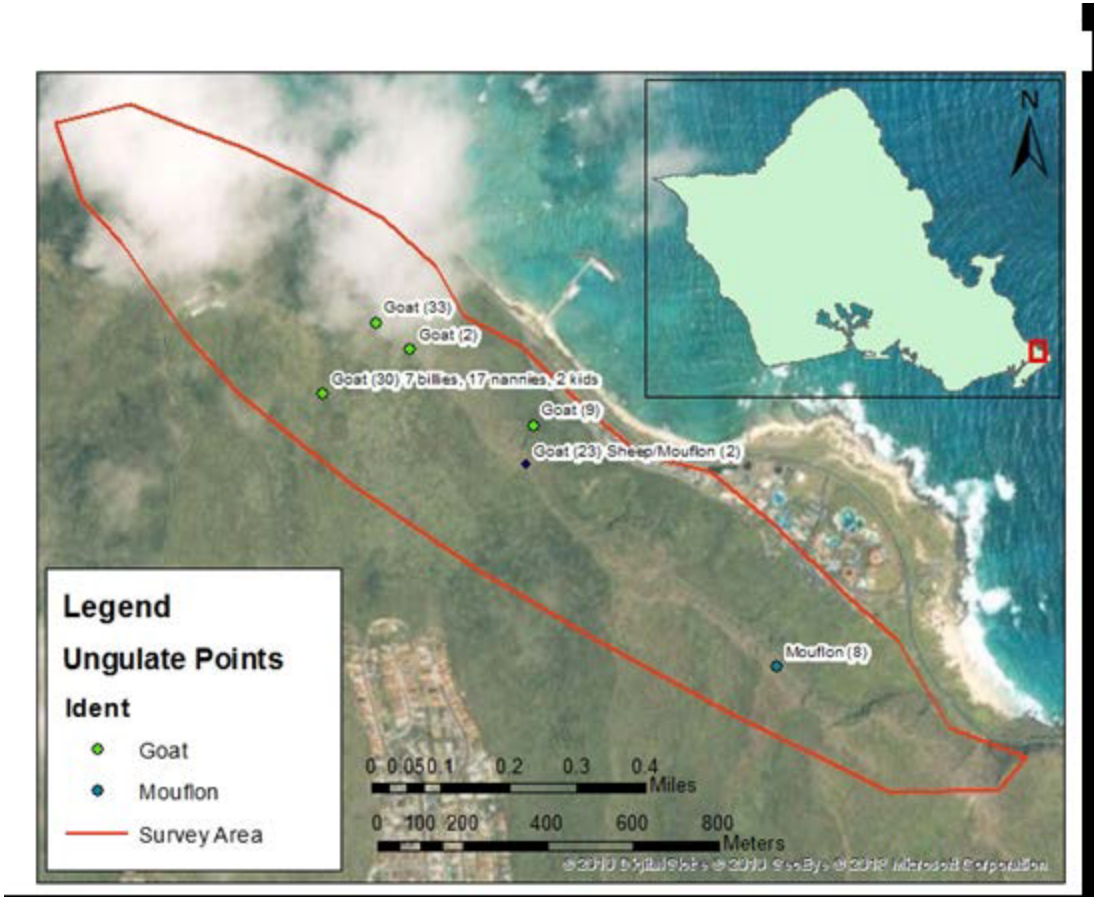
- Every major mountain top
- 2 million acres statewide
- 70 Landowning partners

Focus: Control of Established Pests

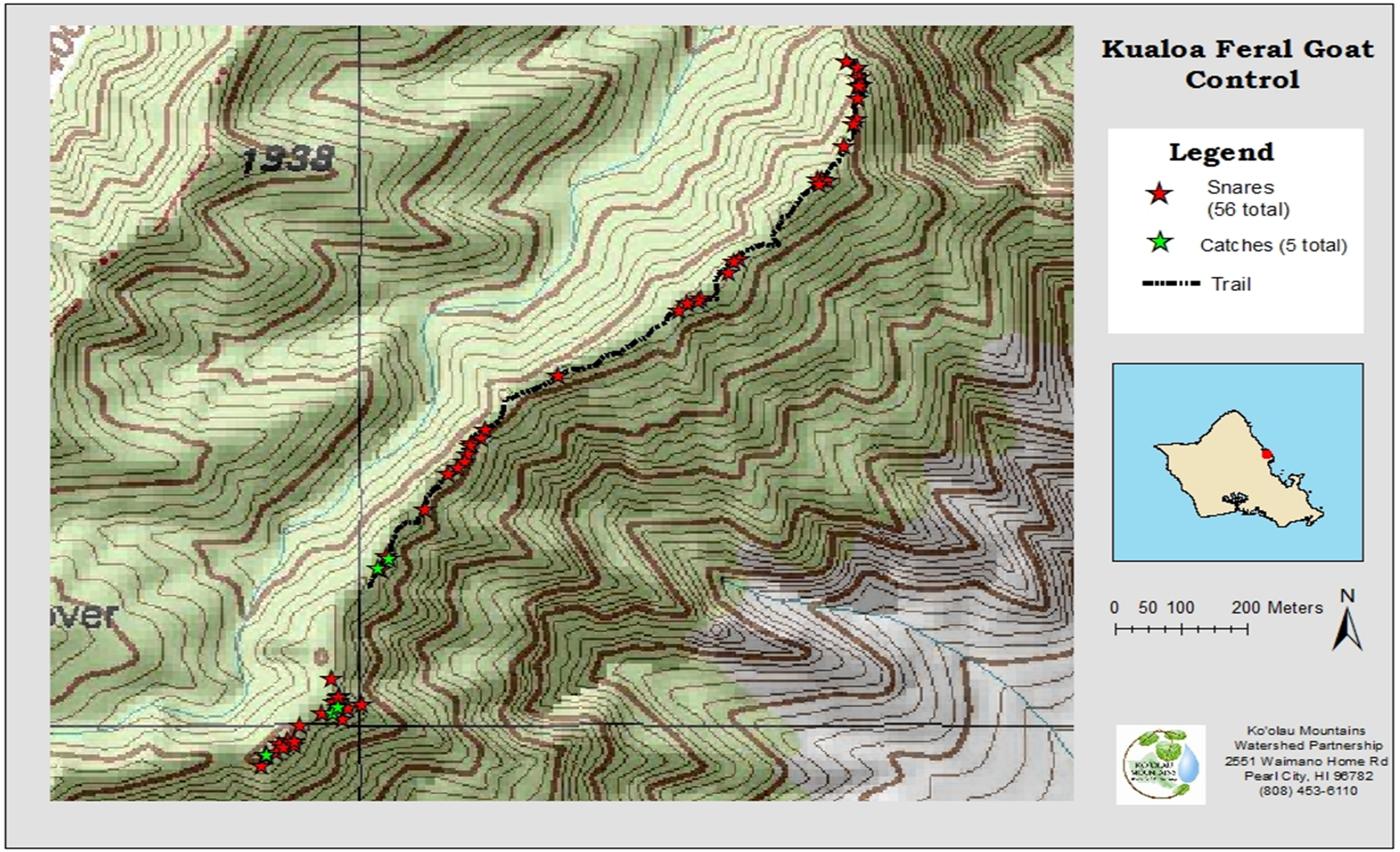
Assist with:

