Aerial Search Effort and Intervention Frequency Leading to Target Density Reduction on Incipient *Miconia* Populations

James Leary
Associate Specialist for Invasive Plant Species Management
Dept. of Natural Resources and Environmental Management
University of Hawaii at Manoa

Herbicide Ballistic Technology (HBT) targeting Miconia (*Miconia calvescens*)

Herbicide Ballistic Technology (HBT)

Concept: Encapsulated 0.68 caliber herbicide-filled projectiles pneumatically delivered to treat isolated plant populations *>>> LONG DISTANCE ACCURACY (30-40 m) WITH FULL TILT TRAJECTORY (0-90^{O})*

Problem: Incipient populations of miconia are colonizing remote sections of class I watersheds on Maui. Average slope of terrain >50% *>>> AREAS INACCESSIBLE TO GROUND MANAGEMENT*

Objective: Enhance aerial reconnaissance and surveillance missions with onboard HBT capabilities *>>> REAL-TIME EFFECTIVE TREATMENT TO HIGH-VALUE TARGETS*

Invasion Biology of Miconia (*Miconia calvescens* DC)

- An autogamous (self-fertile) species
- Millions of seed produced by a single tree
- Small, edible fruit dispersed by birds
- Dispersal range >1000 m
- Seed bank viability >20 years
- Germination in heavy shade

- *A SINGLE MICONIA PLANT CAN IMPACT >1000 HA OF PROTECTED WATERSHED!*

Meyer, J-Y. 1998. Observations on the reproductive biology of *Miconia calvescens* DC (Melastomataceae), an alien invasive tree on the island of Tahiti (South Pacific Ocean). Biotropica. 30: 609–624.

Murphy, H.T., B.D. Hardesty, C.S. Fletcher, D.J. Metcalfe, D.A. Westcott, S.J. Brooks. 2008. Predicting dispersal and recruitment of *Miconia calvescens* (Melastomaceae) in Australian tropical rainforests. Biol. Inv. 10: 925-936.

FIFRA Sec 24(c)
Special Local Need

ACCEPTED
January 30, 2012
Under Hawaii Pesticides Law as Supplement to Product No. 9786.263

HBT-G4U200
With Garlon® 4 Ultra

FOR DISTRIBUTION AND USE ONLY WITHIN THE STATE OF HAWAII

FOR INDIVIDUAL PLANT TREATMENT WITHIN FORESTED WATERSHEDS AND NATURAL AREAS USING SPHERICAL POLYSACCHARIDE CAPSULES CONTAINING GARLON® 4 ULTRA

ACTIVE INGREDIENTS:	
Triclopyr: 3,5,6-trichloro-2-pyridinyloxyacetic acid, butoxyethyl ester	10.07%
OTHER INGREDIENTS	89.93%
	100.00%

EPA SLN No. HI-120001 EPA Est. No. 86199-MI-001

This label must be in the possession of the user at the time of pesticide application.

KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUCION

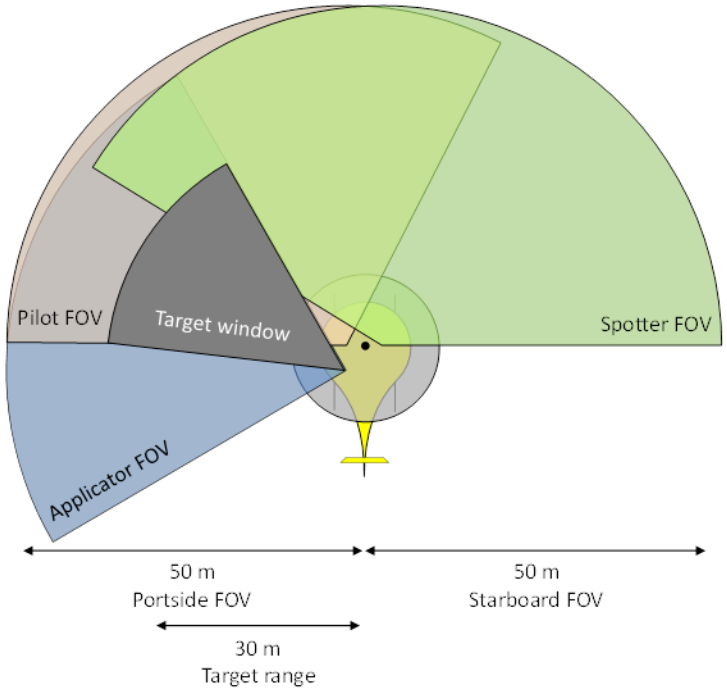
Si usted no entiende la etiqueta, busque a alguien parar que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail).

FIRST AID	
If swallowed:	•Call a poison control center or doctor immediately for treatment advice. •Have person sip a glass of water if able to swallow. •Do not induce vomiting unless told to do so by a poison control center or doctor. •Do not give anything by mouth to an unconscious person.
If in eyes:	•Hold eyes open and rinse slowly and gently with water for 15-20 minutes. •Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. •Call a poison control center or doctor for treatment advice.
If on skin or clothing:	•Take off contaminated clothing. •Rinse skin immediately with plenty of water for 15-20 minutes. •Call a poison control center or doctor for treatment advice.
If inhaled:	•Move person to fresh air. •If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to- mouth, if possible. •Call a poison control center or doctor for further treatment advice.
HOT LINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact CHEMTREC (800-424-9300)	

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

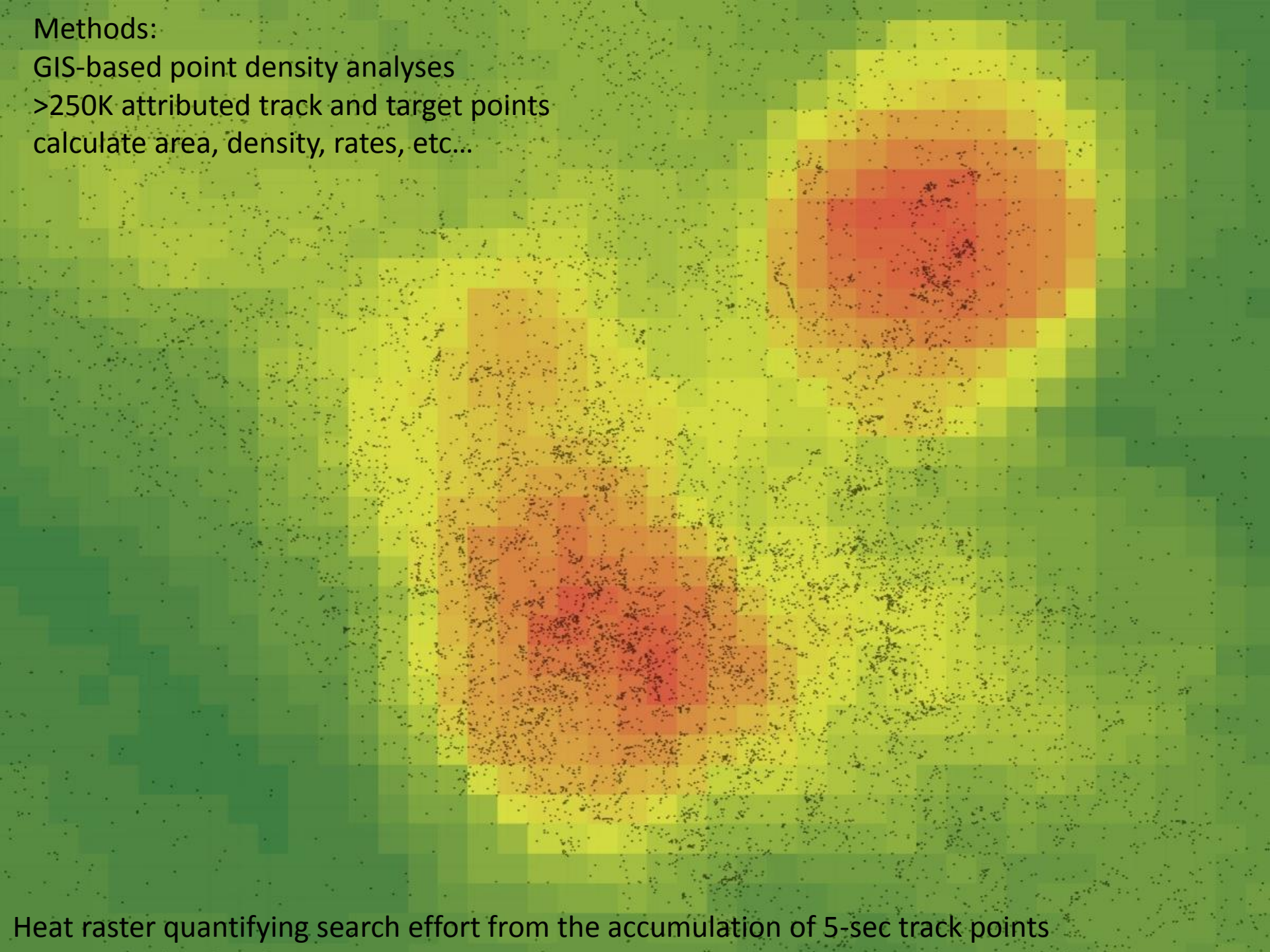
CAUTION: Harmful if swallowed, causes moderate eye irritation. Avoid contact with eyes or clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