- Surveys
- Early detection
- Rapid response

Eradication of Incipients-
Goats in Waimanalo



Eradication of Incipients- Goats in Kualoa



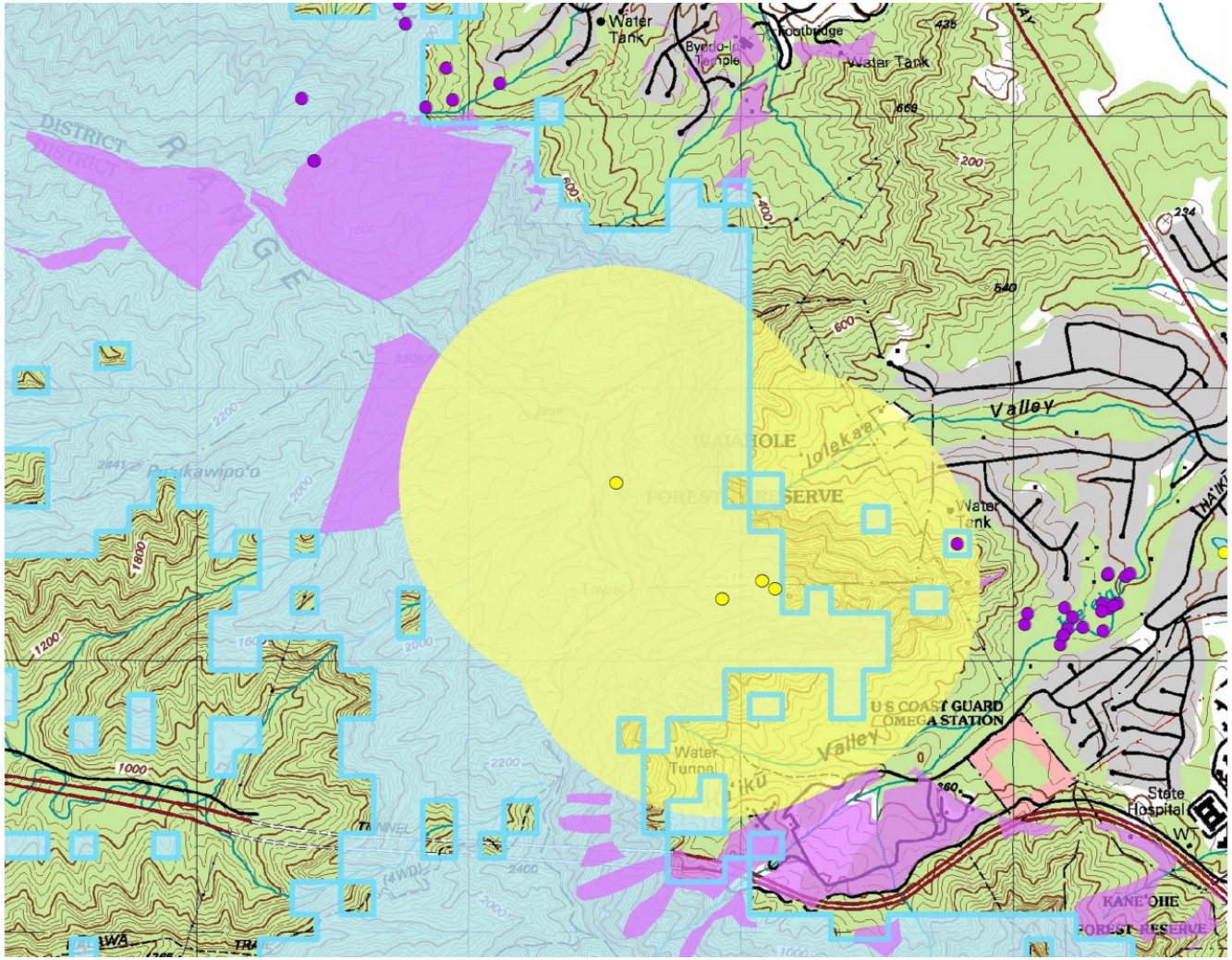
Eradication of Incipients- Axis Deer on Big Island