Photo: C. Duncan



Crew: Portside pilot/applicator + front starboard navigator creating a 210^{o} FOV

Treatment: 0.68 caliber soft gel projectiles encapsulating 199.4 mg triclopyr (HBT-G4U200)

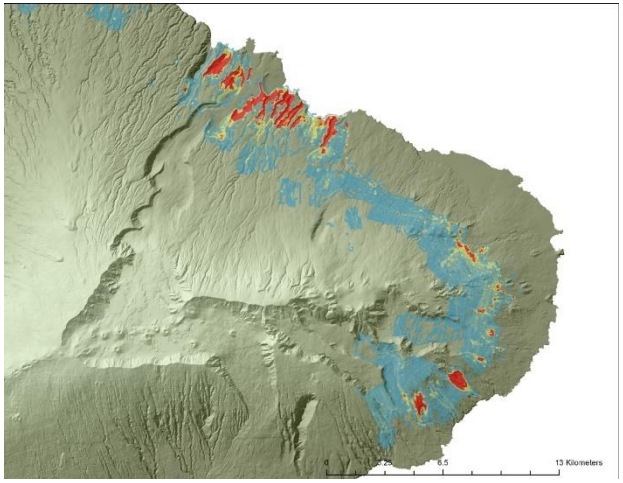


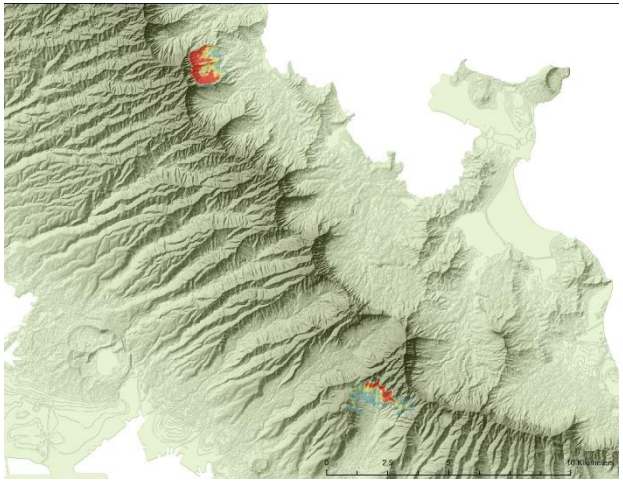
Heat raster quantifying search effort from the accumulation of 5-sec track points