Tibouchina on Oahu

Pampas grass on Oahu and Maui

Regional Containment

Gorse



Regional Containment

Miconia

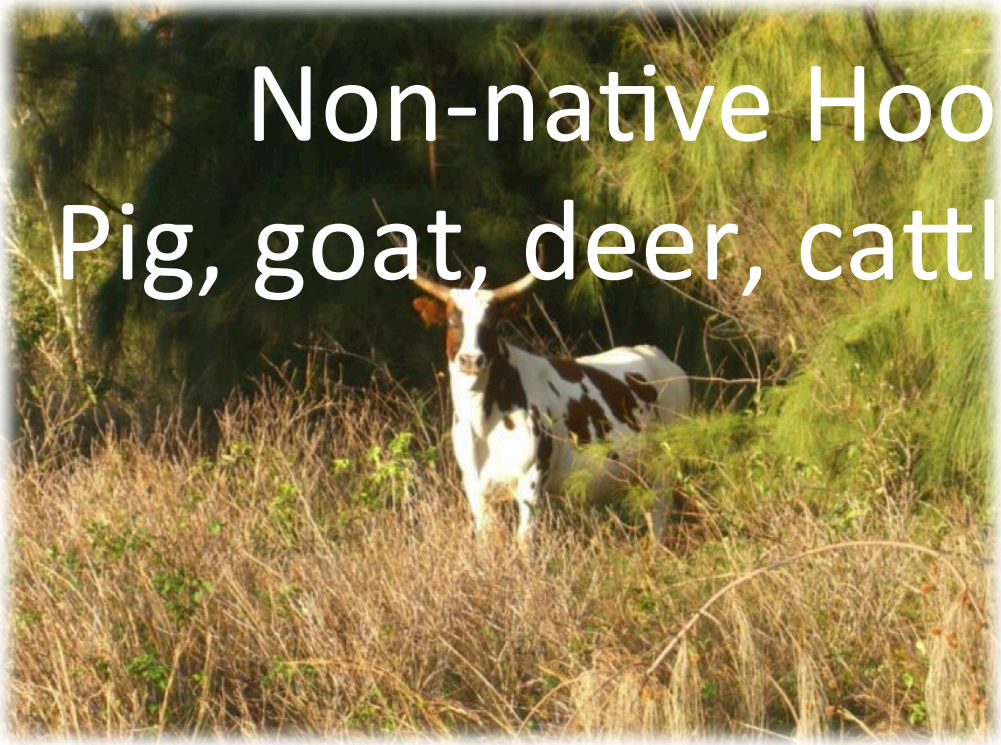
Protect High Value Areas

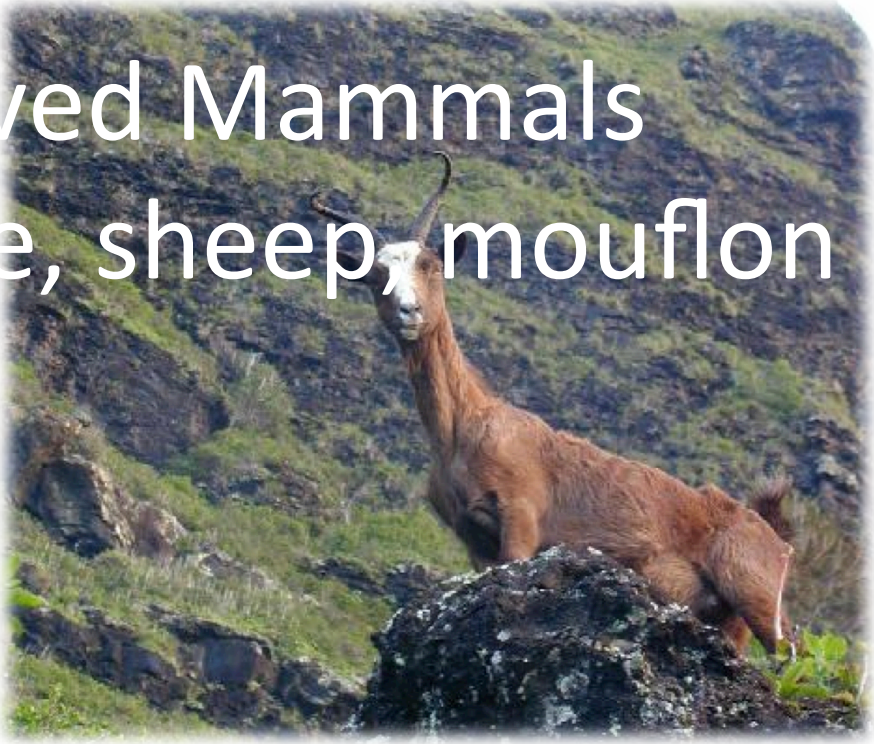
Step 1 FENCING

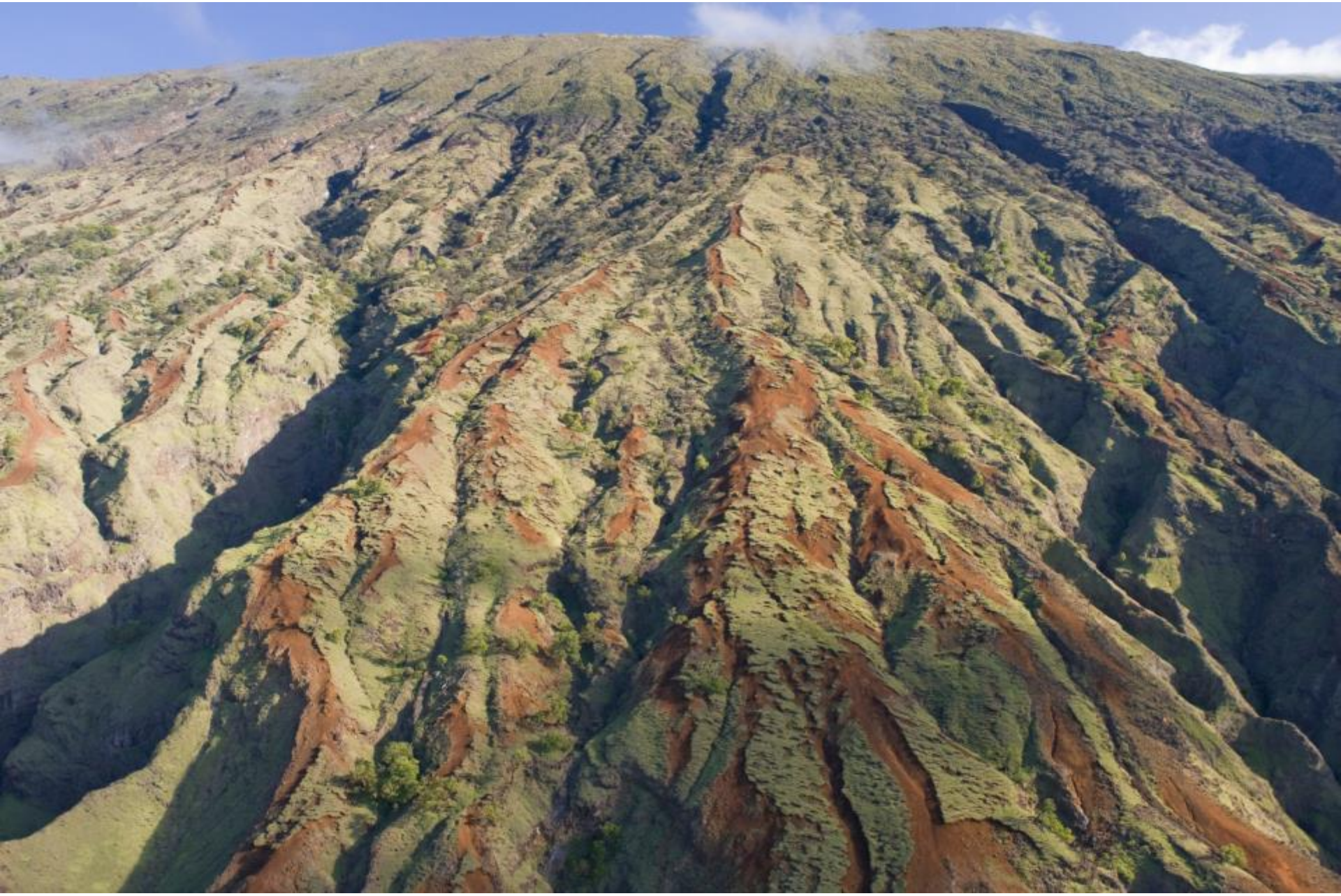
Step 2 Remove Invasive Animals

Step 3 Control Habitat Modifying Weeds

Non-native Hooved Mammals
Pig, goat, deer, cattle, sheep, mouflon







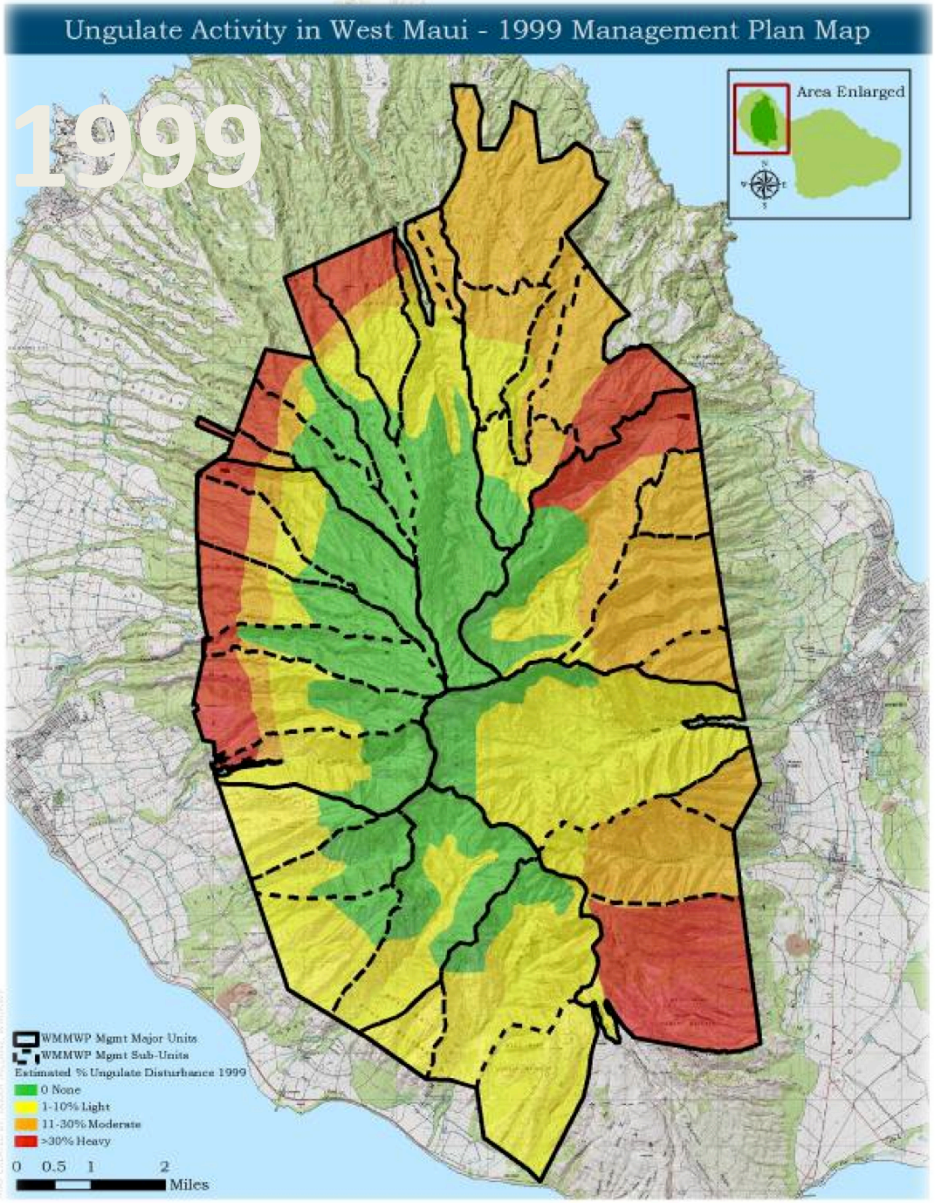
Ungulates Dispatched by Year WMMWP Wide

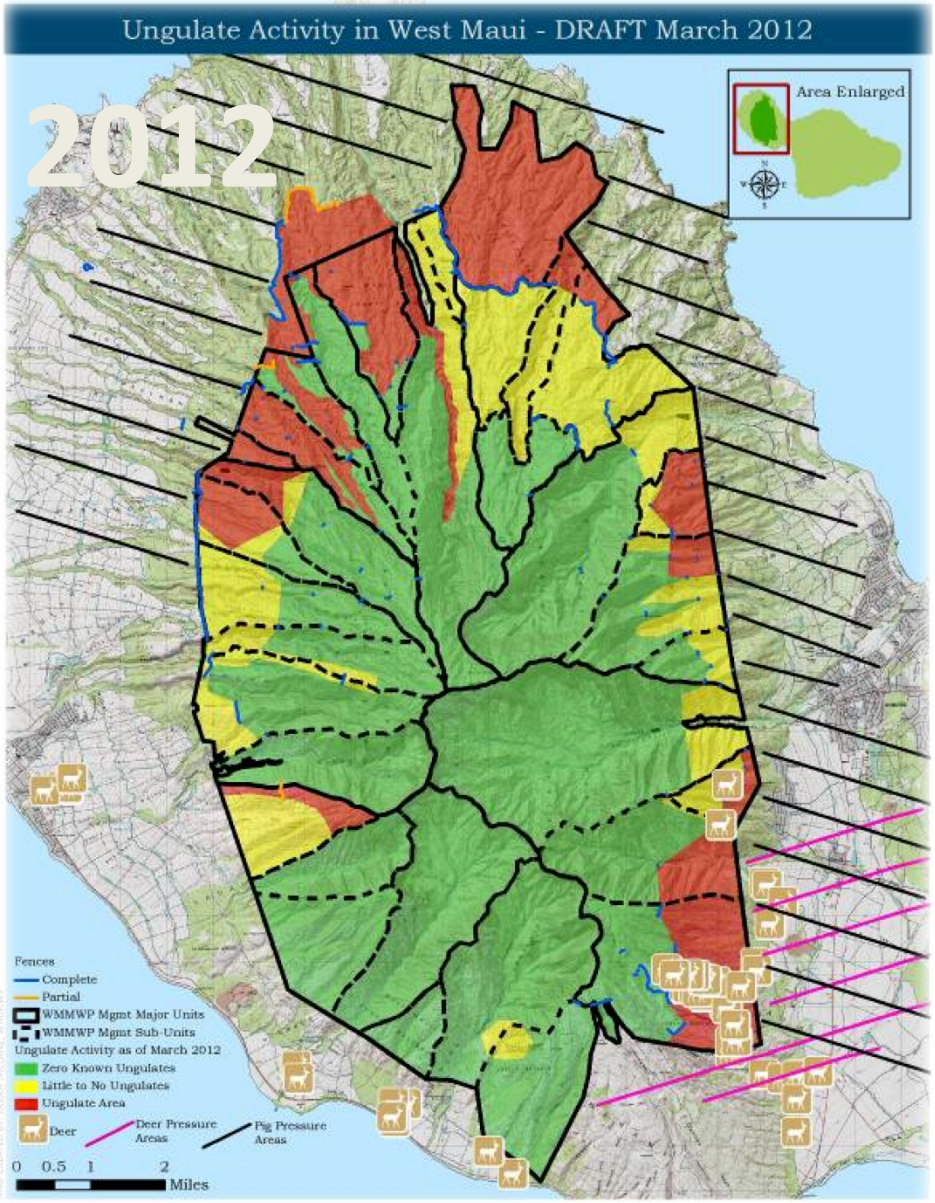
Hanaula	Hahakea/ Wahikuli	Kapunakea	Panaewa	Mauna Alani	Waihe'e	Eke	Kapilau	Waikapu	Honokowai	Waiehu	Helu	Uku-mehame	
77	-	170	-	-	-	-	-	-	-	-	-	-	
47	41	-	-	-	-	-	-	-	-	-	-	-	88
18	43	11	1	0	0	-	-	-	-	-	-	-	73
14	50	36	0	2	1	-	-	-	-	-	-	-	103
4	61	5	1	0	0	-	-	-	-	-	-	-	71
4	15	4	0	0	0	-	-	-	-	-	-	-	23
5	51	15	0	1	0	0	-	-	-	-	-	-	72
1	68	10	0	0	0	1	2	-	-	-	-	-	82
0	26	7	0	4	0	0	8	0	0	-	-	-	45
0	8	16	0	4	0	0	21	0	0	4	-	-	53
0	20	10	0	0	0	0	5	0	3	5	0	-	43
5	4	4	6	0	0	0	7	0	2	2	1	-	31
98	387	288	18	11	1	1	48	0	5	12	1	1500	2354

Average % Ungulate Disturbance for WMMWP Transects

Transect	# stations	Sign	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Wahikuli	54	New	0.38	0.80	2.76	4.54	2.31	2.43	0.00	0.00
		Old			6.76	7.96	8.17	1.04	0.04	0.00
Kahoma	78	New	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Old			0.00	0.64	0.00	0.00	0.00	0.00
Panaewa	94	New	0.18	1.43	0.00	0.00	0.00	0.00	0.00	0.00
		Old			0.35	0.00	0.00	0.00	0.00	0.00
Helu	42	New								0.00
		Old								4.10
Hanaula	76	New	0.23	0.62	0.01	0.00	0.00	0.00	0.00	0.00
		Old			0.12	0.08	0.13	0.03	0.01	0.00
Kapilau	37	New					11.78	0.62	0.00	0.03
		Old					19.38	5.14	0.14	0.22
Puu Kane	42	New							0.00	0.00
		Old							0.00	0.00
Wai 1	42	New							0.05	0.00
		Old							1.64	0.00
Wai 2	48	New							0.00	0.00
		Old							0.58	0.04
Wai 3	50	New							0.16	0.52
		Old							4.22	1.28
Keahialoa	20	New							0.00	0.00
		Old							0.00	0.00
Mauna Alani	33	New							0.24	0.00
		Old							0.00	0.00
Keahikauo	22	New	3.39	3.57			0.00	0.00	0.00	0.00
	(prev. 28)	Old					0.00	0.00	0.00	0.00