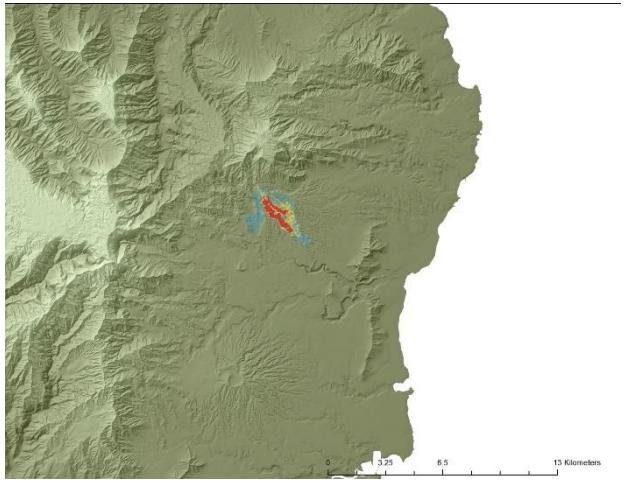
Metrics:

HBT operations used to control Miconia in Hawaii from 2012-2015

Island	Effort (hours)	Projectile consumption	Targets treated	Area protected (ha)	Pop. decay rate ($month^{-1}$)
Kauai	16	3,845	71	459	-1.00%
Oahu	18	11,112	348	505	TBD
Maui	389	395,505	15,837	8604	-2.80%
Total	423	410,462	16,256	9,568	--