- *Heavy* *Little to Moderate* *Ungulate Free*

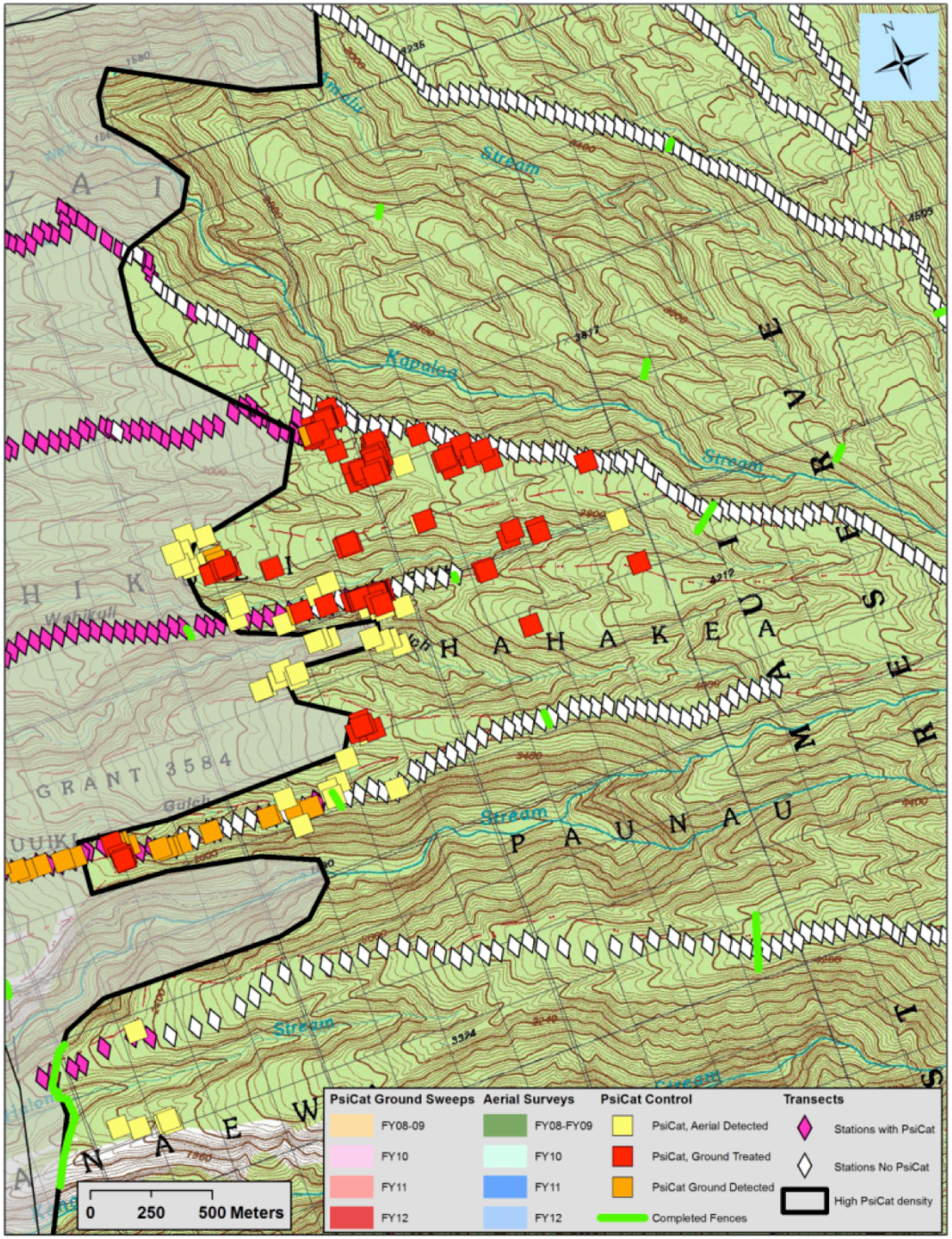




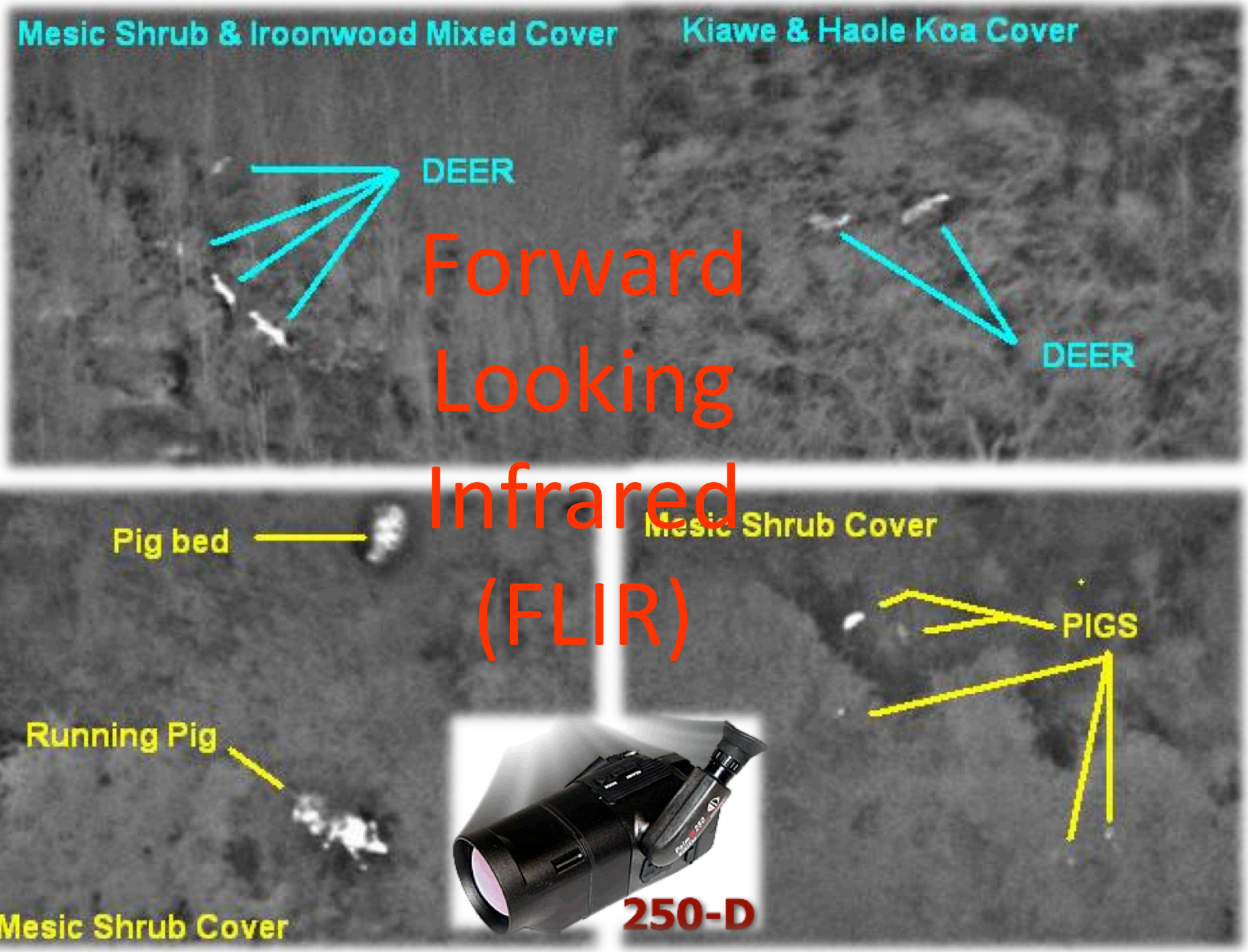
Established Weeds Controlled by Watershed Partnerships

Himalayan Ginger
Strawberry Guava
Australian Tree Fern
Miconia
Manuka
Angiopeteris evecta
Silk oak
Pine
Bocconia
Fountain Grass
Rauvolfia vomitoria
Cape Ivy
Banana poka

Psidium cattleianum (Strawberry Guava) *invading a forest in West Maui.*


PsiCat Ground Sweeps
FY08-09
FY10
FY11
FY12
Aerial Surveys
FY08-FY09
FY10
FY11
FY12
PsiCat Control
PsiCat, Aerial Detected
PsiCat, Ground Treated
PsiCat Ground Detected
Completed Fences
Transects
Stations with PsiCat
Stations No PsiCat
High PsiCat density
0
250
500 Meters
HAHAKEA
PAUNAU
GRANT 3584
Stream
Kapaloa
Gulch

tep Step
3 4


Mesic Shrub & Ironwood Mixed Cover
Kiawe & Haole Koa Cover
DEER
DEER
Forward Looking Infrared (FLIR)
Pig bed
Mesic Shrub Cover
PIGS
Running Pig
250-D
Mesic Shrub Cover