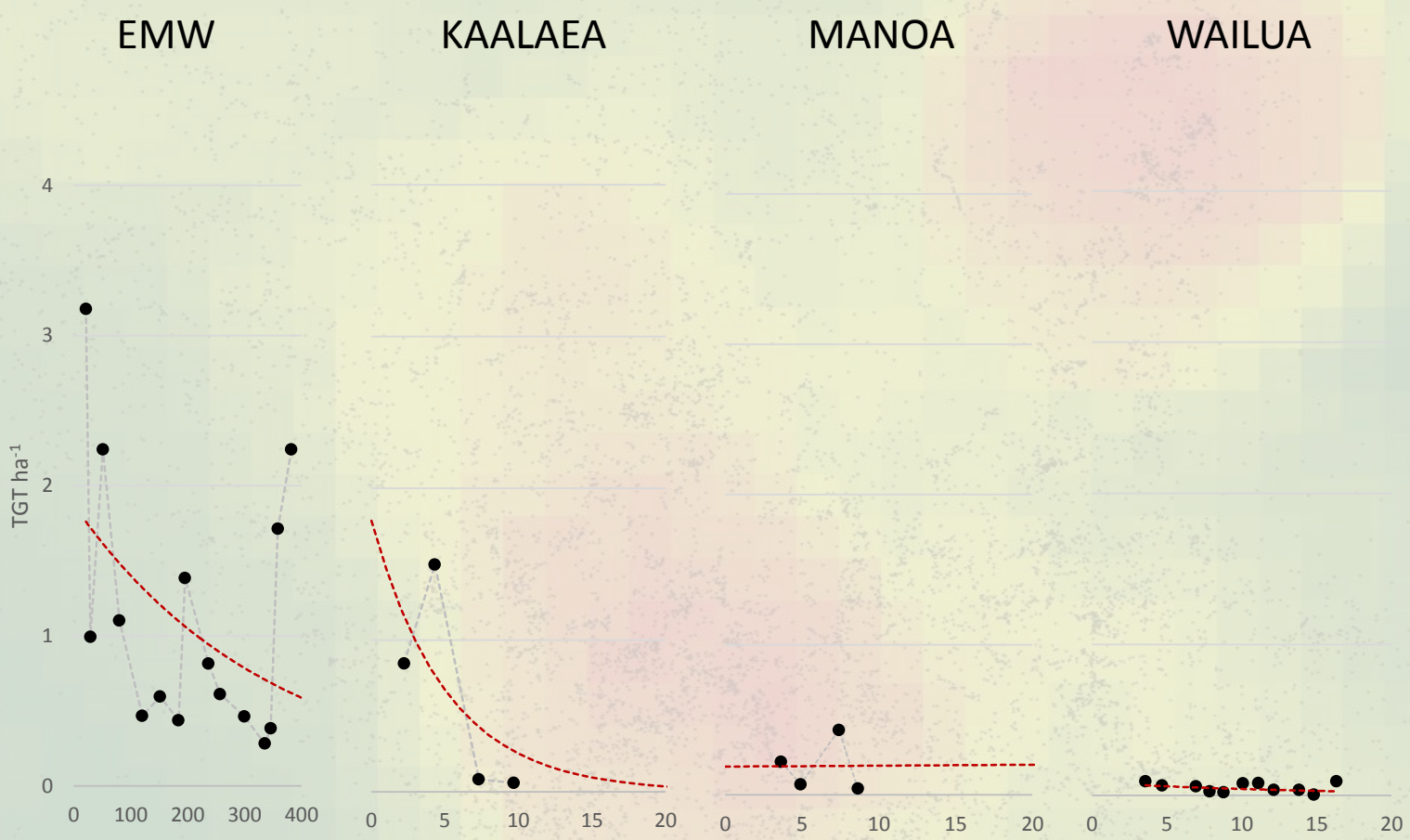






>90% of effort an resources go toward mgmt. of the EMW

Each island incipient population is a unique status with imposed management foretelling future outcomes.



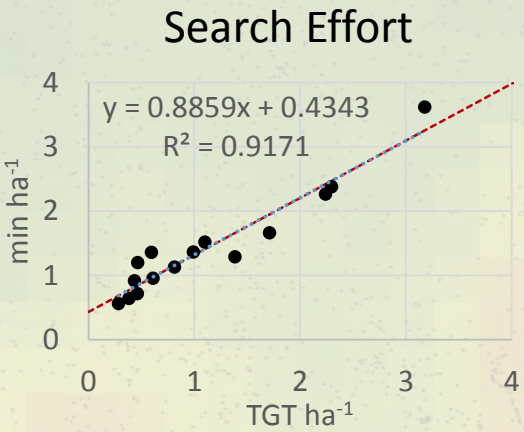
EMW metrics:

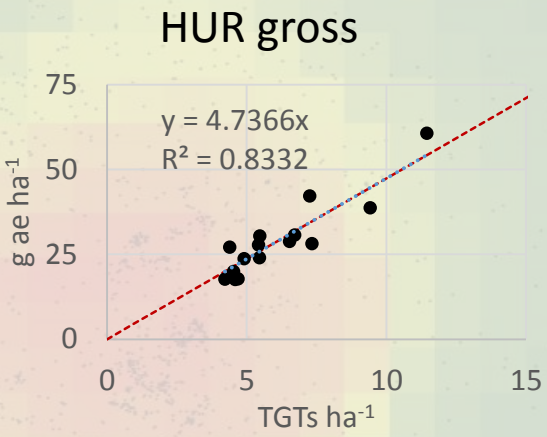
Search effort (min ha^{-1}) is 26 sec ha^{-1} in areas where no targets are detected (y-intercept). Target engagement is 53 sec