Game Camera

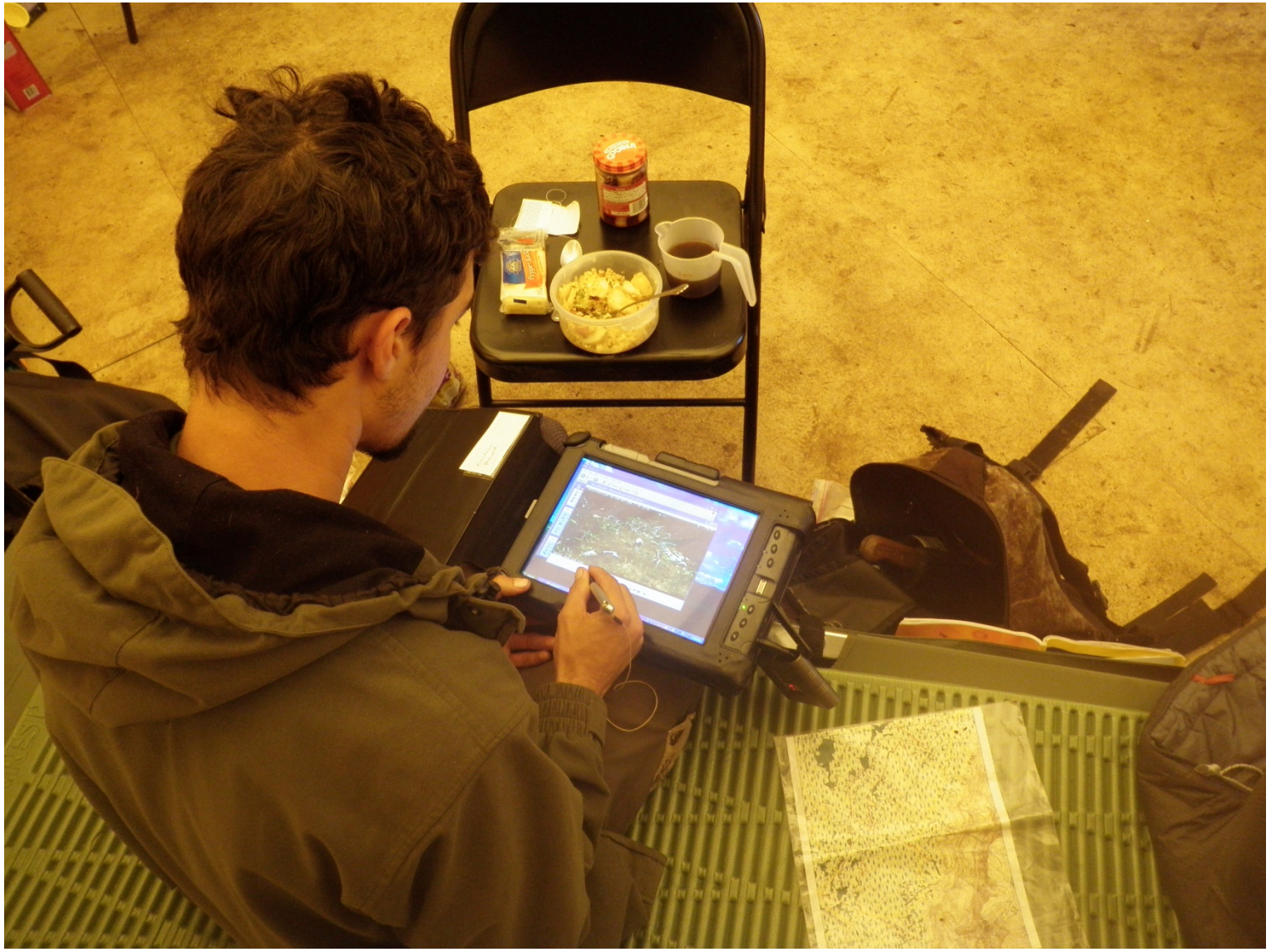

Ltl Acorn HBG1
059°F 015°C
05.19.2012 20:03:19


Ltl Acorn HBG1
071°F 022°C
06.15.2012 17:26:01


Ltl Acorn HBG1
059°F 015°C
05.23.2012 17:49:21


Ltl Acorn CBB1
068°F 020°C
05.31.2012 13:08:58

Game camera picture of the last known goats in the Alakaʻi. These goats were later dispatched.



Reviewing the most recent game-cam photos during breakfast at the weatherport

TRAPS-

In-line trap deployed along the Alakaʻi fence.

Control and or Eliminate Invasive Species-Hunt/Weed Sweeps

High Resolution Aerial Imagery

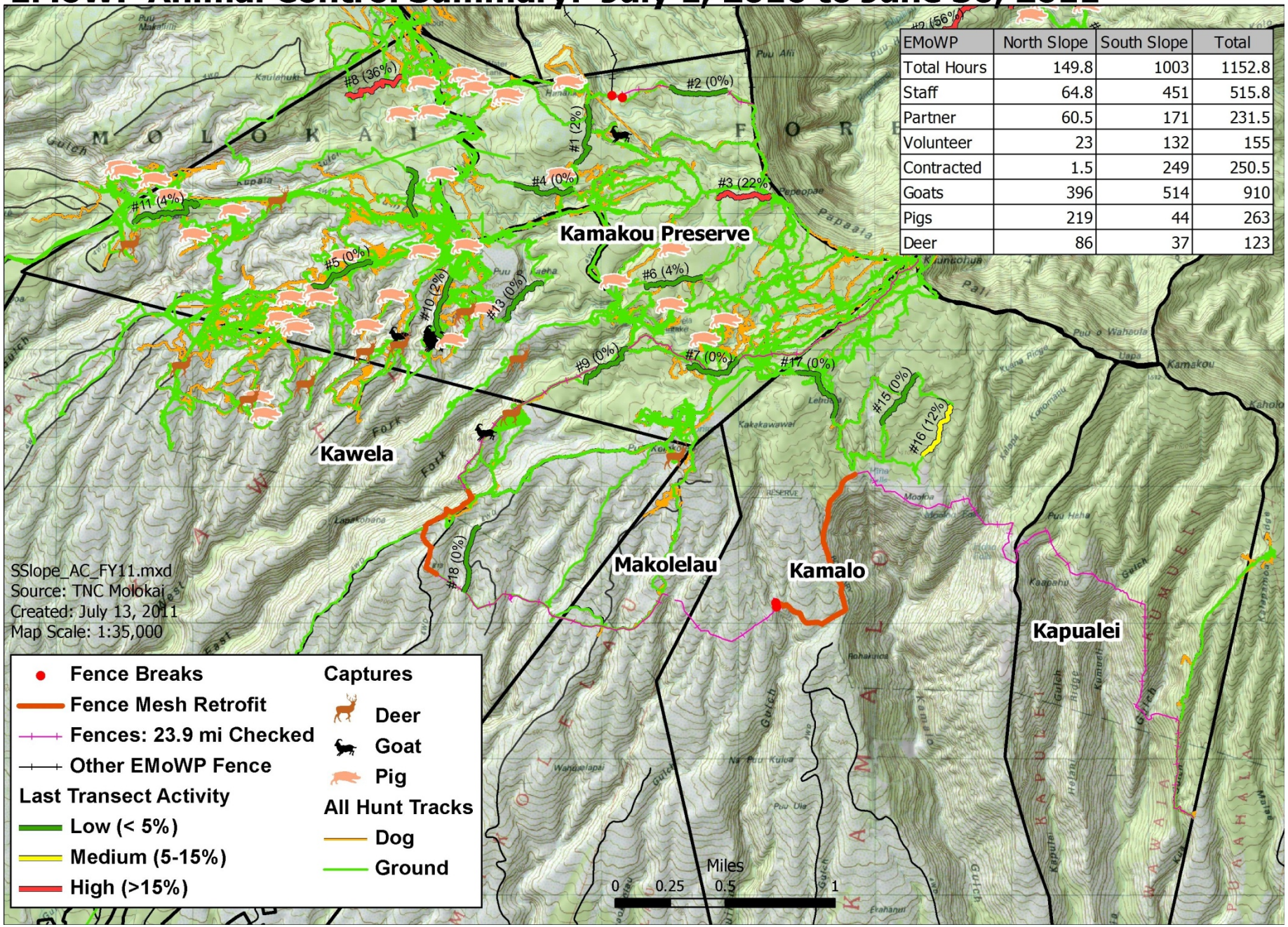
Leptospermum scoparium (Manuka)