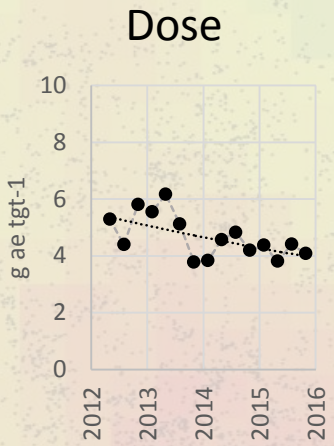
Gross herbicide use rate (HUR; g ae ha^{-1}) is <1% of the maximum allowable rate of 6.7 kg ae ha^{-1}

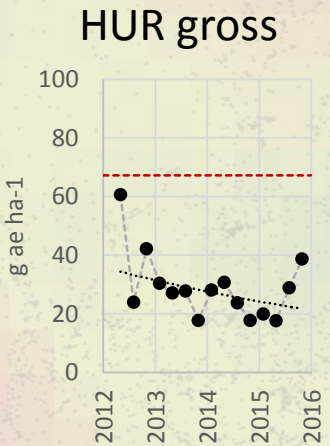
The target dose rate is 4.9 g ae TGT^{-1} (~25 projectiles) with 4% rate reduction over time, attributed to treating smaller targets.

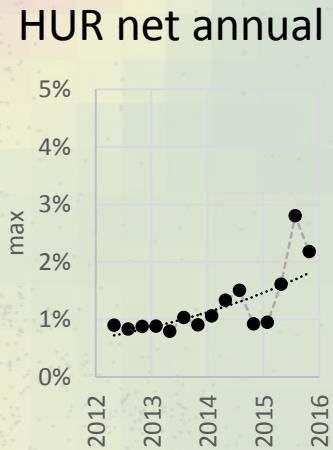
Cost of target dose based on $0.31 per projectile average $7.52 TGT^{-1}. Search effort based on flight time at $0.30 per second averaging $34.70 ha^{-1}. Both cost variables reducing over time to a total cost of <$10 $acre^{-1}$.