Helicopter Stinger

Experimental Herbicide Ballistic Technology = HBT

Working with
Dr. James Leary, CTAHR

EMoWP Animal Control Summary: July 1, 2010 to June 30, 2011



EMoWP	North Slope	South Slope	Total
Total Hours	149.8	1003	1152.8
Staff	64.8	451	515.8
Partner	60.5	171	231.5
Volunteer	23	132	155
Contracted	1.5	249	250.5
Goats	396	514	910
Pigs	219	44	263
Deer	86	37	123

Integrated Pest Management

Strawberry Guava-

- Rear and establish populations of Tectococcus ovatus (leaf galling scale insect)

Integrated Pest Management

Himalayan Ginger

- Host range testing of a number of highly promising natural enemies
- Build up existing cultures of 2 prioritized species
- Continue and complete host range testing
- Continue to catalogue and identify other promising agents.

Integrated Pest Management

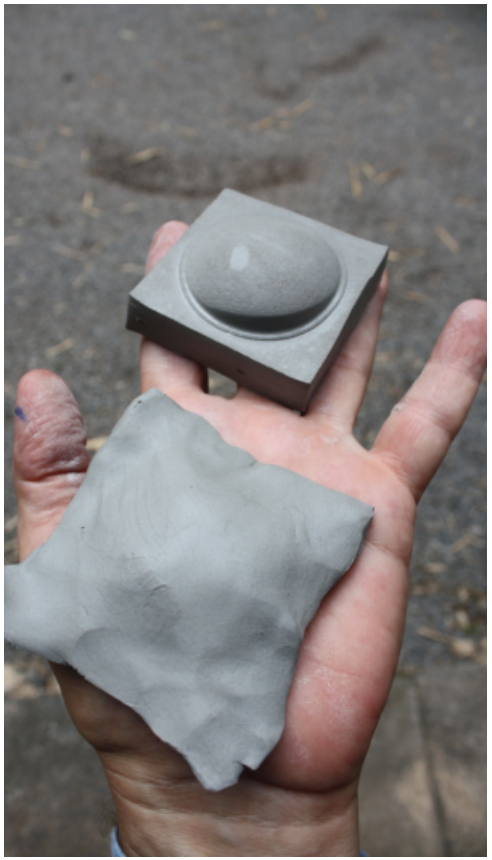
Miconia

- Evaluate a butterlfy, fruit weevil and fruit galling wasp.
- Maintain in quarantine, a miconia stem weevil and flea beetle for Tibouchina and related melastomes
- A post-doctoral researcher will facilitate evaluation of a shoot-galling nematode for clidemia and miconia by HDOA and international partners.

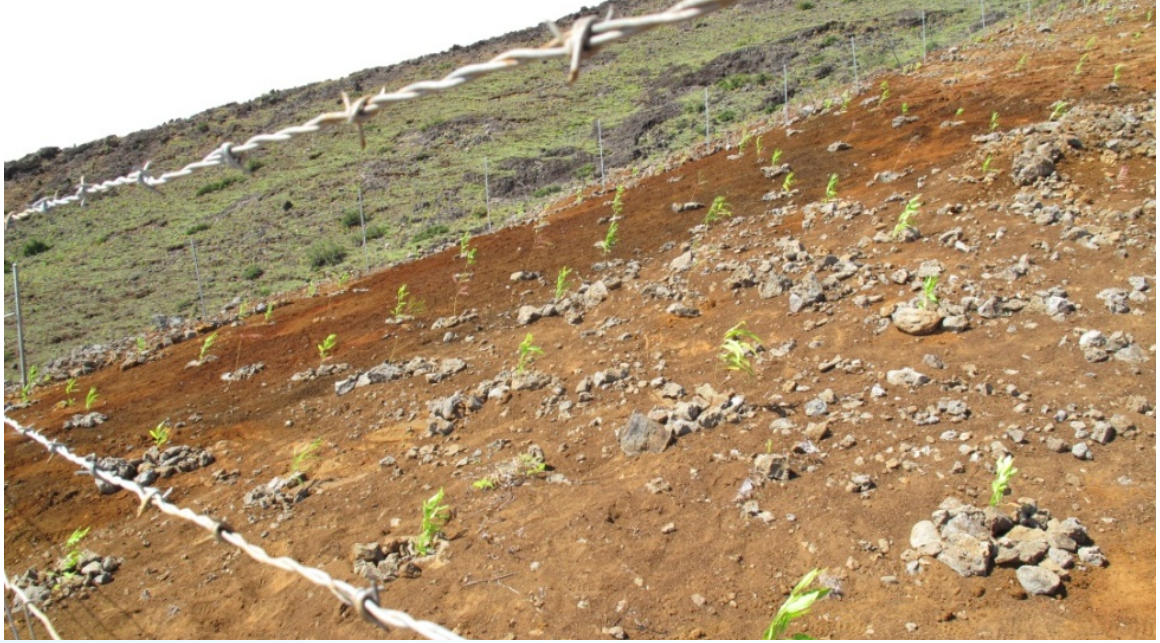
Integrated Pest Management

Rubus ellipticus

- Evaluate specificity of potential fungal and insect agents in quarantine
- Risk assessment
- Application for field release



Restoration




DAS
HAHD