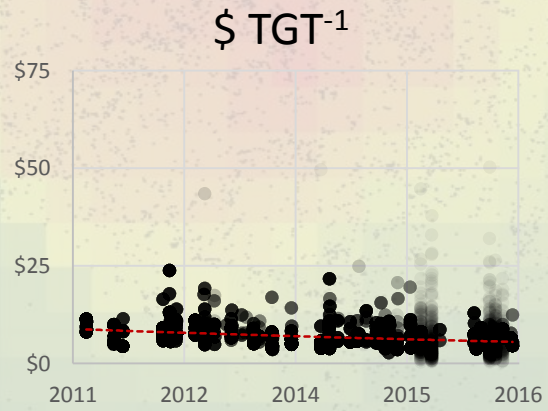


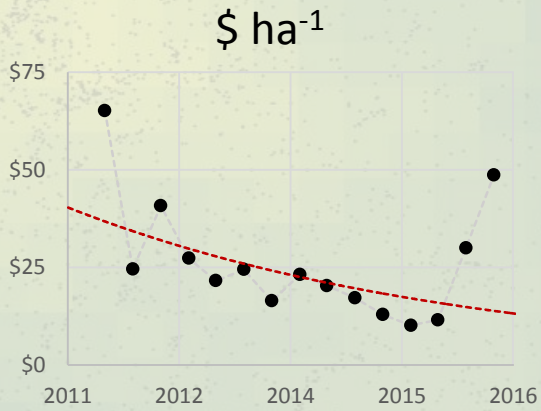




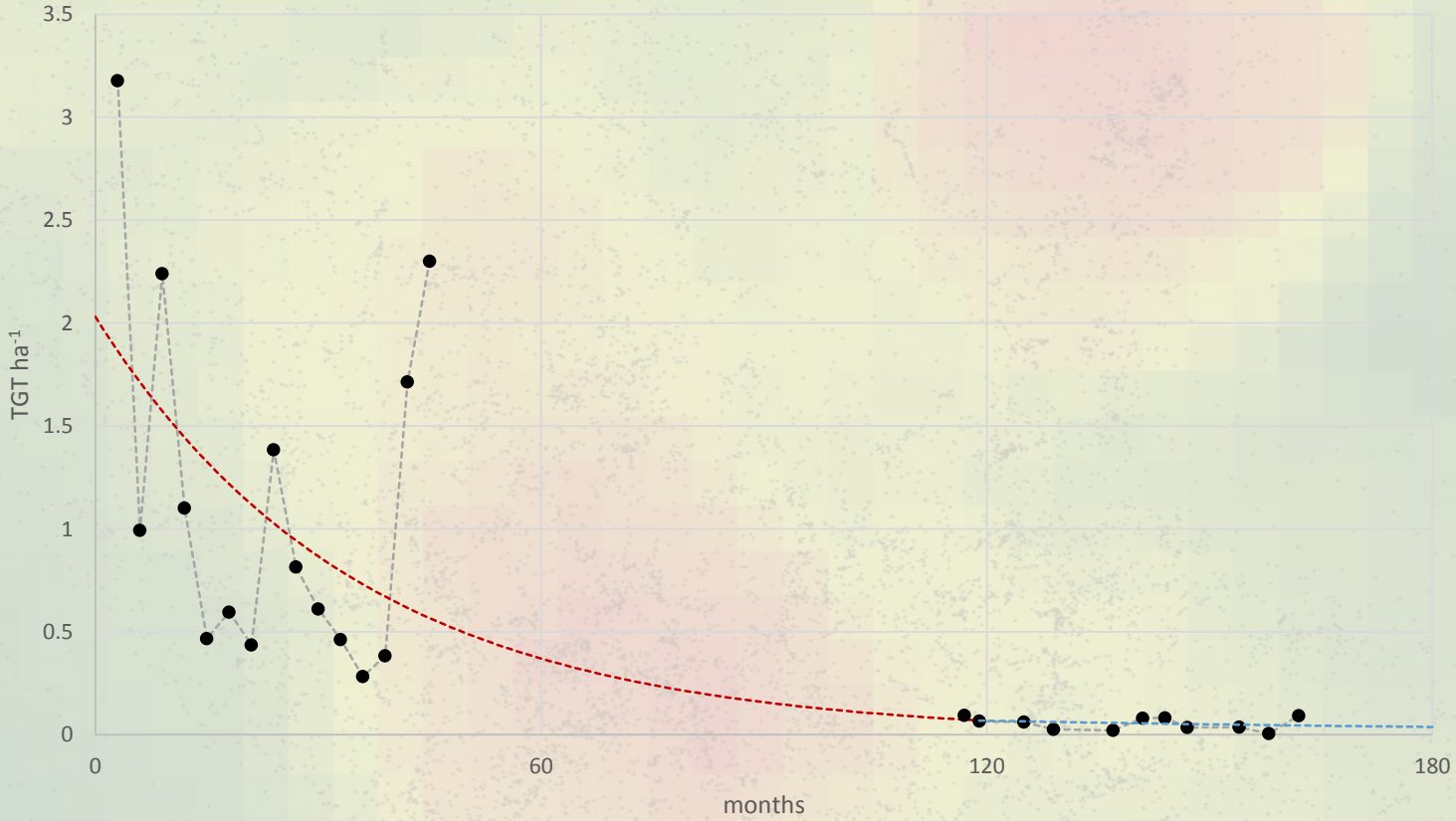








With sustained management, we forecast 99% depletion of the entire incipient miconia population by 2028. Theoretically, reaching densities comparable to Kauai in < 10 years.



SLN registration is due to expire in 2017, with projected net area >10,000 ha, >23,000 TGTs with an expected density reduction of >95%

Collaborators:
KISC, OISC, MISC

Supported in part by :
US Forest Service Special Technology Development Program, Haleakala National Park, Hawaii Invasive Species Council, Maui County Department of Water Supply and Maui County Office of Economic Development

HBT treatment symptoms to PSICAT 100-200 days after treatment